



Size of Gardens: — Botanical A R P.
 80 2 30
 B.A. & Economic Gardens 100.1 - 31

Report on the Zoological Department for 1875.

Total 181-0-21

On 29-4-19

ALTHOUGH a year has now elapsed since we took over the management, we regret that on account of numerous difficulties comparatively little progress has been made in the Zoological Department.

The money allowed us for this department, although quite sufficient for the upkeep of a Zoological Garden of fair dimensions, when thoroughly organised, is quite inadequate for us, as our large expenditure is, and will for some time be, the erection of suitable houses for the various animals.

When the Committee took over the management, a small collection of birds was found. They were kept in a large house or shed, which was considered unsuitable, and as the collection of fowls and pheasants was increasing largely, it was considered necessary to erect a good house for the same, which is now occupied.

In consequence of many animals having been presented by numerous friends, and no suitable accommodation being ready, we have been obliged to make a temporary use of the aviary for these animals.

We have, during the year, bought the material for a large kangaroo shed and enclosure, which is now in course of erection.

In May last a fine two-horned rhinoceros was presented to us by Sir A. Clarke, through the Datu Klana of Sunghie Ujong; a good house has been built for this animal, and that on a rather large scale, with a view of widening it at a little expense for the accommodation of an elephant and tapir, which animals we hope soon to have in our collection.

The animals purchased have been comparatively few, but many have been presented.

Besides the Datu Klana, the liberal donor of the rhinoceros and a pair of argus pheasants, we are much indebted to the late Mr. Birch, who not only manifested great interest in the Zoological Department, but was also the instrument of procuring many specimens for it.

We have also to record our thanks to Mr. Newman in Bangkok, and to Captain Kirk of the Steamer *Royalist*, who took great trouble in procuring for us animals from Siam and from Borneo.

From the Acclimatisation Society in Melbourne we received a fine and valuable collection of Australian animals, such as kangaroos, emeus, parrots, eagles, black swans, &c., and from the Zoological Gardens in Hamburg a fine pair of white swans.

The next building we intend putting up is a monkey house;—and here our spirited and liberal citizen Mr. Cheang Hong Lim has come forward most unexpectedly, promising us a sum of about \$2,000 for building the same.

Orders have been sent to England to get the work done there without loss of time.

The collection of monkeys could be easily increased, but the means of keeping these animals at present are very primitive, and in no way an ornament to the gardens.

Until late, we have had, through the courtesy of Colonel Crowe, two soldiers from H. M. 1-10 Regiment, for looking after the animals, with the assistance of several natives, but this did not work as desired, and we have lately engaged a European as a keeper, for whom a small bungalow is now being built, to enable him to be constantly at the place, which is absolutely necessary, and we trust this arrangement will work better.

Appended is a list of animals in the gardens.

Singapore, January, 1876.

WM. KROHN,
 Member of the Committee.

List of Animals in the Gardens at the end of 1875.

One two-horned Rhinoceros	...	from the Datu Klana of Sunghie Ujong, presented by Sir Andrew Clarke.
„ Sloth Bear	... ..	„ „ Mr. Birch.
„ Jackal	... ..	„ „ Mr. Newman.
Two Tiger Cats	... ..	„ „ Captain Kirk.
One Civet Cat		
„ Sambur Deer	... ..	„ „ Mr. Jamie.
„ do.	... ..	„ „ Mr. Brinkmann.
Two Philippine Deer		
One great Kangaroo	... ..	„ „ Acclimatisation Society in
Three red do.	... ..	„ „ Melbourne.
One bushtailed Wallaby	... ..	„ „ „
Two Porcupines		
Three Australian Rabbits	... ..	„ „ Mr. T. S. Thomson.
Six Kantchills (Mousedeer)		
Two Orang-utangs	... ..	„ „ Captain Kirk.
Two common Macaques		
Three pigtailed do.		
One black do.		
Two white Swans	... ..	„ „ Zoological Gardens in Hamburg.
Four black do.	... ..	„ „ Acclimatisation Society in Mel- bourne.
—Siamese Teals.		
Three mandarin Ducks		
Two moskovit Ducks.		
„ Pelicans		
Seven Adjutants.		
Three Cyrus Cranes.		
Two white Storks.		
„ Herons.		

Cockatoos and Parrots.	Banksfowl (wildfowl.)
Vieillot's Pheasant, fireback.	Copper-coloured do.
Rufous-tailed do. do.	Crown Pigeon.
Siamese do. do.	Sundry Pigeons and Doves.
Golden do.	Two wedgetailed Eagles.
Silver do.	Two Hawks.
Ring do.	Two Owls.
Peacock do.	One Vulture (caught in the garden).
Argus do.	

*Statement of Expenditure for the Zoological Gardens, Singapore, for the year ending
November 30th, 1875.*

	\$	C.	\$	C.
Estimated ...	3,000	00		
By Government Warrant ...	443	10		
			3,443	10
Expended				
By Aviary men and Coolie-hire	435	87		
„ Soldiers' wages	85	00		
„ Food for Animals	299	94		
„ Purchase of Animals	132	10		
„ Tools and Materials	1,312	89		
„ Rails for Deer Park	443	10		
„ Building Aviary	634	59		
„ Building Rhinoceros-house	310	00		
„ Cart-hire and Contingencies	26	88		
Total ...			\$3,680	37
Deficit ...			\$ 237	27

True statements.

(Signed)

H. J. MURTON,
Superintendent,
Botanic Gardens,
Singapore.

March 8th, 1876.

Report on Government Botanic Gardens.

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Singapore, March 9th, 1876.

GENTLEMEN,

I have the honour to submit to you my first annual report of the progress and condition of the Botanic Garden during the year 1875.

No very extensive alterations have as yet been made, as the five months which have elapsed since my arrival have been mostly taken up by the general routine.

Much difficulty has been experienced with the flower-beds, which are infested with a species of sedge (*Cyperus tuberosus*?) which has probably been introduced into the Garden by using partially decomposed animal manure. As a last resource I am now having a foot of the top soil removed and the remainder trenched to the depth of 3 feet, by which I hope this pest will be destroyed. The trenching of the beds has given the Garden a barren appearance in some places, but a few months' growth of the young plants will remedy that.

Several of the walks and drives have been re-made where necessary, and many of the principal drives require re-metalling at once, which I have been unable to do owing to the difficulty of procuring laterite. The bridge leading into the Garden from the Barracks has been renewed. The old trees and shrubs which previously overgrew the clump of sago palms near the principal entrance have been removed, and a collection of young palms planted in front of the sago palms.

A large number of old and dead trees and shrubs have been removed, and are being replaced where necessary by young plants of a more ornamental character; and the line of old betel-nut palms (*Areca Catechu*) bordering Napier Road has also been removed, and is being replaced by *Seaforthia elegans*.

The two small ponds which contained the collection of *Nymphaeas* and *Victoria regia* have been made into one, which is a great improvement to this part of the Garden, beside giving more space for the cultivation of aquatic plants. One part has been devoted to the sacred Lotus (*Nelumbium speciosum*), and at one end it is proposed to locate a pair of alligators. The bank of the pond near Napier Road has been planted with a collection of the various species of *Seaforthia* and *Kentia*, two genera of palms from Australia and Howe's Island. On the garden side an extensive collection of ornamental trees and shrubs has been planted, which are already assuming a striking appearance. Nearly all the alterations in this part of the garden were necessitated in order to get soil for the levelling required for building the Rhinoceros-house.

The Office mentioned in my report of August, 1875, has been commenced, and is now rapidly approaching completion. This will also accommodate the Botanical Library and the collection of dried specimens until the proposed Herbarium is erected. The large verandah around it will prove a boon to visitors, who hitherto have had no proper place of shelter from the heavy showers of rain. It is proposed to erect an Orchid House near the Office, in lieu of the one now existing, which is ill adapted to their growth. It is hoped that the verandah around the Office will afford facilities for ripening the orchids, and giving them a distinct season of rest, by which I hope to secure a larger proportion of bloom than is usually obtained from orchids grown in Singapore.

During the year large numbers of *Phalœnopsis Arides*, *Saccolabiums*, *Dendrobiums*, &c., have been established on the trees in various parts of the garden.

A catalogue has been compiled of all the plants in the garden which I have as yet determined; but a very large number still remain to be identified. The catalogue is appended to this report.

A good collection of standard botanical works has been ordered from England, in addition to a microscope, which will afford very great assistance in the identification of the large number of plants which remain to be determined.

The experimental garden is as yet in its infancy; consequently I have little to report in this department.

Trials are being made with the Liberian and Cape Coast coffees, in order to prove or otherwise their adaptability for commercial purposes in this colony. From all that is known of these new products, it is fully anticipated that they will prove the most useful and remarkable introductions of the present century. The fruit is of much better flavour than the old *C. Arabica*, and they produce berries nearly double the size of that species, and are said to be very prolific. I fear Singapore will not prove well adapted for the cultivation even of these species, but the Malay Peninsula promises a good field for this enterprise, and I shall endeavour to get some eligible planters in the Peninsula, Province Wellesley, and Penang to plant some of these species, and report on their progress, and I shall be glad to receive applications for some at any time.

Of *Ipecacuanha* the stock as yet is very limited, consisting only of a few plants given me by Dr. Thwaites during my stay in Ceylon, but I hope soon to be in a position to make some extensive trials with this valuable plant. The result of these trials will be very important, as it is disappearing from its native habitats, which may in a great measure be attributed to the small quantity of drug afforded by even a full-grown plant. Its importance in India as a remedy for dysentery, and the increasing costliness of the drug, have occasioned active measures to be taken for attempting its cultivation there.

With regard to these trials Dr. King, in his report for the year 1874, thus speaks:--

“ Experience having shown that this plant requires essentially tropical conditions, warm well-sheltered places, with good virgin soil, were chosen; some of the plants thus put out were protected by the natural shade of the forest, others by a sloping thatch of grass. Until the arrival of the cold season all went well, but the unusually low temperature that prevailed during that season was fatal to the majority of the plants, and I am driven reluctantly to the conclusion that it is doubtful whether ipecacuanha can be successfully cultivated as an outdoor crop in Sikkim.—This is also the opinion of Mr. Gammie, the resident manager of the Cinchona plantation.”

Judging from Dr. King's experience, and from its native habitats, viz: in shady forests of South America, lying between 8° and 22° S. lat., the Straits promises a good field for the cultivation of this plant. To mark its importance and increasing costliness, I extract the following average prices at which the drug was purchased wholesale in London, during three periods of 10 years each, from Flückiger and Hanbury's Pharmacographia:—

10 years ending 1850,	average price	2s. 9½d.	per lb.
10 „ 1860,	„	6s. 11½d.	„
10 „ 1870,	„	8s. 8¼d.	„

Cardamum cultivation promises to become a profitable speculation for small proprietors in this Colony. I hope soon to have a stock for distribution.

A large number of economic and medicinal plants have been introduced, and an “Economic Garden” will be commenced almost immediately on the ground now occupied by the nursery, which will be removed to the back of the hill below the manager's residence. In the new economic ground I shall endeavour to represent, systematically arranged, all the plants yielding economic and medicinal products which are amenable to cultivation in this climate. This department I venture to hope will in a few years form one of the most instructive and interesting features of the Garden.

A quantity of slate labels, recommended by Dr. Hooker, have been ordered from England. As soon as they arrive, the labelling of the trees, shrubs, &c. will be commenced. From June 30th to November 30th, over 700 baskets of flowers were supplied to subscribers, and I cannot forbear again recommending that this practice be stopped or considerably modified, as the Garden can never present a gay appearance under existing circumstances. A large number of plants have also been supplied to the subscribers, and arrangements are now being made to meet the constant demands for seeds.

From June 30th to November 30th, 11 Wardian cases of plants and 10 large boxes of epiphytal orchids have been despatched to other botanical establishments. Large quantities of seeds and plants have been sent to various establishments in Australia, consisting principally of bread-fruit, litchi, rambutan, durian, mangosteen, mango, pepper, clove, nutmeg, sapodilla, gamboge, and quassia. A case of gutta percha (*Isonandra gutta*) has been forwarded to Ceylon for trial there. A list of the contributors to the Garden and a list of the subscribers are appended.

It is my unpleasant duty to report many serious infringements of the Rules, not only by natives but also by Europeans. The latter on more than one occasion have been detected cutting flowers by moonlight. The principal part of the collection of orchidaceæ, ferns, and rare plants have been kept private, as they have often been removed when exposed to the public, while as regards orchids the flowers are almost invariably cut. It might be advisable to call to the minds of the perpetrators of these thefts that several of the plants now in the Garden are quite unique in the Straits Settlements, and it might happen that such a unique plant found in their possession might lead to their prosecution to give account from whom they received it.

To Dr. Thwaites, F.R.S., &c., and his assistant, M. M. Hartog, Esquire, F.L.S., my thanks are due for much valuable assistance and instruction I received from them during my stay in Ceylon; and also to Mr. Niven, the Manager of this Garden, for much valuable assistance in its management.

It seems desirable that the present opportunity should be used to direct attention to the timber supply of Singapore. Good timber trees have almost entirely disappeared, and we have large tracts of land at present overrun by “lalang” grass (*Imperata Kænigii*) and *Elephantopus scaber*, the soil of which is too poor for cropping purposes, but well adapted to the growth of such trees as the “tembesoe” (*Fagraea peregrina*), redwood (*Gluta velutina*), beside numerous *Calophyllums* and *Dipterocarpaceæ*. Trees of this sort might be planted on the sides of future public roads, instead of the worthless *Erythrinæ*, &c., now used for similar situations.

The Garden, with the sanction of the Government, could thus be rendered useful to the Colony by forming nurseries of valuable timber-producing trees, while many exotic species, as ebony, calamander, teak, and mahogany, &c., could be introduced.

I have, &c.,

(Signed) H. J. MURTON,
Superintendent.



Straits Settlements.

ORDINANCE No. VII. OF 1878.

An Ordinance to confirm arrangements relating to the Agri-horticultural Society and the Raffles Museum and Library, and to provide for the more efficient management of the said Institutions.

[16th December, 1878.]

WILLIAM C. F. ROBINSON,
Governor and Commander-in-Chief.

WHEREAS a Society was formed in Singapore in or about the year 1866, for the encouragement and improvement of agriculture and horticulture, and the said Society became possessed of a certain piece of land in the district of Tanglin, in Singapore Island, containing 1 rood, and 19 perches under a deed of sale dated the 1st day of March, 1866; And Whereas the then Government, to aid the said Society, on the 27th day of October, 1866, granted to the Vice-President and Treasurer of the Society under the name of the Agri-horticultural Society a grant of 25 acres, 3 roods, and 20 poles of Crown land in the same press condition that the said land should be used for the purposes, under the title and designation of "The Agri-horticultural Society's Gardens," with a proviso that if the said land should not be used for the public purpose of an Agricultural Garden or Gardens it should revert to the Crown;

And Whereas the said Society for the purpose of procuring to build a dwelling-house for the Curator of the said Gardens, mortgaged the said lands for the sum of four thousand dollars;

And Whereas the Government of the Colony contributed the sum of one thousand and two hundred dollars annually, for the purpose of carrying on the said Gardens, the rest of the funds having been raised by private subscription;

And Whereas the said Society became unable, owing to the want of funds, to carry on the work at the said Gardens in such a way as to be useful to the public, and in the year 1874, applied

to the Government of the Colony for assistance, offering to make over the whole of the property of the Society to Government, for the use of the public, on condition of Government paying off the debts incurred by the Society, that is to say, the sum of four thousand dollars due on the mortgage above set out, and a further sum of five hundred and eighty-six dollars and twenty cents due to the Honorary Secretary for advances made by him for current expenses, and on the further conditions that the Subscribers to the Gardens should continue to enjoy the privilege theretofore enjoyed by them of procuring plants and flowers from the Gardens when available, and that Government should carry on the works at the Gardens from the public funds, with such aid thereto as might be raised by voluntary subscriptions ;

And Whereas thereafter the debts of the said Society were paid off by the Government, and the Title Deeds of the property of the Society were made over to Government, and pending the passing of an Ordinance to legalize the transfer, the said Gardens have been managed by a Committee called "The Raffles Library, Gardens and Museum Committee";

And Whereas certain individuals in or about the year 1844 established a circulating Library under the name of the Singapore Library, for the use of themselves and of such persons as they admitted as subscribers, and in the year 1874, the proprietors of the said Library, being indebted for books furnished, and being unable any longer to support the Library in an efficient manner, offered to make over to Government the books and property of the Library, on condition of Government upholding a Public Library from the public funds, with such assistance as might be received from subscribers for the use of the books lent out, and on the further condition that the proprietors, on surrendering their property, should be entitled to the rights of subscribers during the period of their natural lives; and the said Library was thereafter taken over on the part of Government, and the debt was paid off by Government amounting to five hundred and sixty dollars and seventy-one cents;

And Whereas a Museum has lately been established in the same building as the Library, at the cost of Government, aided by contributions from private individuals;

And Whereas the expenditure for the said Gardens now amounts to upwards of ten thousand dollars yearly, of which, all, except about five hundred dollars yearly is paid by Government out of the public funds;

And Whereas the expenditure of the said Library now amounts to upwards of seven thousand dollars of which, except about seven hundred dollars yearly from subscriptions, is paid by Government out of the public funds;

And Whereas it is expedient for the public service, that the said Agri-horticultural Gardens, and the said Library and Museum, should be supported at the public expense, aided by such voluntary contributions and subscriptions as may be received from the public; and that suitable arrangements should be made by law for confirming the transfer of the said Gardens, and Library, and Museum to the Government for the service of the Colony, and for providing a proper system of administering the funds to be expended by Government in future, and of managing the affairs of the said Gardens, and Library, and Museum ;

It is hereby enacted by the Governor of the Straits Settlements, with the advice and consent of the Legislative Council thereof, as follows :—

1. The arrangements entered into between the Government of the Colony and the members of the Agri-horticultural Society, by which the Gardens and property of the Society were transferred to the Government of the Colony, are hereby confirmed, and the two parcels of land above referred to, consisting of 24 acres, 1 rood and 19 perches, and 55 acres, 3 roods and 28 poles are hereby vested in Her Majesty the Queen, Her Heirs and Successors, subject to the provisions of this Ordinance, for the use and occupation and management of the same.

Arrangement above recited for Agri-horticultural Society confirmed.

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2. The arrangement entered into between the Government of the Colony and the proprietors of the late Singapore Library, by which the Library was handed over to the Government of the Colony, is hereby confirmed, and the books and property of the said Library, and the articles in the said Museum, are hereby declared to be the property of Her Majesty the Queen, Her Heirs and Successors, subject to the provisions of this Ordinance for the use and management of the same.

Ditto for the Library and Museum.

3. And Whereas it is expedient, where such a large proportion of the funds required for the support of the said Gardens and Library and Museum, is provided by Government, out of the public revenues of the Colony, that care should be taken for the due and proper control of the expenditure of the said funds, by persons responsible to the executive Government of the Colony; it is further enacted that the said Gardens, which shall be called the Botanical Gardens of Singapore, and the said Library and Museum, which shall be called, respectively, the Raffles Library and the Raffles Museum, shall be managed as Government establishments, by a committee or committees, to be from time to time appointed by the Governor for the purpose, and subject to the regulations in force in the Colony, as to the appointment of officers, payment of their salaries, and otherwise.

Preamble.

Gardens, Library and Museum to be managed by Committees.

4. Such sum as may, from time to time, be voted by the Legislative Council, for the service of the said Gardens and Library and Museum, together with all sums to be received from voluntary donations and subscriptions, shall be administered by the said committee according to the terms of the several votes, donations and subscriptions, for the different purposes, and subject to such rules and regulations as the Governor may from time to time prescribe for the conduct of the business of the committee, and for the payment of the officers employed.

Appropriations of revenue subscriptions and donations how to be administered.

5. The accounts of the said committee shall be subject to audit by the Auditor-General of the Colony, according to the rules in force in the Audit Department for the audit of accounts of the expenditure of public monies.

Accounts subject to audit.

The following persons, proprietors of the late Library, that is to say, John D. Esquire, Alexander Somerville Cumming Esquire, Jose d'Almeida Esquire, Christian Baumgarten Esquire, Thomas Shelford Esquire, Alexander Muirhead Aitken Esquire, Miss Jessie Little, and Robert Campbell, Esquire, shall be entitled to be classed as subscribers to the Raffles Library, without payment, during the term of their natural lives; and, during their residence in the Colony, shall be entitled to the privileges of subscribers, subject to any by-laws to be framed under Section 7; but the rights herein provided for shall not be transferable.

Privileges to subscribers to the Gardens.

7. It shall be lawful for the Committee or Committees appointed under this Ordinance, with the approval of the Governor, from time to time, to frame by-laws which shall be duly published in the *Government Gazette* for the internal management and protection of their several institutions, and for

Committees may frame By-laws.

the use of the same by the public, and for the manner in which, and the extent to which, the privileges of subscribers to the same are to be used and enjoyed, and any person infringing any by-law so made, shall, on conviction, before a Magistrate be liable to a penalty not exceeding fifty dollars.

Penalty.
Property to be held to be public property.

8. The Botanical Gardens, and the Raffles Library, and the Raffles Museum, together with all growing and dead plants, trees, and flowers, and other property in the said Gardens, and all books, papers, and manuscripts, and other property in the said Library, and all articles in the said Museum, shall be held to be public property in relation to all laws in force, or to be in force, in the Colony for the protection of public property, and for the punishment of persons injuring or committing mischief, trespass, theft or other offences of whatever nature relating to the same.

Contracts of the Committees how signed and enforced.

9. All contracts entered into, by the Committees to be appointed under this Ordinance, shall be signed or executed by the President or Chairman for the time being of the Committee, and shall be deemed to be Crown Contracts under the provisions of the Crown Suits Ordinance, 1876.

Short Title.

10. This Ordinance may be cited as "The Raffles Societies Ordinance, 1878."

Passed this 16th day of December, 1878.

E. A. IRVING,
Clerk of Councils.

STRAITS SETTLEMENTS.

Paper to be laid before the Legislative Council by Command
of His Excellency the Governor.

Annual Report on the Botanical and Zoological Gardens, Singapore, for 1881.

*The Superintendent of the Botanical and Zoological Gardens, Singapore,
to the Hon'ble the Colonial Secretary.*

[No. 5.]

BOTANICAL GARDENS,
Singapore, 30th January, 1882.

SIR,—As arranged, the Acting Superintendent has handed me a Report on operations carried out in the Botanical Gardens during the year 1881, and an abstract of the expenditure of the preceding year, to be forwarded to you for the information of His Excellency the Governor, and I have the honour to forward it herewith as received accordingly.

2. I have also the honour to forward at your suggestion, a short account of my doings while on leave of absence in England.

I have, &c.,

N. CANTLEY,
Superintendent.

Annual Report on the Botanical and Zoological Gardens, Singapore, for 1881.

1. During the past year the department has had to contend with a serious disadvantage by the unavoidable absence of the Superintendent, who was invalided home in the early part of March last. This is more particularly to be regretted, because previous to his arrival, in November, 1880, the Gardens had, for some time, been worked single-handed. The initiatory changes, however, planned out by the Superintendent during his brief administration, have, as far as circumstances permitted, been carried out, and will subsequently be noticed under their respective heads.

2. The year under review has not been characterised by any extreme meteorological phenomena, with the exception of a few weeks' drought in the month of June, which, happily, was not of a sufficiently long duration to cause much harm to the health of planted out specimens. It, however, was the cause of some anxiety at the time, and increased labour was necessary in systematic and copious watering. With this exception, the amount of rainfall has been very evenly distributed.

3. The general neat appearance of the Gardens has been maintained in a very satisfactory manner, due, in a great measure, to the increased attention paid to the lawns and walks, the former requiring the constant attention of six men cutting grass.

4. As usual, the white ants continue to be destructive to the planted out specimens, several of the larger ones having fallen preys to their ravages, notably, three of the tall Norfolk Island Pine, "Araucaria excelsa."

which form such striking features in the Gardens, also a "Dammara robusta" and a fine "Jonesia (Saraca) asoca" having succumbed to their attacks. The line of "Araucaria Cunninghami" against Cluny Road, planted in 1877, begin to shew signs of having exhausted the prepared soil in which they were planted, by the premature decay of some of their branches, and straggly and weak growth; indeed, the soil being so wretchedly poor in all parts of the Gardens, it is almost hopeless to expect introduced trees to become really good specimens, and attain their natural dimensions.

5. The above does not apply to palms, which thrive remarkably well in various parts of the Gardens. The palm clump leading to the Band-stand shewing signs of crowding in the near future, it was resolved to thin out the palms, arranging them in their different genera, according to BENTHAM and HOOKER in the "Genera Plantarum;" as, however, the elaboration of Palmæ in the above-mentioned work was not completed, the arrangement was deferred, with the exception of some plants that were required for a clump at the front entrance, and also one near the monkey house. The fine clump of sago palms near the Nymphæ pond have, for some time, been shewing signs of flowering, the earliest of which the seeds are nearly ripe. These plants, with their bold foliage crowned with dense clusters of fruits, are most interesting.

6. *Flower Beds.*—During the early part of the year, these were entirely re-planted with plants differing in nature from those hitherto used; not only were the old plants rendered unsightly by the constant cutting of their flowers, but they had also grown too tall, thus obstructing one of the prettiest views in the Gardens. It was a matter of some difficulty to find sufficient variety in the few dwarf plants at disposal, but the beautiful deep colour of the small Crotons, the Coleus and Alternanthera, more than amply repaid for their frequent recurrence. The supply of flowers, which had hitherto been mainly supplied from these beds, is now met by the plants, planted for the purpose, close to the nursery.

7. *Lake.*—This has required the usual monthly clearings of weeds, &c., the work being greatly facilitated by the employment of a punt, which was made for the purpose of going about the lake to collect the floating masses of weeds, branches, &c. that collect together. Before the introduction of the punt, the pond was cleared by swimmers.

8. *Lily Pond.*—This also has been cleaned out on several occasions, and the Sacred Lotus, "Nelumbium speciosum," which occupies one end of it, kept in check. In this pond is grown the "Victoria regia," but, as pointed out by the Superintendent immediately on his arrival, unless it can be accommodated by a separate and special tank, it is hopeless to expect that it will ever increase from the diminutive size in which it is at present.

9. *Roads and Walks.*—These have been kept in good order during the year, a work which entailed the constant employment of five men repairing and weeding, where necessary. Two drives stand in need of re-mettaling—the one leading from the front entrance past the palm clumps, the other leading from the Band-stand to Garden Road. A welcome addition to the tools for trimming the edges of turf has been received in the shape of a patent "Lawn Edger," sent out on the recommendation of the Superintendent; this little machine performs its work admirably where the edges are in good order, but owing to the steep gradients of some of the walks, and the heavy rains washing the

sand against the sides, it cannot be used in all cases. Several of the smaller walks stand in need of side drains.

10. *Orchid and Plant House*.—During the past year, the orchids have all been re-potted in more suitable baskets made of galvanised wire, which have the advantage of being both neat and durable. It was with some diffidence at first that I used the galvanised wire, thinking it might have an injurious effect on the tender rootlets which are so abundantly developed in all the family; by experiment I found my fear groundless, and in consequence have had the remaining orchids put in similar baskets.

The remaining plants which are here arranged for effect, as in a conservatory at home, are, I regret to say, not happy in their situation, owing to the low flat roof which is covered with creepers; the superincumbent weight is causing the roof to give way in several places, and the wooden supports are also in a decayed state owing to white ants.

11. *Propagating Department*.—This important department has increased considerably since the inauguration of "sales of plants" by the Superintendent; although only one sale has taken place during the year, the work of propagation has been actively carried on, and a large quantity of plants is now available for sale. In addition to various economic plants, a great demand for our native India rubber plants has sprung up, upwards of 2,000 having been sent to Ceylon alone. Various plants have also been supplied to the Malay College, the Hospitals, new Criminal Prison, Dhoby Green, Government House, and also to Pêrak.

12. *Oranges*.—During the year, two large Wardian cases of selected oranges were received, containing varieties sent by the Director of the Botanic Gardens, Sydney, to His Excellency the Governor, who liberally distributed them between Singapore, Penang, and Pêrak.

13. *Economic Grounds*.—These grounds have occupied by far the greatest amount of time and attention during the past year. For some considerable time back, the question as to how these grounds could be arranged to accommodate the rapidly increasing plants of economic value and interest, has occupied considerable attention, and has resulted in a plan drawn up by the Superintendent before his departure for Europe, in which he proposed to extend the grounds considerably by cutting down jungle (secondary growth), and clearing the slope of one of the hills of Lalang, "*Imperata Kœnigii*," by which the grounds were bounded. In connection, it was also proposed to form an arboretum for our native timber trees; and also have a piece of ground for shewing the various fruits of the Settlements. It will hardly be necessary to say that this work is as yet incomplete, although during the year great progress has been made. The Lalang hill referred to has been dug over, and the roots picked out (a most tedious process); the ground was then levelled and laid down in grass; a walk has also been made parallel to it. A most interesting experiment was tried during the progress of the work, it was found necessary to move 200 Liberian Coffee trees which were just commencing to fruit; the operation being done carefully, only 5 or 6 of the trees died, which goes to prove that, with care, trees may be moved at almost any time, or in any condition. This ground, together with the remaining portion cleared, was subsequently turfed over; considerable difficulty was experienced in finding a sufficiency of turf, whose chief benefit is to prevent the surface soil from being washed away. The intending grouping, either botanically or commercially, such as arranging together in groups plants which produce oils, resins, gums, fibres, medicines, cordage, food, &c., &c., will be a great improvement.

14. *India Rubbers*.—The Central American “*Castilloa elastica*” and the Panama “*Hevea brasiliensis*” have baffled all attempts to strike by cuttings. It is the more remarkable that precisely the same manner and treatment was observed as practised so successfully at Kew. Out of six trials, only one of the first-named species struck; this piece was taken from the base of the trunk with a piece of the old bark. Cuttings being so unsuccessful, it was resolved not to retard the trees by further cutting, but by encouraging them to grow quickly, and look forward to the production of seed. The tallest “*Castilloa*” is now about 30 feet high, and measures 24 inches at the base; while the tallest “*Hevea*” is 25 feet high and 14 inches round the base.

15. *Ceara Scrap Rubber* “*Manihot Glaziovii*.”—The late Superintendent mentioned, in his Report for 1878, his belief that the climate of Singapore was too wet to be suitable for this rubber. Plants, however, raised from seed sent from Ceylon are growing well, the tallest being four feet high; the seeds germinated in August last.

16. *Gutta Percha*.—These plants grow exceedingly slowly, and are, moreover, unfortunately visited by some night flying insect which punctures the leaves, giving them the appearance of having been riddled with shot; all attempts to catch the insects have been unavailing.

17. *Cacao*.—In common with Ceylon and several other Colonial Botanical establishments, we have been supplied with some seedling varieties of the best kinds of the Cacao grown in Trinidad. A Wardian case containing 24 plants arrived here from Ceylon in March last; of these, 3 were dead and 4 doubtful; 12 have altogether died, leaving just half, which are growing well, and the time for their fruiting is anxiously awaited by the local planters.

18. *Liberian Coffee*.—Little has been done in the way of distribution, it being so thoroughly established. The few seeds we have had ripened have found ready customers.

19. *Ipecacuanha*.—These plants, which had hitherto been grown in partial shade under some trees in the economic grounds, were lifted and placed in pots, the change evidently being highly beneficial to them, for from the diminutive and starved appearance, they have developed into nice little shrubby plants. As most people complain of their slow growth when planted in the ground, it might be found advantageous for planters to try them in pots; the cost could be considerably reduced by making the pots themselves.

20. *Forest Nursery*.—During the year a forest nursery has been formed in connection with the Botanical Gardens, which is intended ultimately to be the base of a series of similar nurseries throughout the Settlements. As, however, the question of Forest Administration is at present under consideration, it will only be necessary here to state that, since the formation of the present nursery, the work of collecting seeds and plants has been actively carried on, so much so that upwards of thirty thousand seedlings (chiefly timber trees) have been pricked off. Of these, about thirteen thousand are Teak (“*Tectona grandis*”), the seeds of which were received from the Conservator of Forests, Pegu Circle, British Burmah, through the Hon’ble the Colonial Secretary, Straits Settlements. The seeds were immediately sown in narrow beds, and germinated to the extent of about ninety per cent. In order to enable them to be moved about, when ready for planting, to any part of the island, it was resolved to pot them; advantage was taken of the “*Planter’s pot*,” which is simply

and easily made, securing to the plants several advantages. The composition of the pots is about three-fourths cow-shed manure, the remainder being clay, with just a sufficiency of rubble to make the compost binding, the whole being puddled to a consistency similar to that of brick-making clay; the mould is made of stout tin, about six inches in diameter and nine inches deep. About 10,000 pots were made, which were used for Teak. Bukit Timah being the place selected for planting the Teak, a band of twenty men were engaged clearing jungle, holing, &c. About 3,000 trees have already been put out. A small nursery has also been formed there for the reception of further consignments of Teak seeds.

21. *Military Reserve*.—Very few trees have been added to those planted last year; the undergrowth has been cut over, and the health of the trees is very satisfactory, the Mahogany and Dammar growing very freely.

22. *Labelling*.—This important feature has not been kept up so well as could be wished, owing to the small supply of printed labels which have been received. In our moist humid climate the letters become illegible in a few months' time; and I would suggest that, instead of being dependent on one of the convicts at the Criminal Prison, an intelligent Chinaman be appointed, who could reside and work on the place. Some such plan seems the only way to secure that much desired end—"a well labelled Garden."

23. *Buildings*.—These have been repaired where necessary, and three new coolie-houses erected, viz., a coolie-house at Bukit Timah, a Mandor's house, and a Carpenter's house and shed at the Gardens. A small bungalow, formerly occupied by the Manager of the Zoological Department, has been converted into a coolie-house; by these means all the men are located together, behind the propagating sheds and close to Cluny Road, thus preventing the necessity for their being in the Gardens at night. Undoubtedly this is a precaution against theft, for when the coolie-houses were scattered over the Gardens in three places, numbers of men were continually walking about, and if questioned had the ready answer, that they were going to see their friends.

24. *Interchange of Plants and Seeds*.—Our relations with foreign and Colonial Botanical establishments have been maintained, and some valuable additions have been made to the collections, notably those from Royal Gardens, Kew and Mauritius. Consignments have also been received from Calcutta, Ceylon, Hongkong, Jamaica, Trinidad, Demerara, Australia, Manila, Japan, &c. Valuable collections of seeds have been received, especially from Messrs. HAAGE and SCHMIDT, Erfurt, Germany; the Director, Botanic Gardens, Sydney; Mr. J. F. ROBERTS, Nurseryman, Kew, Melbourne; the Director, Public Gardens, Jamaica, &c. Plants and seeds have also been presented by the following gentlemen in the Colony:—

His Excellency the Governor, the Hon'ble the Colonial Secretary, the Hon'ble the Colonial Engineer, the Hon'ble the Colonial Treasurer, H. H. the Maharaja of Johor, Lieutenant RHODES, R.E., Captain ROSS, A. L. DONALDSON, Esquire, Dr. DENNYS and H. A. G. WHAMPOA, Esquire.

25. Sixteen Wardian cases have been despatched outwards, and about fifty packets of seeds distributed between the Botanical establishments mentioned above.

26. Among the more interesting and useful plants from Kew and elsewhere are the following:—

Landolphia Watsonii.	Clavija sp.
Do. Petersiana.	Oxalis cupleurifolius.
Cola acuminata	Cupania mimosæfolia.
Chrysobalanus Icaco; white and purple fruited.	Pleuropetalum Costa Ricense.
Galactodendron utile.	Landolphia Kirkii.
Smilax sp. Caracas	Diospyros discolor.
Bertholletia excelsa.	Holmskioldia sanguinea.
Artanthe elongata.	Lecythis minor.
Nectandra Rodicci.	Magnolia fuscata.
Zingiber sp.	Tecoma leucoxydon.

and many others too numerous to mention.

27. *Library.*—The following new works have been received during the year:—“Flora Australensis,” 7 vols.; “Flora Trop. Africa,” 3 vols.; “Flora of Mauritius and Seychelles;” “Flora West Indian Islands;” “Select Plants for Tropical Countries.”

28. The Periodicals have also been increased by the “Tropical Agriculturist,” published in Ceylon. Through the courtesy of the Superintendent of the Forest Branch, Home, Revenue and Agricultural Department, Calcutta, we have received the various Forest Reports of the different Provinces of India, which are most valuable for reference.

29. *Zoological Department.*—The following gentlemen have contributed the undermentioned birds:—W. A. BERGHUINS VAN WOORTMAN, Esquire, two Victoria crowned pigeons from New Guinea and also one Sambur deer; Captain PAYNE, two adjutants; C. DUNLOP, Esquire, one large adjutant. I regret to report the theft, in April last, of one of the large white swans from off the lake.

30. An abstract of Revenue and Expenditure for the year is appended, also one for the preceding year.

WALTER FOX,
Acting Superintendent.

Abstract of Revenue and Expenditure of the Botanical and Zoological Gardens, Singapore, for the year 1881.

REVENUE.		EXPENDITURE.	
	\$ c.		\$ c.
By Government Grant, ...	10,000 00	Superintendent's Salary (9 months on sick leave), ...	1,353 00
Sales of Plants, ...	313 77	Acting Assistant Superintendent (9 months Acting Supt.), ...	1,403 87
Do. Flowers, ...	40 95	Bill Collector, ...	179 75
Balance in hand, 1st January, ...	2,263 22	Road Mandor, ...	169 91
		Coolie-hire (general purposes), ...	2,748 17
		Do. (special do.), ...	1,195 99
		Cartage, Manure, &c., ...	219 05
		Birds' Food, ...	185 75
		Laterite, ...	156 25
		Office Contingencies & Transport, ...	457 13
		Miscellaneous, ...	1,651 21
	<u>\$12,617 94</u>		<u>\$9,720 08</u>

WALTER FOX,
Acting Superintendent.

Abstract of Revenue and Expenditure, for the year 1880.

EXPENDITURE.

SALARIES.

				\$	c.
Superintendent,	...	...	...	865	66
Assistant Superintendent,	...	...	..	1,140	00
Acting do.,	...	...	..
Bill Collector,	...	...	...	180	00
Road Mandor,	...	...	...	180	00
Garden Labourers,	...	...	...	2,840	45
Extra do.,	...	...	...	561	68

OTHER ITEMS.

Manure and Cartage,	...	...	...	416	95
Laterite,	...	...	...	483	00
New Buildings,	...	...	...	255	00
Repairs to Buildings,	...	...	...	57	10
Food for Animals,	...	...	...	218	52
Purchase of Plants,	...	...	...	16	10
Do. Garden Tools,	...	...	...	314	69

CONTINGENT EXPENDITURE.

Travelling Expenses of Superintendent, &c.,	...	...	...	71	25
Do. Assistant Superintendent,	...	...	...	136	15
Do. Bill Collector,	...	...	...	37	02
Repairs to Garden Tools,	...	...	...	65	58
Purchase of Stationery and Sundries,	...	...	...	35	50
Do. Books,	...	...	...	123	77
Miscellaneous,	...	...	...	1,160	49
				\$9,158 91	

REVENUE.

GOVERNMENT GRANT FOR THE YEAR:—

Botanical,	...	...	...	...	\$8,000	00
Zoological,	...	...	...	...	2,000	00
Other Receipts,	...	...	...	...	1,191	41
					Total, \$11,191 41	
					Expenditure, 9,158 91	
					Balance, \$2,032 50	

WALTER FOX,
Acting Superintendent.

Report by Mr. Cantley on a short Visit to England in 1881.

1. Having obtained six months' leave of absence, I proceeded to England direct *viâ* the Cape of Good Hope and took with me for identification about two thousand Botanical specimens, collected from trees in the Botanical Gardens and jungles in the neighbourhood, which being packed and sent on board in a green state, afforded me constant employment in pressing and drying for a considerable part of the voyage.

2. This, however, was scarcely completed, when a storm, met with at the Cape of Good Hope, caused the destruction of about five hundred of them.

3. On arriving in England, I was readily granted permission by Sir J. D. HOOKER to compare what specimens remained with those in the Kew Herbarium, a work which occupied me some considerable time.

4. While thus engaged in the Herbarium, I received from the Hon'ble Major J. F. A. McNAIR, R.A., C.M.G., Lieutenant-Governor of Penang, and HUGH LOW, Esquire, C.M.G., H. B. M.'s Resident in Pêrak, several consignments of dried Botanical specimens of the forest trees of those countries, and to which I drew their special attention before leaving Singapore, but unfortunately all of those sent could not be botanically identified.

5. Among those determined, however, were many of great interest, such as Gutta-producers, &c., and notoriously so among those specimens collected from trees in the jungle in the Botanical Gardens, Singapore, which seem to have remained unrecognised since the formation of the Gardens: their identification has, however, greatly added to the Garden Catalogue published in 1880.

6. Of the above, two proved entirely new to science—one of these, a *Dracæna* with ornamental foliage and of some commercial value, is being propagated with the intention of introducing it into England.

7. Having finished with the above, I set about an inspection of the Herbarium itself, and noted carefully its construction and general working, together with the excellent Library attached.

8. This examination led to my recommending the establishing of an Herbarium and Library, on the same principle, but smaller scale, in connection with the Gardens here, and I rejoice to think the Government has so far approved of the plan as to have the work already in hand.

9. It is proposed to confine the Herbarium thus commenced to the local flora or plants of the Peninsula and adjacent Islands. The Garden flora will also form a part of its contents, but in a separate arrangement.

10. This latter will include all plants at present growing in the Botanical Gardens, and introductions from time to time, and will thereby maintain a distinct line of demarcation between introduced and indigenous species, and be particularly useful for reference when labels get misplaced or lost.

11. An Herbarium being chiefly for reference, a written description of its contents should always be at hand, and when this description is scattered over many books, the establishment of a suitable Library becomes a necessity, but it is not always easy to hit upon the precise works which are likely to prove most useful, I therefore asked the aid of Sir J. D. HOOKER to assist me in making a suitable selection to recommend, to which he readily consented. The selection made has been submitted, and its purchase approved of.

12. With the provision thus made, unnamed timber trees and plants of the peninsula generally will soon be a thing of the past, and the garden, it is hoped, will become what it is now called, but what it has never been, namely, a "Botanical Garden," and one capable of dealing with the flora of the peninsula in a scientific and practical manner.

13. Sir J. D. HOOKER having kindly relieved me of the work mentioned, I lost no time, previously obtaining the sanction of the Director, in setting about making a selection from the Kew green-houses of such economic and other plants which I considered would be of use in Singapore.

14. The selection made number two hundred and sixty in all, chiefly economics, and includes many American and West African species difficult, if not impossible, to obtain otherwise at Singapore.

15. This work took some time, as I had to go over the houses one by one, and consider the likely merits of each plant as I went on.

16. Plants of a rare, and chiefly ornamental nature, which are not kept in stock at Kew for exchange, I chose from the nurseries of Messrs. BULL & VEITCH, where I found many of a very ornamental and interesting character well worth securing, and the purchase of which has been already approved of by Government.

17. Before quitting the Gardens at Kew, I had the pleasure of looking over the fine Economic Museums which have greatly helped to raise the Gardens to their present fame, and which are universally acknowledged to be the finest of the kind in the world. To these I gave special attention, going over the cabinets in detail.

18. The inspection of these occupied me nearly two months, and to one who took less interest in the science of which these Museums are intended to illustrate the practical application might well think it a rather tedious process, but I felt the opportunity might not soon again present itself.

19. The collections in these Museums are really grand, and I confess I learned a great deal during the time I spent in them, but in this direction I had the advantage over most visitors in having the ready explanation and advice of the obliging Curator, Mr. JACKSON, A. L. S., at command, and with whom I went fully into the construction of the cabinets, the methods of mounting, curing, preserving, distilling, and setting up specimens, and the general working of the place.

20. When in charge in the Mauritius, the Government readily granted, on my representation, a suitable building for a Museum of such botanical objects as cannot be preserved in an Herbarium, such as large fleshy fruits and many other objects too numerous to mention, and I hope the time is not far distant when the Botanical Gardens of Singapore will also possess a Museum of this kind, without which they must remain shorn of a great and important part of their utility: but this subject will be better treated in a separate document.

21. Having left Kew, the British Museum and Zoological Gardens next claimed my attention. In the former I was able to obtain the names of the birds in the Garden Aviaries here, and in the latter I learned something in the construction of aviaries and their protection from rats and vermin, I was surprised to find, however, that the mortality among the birds there is nearly, if not quite, as great as at Singapore, especially among the pheasants, which appear difficult to keep in a confined state anywhere.

22. I need hardly allude here to the selection of tools I made choice of for the Gardens while in England, although their use are likely to prove highly economical when compared with those previously in use, this is especially the case as regards Adie's Patent Lawn Edger, which has completely revolutionised this part of the work since its introduction.

N. CANTLEY,

Superintendent.



STRAITS SETTLEMENTS.

Paper to be laid before the Legislative Council by command
of His Excellency the Administrator.

Annual Report on the Botanical Gardens for the year 1879.

BOTANICAL GARDENS,
Singapore, 25th March, 1880.

SIR,—I have the honour to submit herewith my Annual Report on this department for the year 1879.

To
The Hon'ble
CECIL C. SMITH,
Chairman of the Gardens Committee,
Singapore.

I have, &c.,
H. J. MURTON,
Superintendent.

REPORT.

The extraordinary quantity of rain that has fallen in Singapore during the past year, viz., 114.98 inches, has rendered the task of keeping the Gardens in good order more than usually hard, as weeds have grown with such astonishing rapidity and vigour that a considerable portion of the time and labour that would otherwise have been devoted to carrying out projected improvements has been necessarily taken up by matters of ordinary routine.

It has, however, proved beneficial to all the newly planted trees, &c., and I have not to record the death of one specimen of tree or shrub of value or importance.

One large specimen of *Araucaria Cookii* is showing signs of decay, owing to attacks of white ants, and although various remedies have been applied, I have little hope of its recovery. This, however, will prove a very trifling loss, as the Gardens are rather overstocked with cone-shaped trees of this description already.

A considerable number of alterations have been carried out during the year, which will doubtless prove improvements to the general appearance of the Gardens.

A large clump of trees near the orchid house, which had become covered with coarse-growing climbers and served only to conceal a rubbish pit, has been removed, the pit filled up, and the ground sown with grass seeds. A large quantity of thoroughly decayed leaf-mould was obtained from this place, which has proved of material use for mixing with the compost for plants in pots.

The ground on which the large Carnivora cages formerly stood has been drained, filled with suitable compost, and is now being laid out for the reception of the *Bomeliaceae*, a very beautiful class of plants, to which, through the generosity of Dr. SCHEFFER, Java, and M. GODEFROY-LEBEUF, Argenteuil, no less than 22 genera and 63 species have been added during the year.

A number of old, unsightly plants of the Pumelow and "Buah Kanarie" (*Canarium commune*) have been removed from the lawn on the side of the Gardens nearest Tyersall, where the soil is of the very worst description.

A great improvement to the general appearance of the Gardens has been made by lifting the turf on the right-hand side of the drive leading past the lake to the Band-stand, and raising it above the level of the side-drains: over 400 carts of soil were used for this purpose.

Roads and Walks.—These have all been gone over during the year, and many of them entirely re-made. 360 cubic yards of laterite were placed on the road around the Band-stand alone, besides which the following roads have been entirely remetalled:—Road to Superintendent's Quarters; road from junction near the palm clump past the orchid house to the long border; road past palm clump to Cluny Road; the road from the orchid house past the head of the lake; and the road from the Band-stand to Rogie is now undergoing a thorough repair. The main drive past the lake and over the hill has also undergone extensive repairs.

20/10

Owing to the quantity of rain that annually falls in this Colony, and the character of the land on which the Gardens are established necessitating rather steep walks, the amount annually expended for the upkeep of the roads, &c., is very considerable, and I would suggest the propriety of a fixed sum being set apart annually for this purpose.

Drains.—In consequence of the extensive additions under this head during 1877-78, but little was required last year, beyond ordinary repairs. New drains have been put down near the orchid house and the approach to the aviary. A drain on each side of the Oleander walk would prove beneficial.

Fences.—These have been kept in fairly good order by means of monthly clippings, the shoe-flower (*Hibiscus rosa sinensis, vars.*) continues to answer for this work effectively, and the example is being extensively followed in Singapore.

Seeds of plants suitable for fences have been procured from India, and will be tried for that purpose in the Economic Garden.

A new fence has been planted at the back of the plant sheds.

Lake.—This has been cleared out repeatedly as the weeds grow very rapidly, a coarse growing *Utricularia* being particularly troublesome. Perhaps if a few more swans were introduced this nuisance would be lessened.

The Water Lily pond is the gayest part of the Gardens in early morning, but the plants of the *Victoria* are now getting old—over five years—and small, and it seems desirable to remove them, as well as the *Nymphæas*, place a lot of manure in the pond, replant the *Nymphæas*, and replace the *Victoria* by young seedlings.

The *Nelumbiums* have been provided with a separate pond, and are commencing to grow in their new quarters.

Flower Beds—Those near the office were pretty during the early part of the year, but during the heavy rains of the latter part the annuals planted there succumbed to the adverse weather.

Those near the aviary have been remodelled, and were very gay for some time with Dahlias, &c., &c.

The beds below the Band-stand are about to be entirely remodelled and planted, as the shrubs, &c., planted there two years ago have become much too large for the situation, thereby obstructing the view of the surrounding country. Several large *Coniferae*, &c., have been removed from the upper terrace for the same reason.

Great difficulty is experienced in getting plants suitable for these beds, as none over two feet high are adapted to this purpose, while a fair proportion of flowering plants is indispensable in such situations, by far the greater part of the tropical flowering-plants that will grow in the sun are shrubs like *Ixoras*, *Olerodendrons*, *Eranthemums*, &c.

Orchid House.—This structure would now be more appropriately designated as the Plant House, as the larger part of the *Orchidaceæ* has been removed and fixed on trees in various parts of the Gardens, beyond the reach of visitors, in order to prevent their being stolen. Most of those already put out are doing well, and are evidently far happier in their more natural positions, besides giving a much better chance of their being observed. *Phalenopsis grandiflora*, *Saccolabiums*, &c., &c., and the curious monstrosity *Bolbophyllum Beccarii* are especially noticeable, and various species of *Arides* are always to be found in bloom.

The house is now almost entirely taken up with staging for pot plants, and, considering that this style of cultivation was commenced only nine months since, a very fair collection has been got together, and now form one of the principal features of the Gardens.

A large number of Annuals were grown for this purpose in the early part of the year, but, although they are extremely showy while in bloom, the short time that they remain so was considered by the Committee not enough to repay the trouble and attention necessary to bring them on, and their culture was discontinued.

The Ferns have received more than ordinary attention during the year, and the thanks of the Committee are particularly due to Lady LONGDEN, Ceylon; C. FORD, Esq., Hongkong; W. HILL, Esq., Brisbane; and the Venerable Archdeacon HOSE. I take this opportunity of acknowledging my indebtedness to the latter Reverend gentleman for much useful information about Malayan Ferns and his assistance in clearing up many knotty points connected with their nomenclature.

Upwards of sixty species have been added to this popular class of plants during the year.

The Fernery is worthy of little attention just now, as the trees that supported the screen of *Thunbergia laurifolia*, which so effectively shaded the fernery, have rotted and fallen down, and most of the Ferns are unable to bear the full rays of the sun, and I would recommend that it should be planted with coarse growing kinds; the more delicate ones being reserved for growing in pots.

The screen of *Thunbergia* has hitherto been one of the most attractive parts of the Gardens, and when its fall was foreseen in 1877 a number of supports were placed under it at a cost of upwards of \$70, but these soon succumbed to the attacks of white ants.

Planting.—Little has been done in this line, except in filling up vacancies, and a large number of exotic trees are being starved in pots for want of a safe place for planting them.

Some large palms have been removed from near the Sago Clump to another place near the aviary, an operation which proved unexpectedly successful, and only one—*Areca rubra*—suffered to any extent, although they consisted of large plants of *Cocos flexuosa*, *Cocos plumosa*, *Martinezia granatensis*, *Phytelephas macrocarpa*, &c., &c.

The collection of palms planted in 1878 have made good progress and now require thinning out. This family has been increased by fourteen genera and forty-six species during the year, and some other place must soon be selected for them.

The *Cycadaceæ*, now numbering five genera and twenty species, have been collected and planted together.

The Committee are indebted to W. HILL, Esq., of Brisbane, for a very fine specimen of *Cataglyphis Hopcana*. Representatives of this family from the Cape are expected during the current year.

A collection of named varieties of *Nerium Oleander* has been planted on the side of the road leading from the plant house to the lake, and an invoice has been received of upwards of one hundred additional varieties, which will be planted on the other side of the same walk, as soon as they arrive.

A border has been made near the aviary where the *Musaceæ*, *Zingiberaceæ*, *Cannaceæ*, and *Aroidææ* are being planted.

Nursery.—This has been extended during the year, and quantities of plants have been distributed during the year. Dr. ROWELL, P.C.M.O., and Dr. ANDERSON, have been supplied gratuitously for planting near the Hospitals, and also for the Cemetery. Upwards of 5,000 plants (5,023) have been distributed during the year, showing an increase on the number supplied in 1878, when it amounted to 1,074. Numerous packets of seeds have also been sent away. A list of recipients is appended.

A large packing shed has been erected in a convenient place near the Cluny Road and sheds for growing on plants for the show-house, &c. near it.

A number of forest-trees has been raised in the Nursery for roadside planting, and were offered to the Municipal Commissioners in October last, and detailed descriptions of each species forwarded, but no answer has been received, and they will now be used for Dhoby Green and the Raffles Institution grounds.

The number of plants given above does not include those sent to Government House, from time to time.

Flower and Vegetable seeds have been received from MESSRS. CARTER & Co. and MESSRS. SUTTON & SONS; the latter firm presented a collection through their Singapore Agents, MESSRS. JOHN LITTLE & Co.

It is but justice to the first named firm to acknowledge that their seeds were, without exception, faultless, and their strains of flower seeds were really very fine, their Balsams, Colens, Dianthus, &c., &c., being by far the finest that I have seen.

As regards the Vegetable Seeds, I have to report a similar result as in my last.

Peas that under normal conditions would reach six feet in height, here scarcely attained to so many inches, and within two months of their being sown diminutive pods may be picked containing, at most, two peas only.

Lettuces, Radishes, and Endive do well, and even Leeks and Cabbages look better than could be expected.

Economic Garden.—The following economic and interesting plants have been introduced during the year:—

Canella bark (*Canella alba*); Cuba bast (*Paritum elatum*); Baobab (*Adansonia digitata*); Cola Nut (*Cola acuminata*); Trincomalee Wood (*Berrya Ammonilla*); Brazil Elemi (*Amyris sp.*); Guarana bread (*Paullinia*); Brazil Iron Wood (*Casalpinia ferrea*); Mesquit Bean (*Prosopis glandulosa*); Negro Peach (*Sarcoccephalus esculentus*); *Lucuma deliciosa*; Nux Vomica (*Strychnos nux vomica*); Lace-bark (*Lagetta lintearia*); Upas (*Antiaris toxicaria*); Sandal Wood (*Santalum album*); Friendly Isles Vegetable Ivory (*Sagus amicarum*); &c., &c.

A short account of the uses of the various economic plants now in the Gardens is appended.

Cinchona.—All attempts to grow this here have proved fruitless, but *Cinchona calisaya* and *Cinchona succirubra* are likely to do well at 2,000 feet elevation in Pêrak.

Cocoa.—Continual applications are being received from North-Australia, Borneo, and Pêrak, for supplies of seeds of this tree, which have been complied with as far as our limited stock permitted.

A communication has been received from the Right Hon'ble the Secretary of State for the Colonies relative to the advisability of introducing the best varieties from Trinidad.

Mr. CAMPBELL has also promised to get some seeds of the best varieties from Manila.

Coffee.—The Arabian coffee here is severely attacked by the disease (*Hemileia vastatrix*) which has destroyed all hopes of our being able to supply seeds for planters in the Peninsula.

The possibility of the fungus being disseminated by means of the fruit is open to doubt, but if fruits from clean trees can be procured, it would certainly be preferable to that from infected trees.

A discussion is being carried on in Ceylon relative to the value of lime and sulphur as a remedy for this disease, both sides having very strong supporters, but it yet remains to be seen whether the application of these specifics have any permanent effect in checking its ravages. A new remedy, it may be noted, is now being tried in Johor, and the result is looked forward to with much interest.

The Liberian Coffee has not as yet shown any signs of being attacked with the disease, although some Pêrak planters have been scared by the yellow blotches on the younger parts of the branches, but after careful examination I have arrived at the conclusion that this is due to the hardening of the wood only, as it is always found at the base of the green wood next to the riper parts and never scattered irregularly over the branches.

This species is evidently very impatient of deficient drainage to which it is far more sensitive than the Arabian.

The plants raised from seeds received from Kew, in May, 1878, are now blooming profusely.

Eight hundred fruits from our plants have been sent to Government Hill, Penang, and 500 sent to Pêrak.

About 300 plants have been raised in the Gardens, but as the plant is now firmly established in the Colony, the Committee have decided to discontinue planting it.

Very favourable reports have been received from the Native States regarding the progress of the plants of this species there, and there can now be no doubt that the Liberian Coffee has found a congenial home in the Malay Peninsula and adjacent islands, and its future propagation may now be left to planters. &c.

Gum Benzoin or Benjamin (Styrax Benzoin).—Through the kindness of L. WRAY, Esq., and J. G. DAVIDSON, Esq., a quantity of seeds of this valuable tree has been procured and sown, but as they take some time to germinate, no definite report can yet be made on them.

India Rubber.—The plants of the American genera *Hevea* and *Castilloa* in the Gardens are now large plants, but hitherto propagation from the strong growths they are making seems rather difficult, whereas they used to propagate freely from the weak wood produced while in pots. The *Castilloa* is evidently at home here and produces leaves of enormous size, while the *Heveas* make single growths, from two to three feet in length.

Latest information from Pêrak give good accounts of the *Hevea*, but Mr. Low writes as follows respecting the *Castilloa*:—

“This (the *Castilloa*) is now attacked by a worm which bores into the stem, and must injure it very much, as the holes are quite large, and it still continues its ravages “which began many months ago.”

This is not very cheering news, and the life-history of the borer should be investigated at once, in order to ascertain its origin and progress of development, when some means could doubtless be devised to put a stop to its ravages. I would suggest the propriety of the Government appointing some one with some entomological knowledge to investigate this matter before the plants get extensively circulated, and possibly the borer also.

It would be interesting to learn from Mr. Cross and other South American travellers whether the *Castilloa* is liable in its native habitats to such attacks as Mr. Low describes.

Ceara Scrap Rubber (*Manihot Glazionii*) must be omitted from the list of rubbers adapted to the climate of the Peninsula, as it has invariably rotted off during continued wet weather.

Specimens of other species of our indigenous rubber-producing trees have been sent to Kew, whence information about their nomenclature is anxiously looked for.

The Right Hon'ble the Secretary of State for the Colonies has directed a report to be drawn up for the India Office, but it must necessarily be incomplete unless the Kew authorities furnish the desired information. The Report is now ready, with the above exception.

Messrs. TREACHER & BURBIDGE have added considerably to our knowledge of the Bornean species by their paper in the 3rd number of the *Journal of the Straits Branch of the Royal Asiatic Society*.

Specimens or plants of the TREE *Urceola elastica*, (Roxb.) are a desideratum, as all the so called *Urceolas* have proved to be *Willughbeia* or *Chilocarpus*.

About 1,000 plants of the two latter genera have been distributed to the following establishments:—Kew, for the West-Indies and South-America; Brisbane, for more Northern Colonists; Hongkong, Mauritius, Calcutta, Manila, and Rangoon.

Gutta Percha.—Through the kindness of HUGH LOW, Esq., C.M.G., Resident of Pêrak, we have received a consignment of seeds of a species of *Isonandra* producing “Gutta Sundek,” from which, I believe, about 3,000 plants will be produced.

The trees shown to me, when in Pêrak in 1877, as the ones producing “Gutta Sundek” appeared to be *Dichopsis macrophylla*.

As so little is known about the life history of the *Gutta Percha* producing trees, it will be instructive to watch the development of these plants, and ascertain the number of years required to produce a fair sized tree from seed; which, I think, cannot be much, if anything, under 40 years.

The seeds were received here on 14th February last, and sown the same day, and a great number had appeared above ground on 1st March.

A piece of land measuring 102 acres 1 rood and 34 poles has been allotted by Government for the cultivation of economic plants, but principally gutta- and rubber-producing trees, which is now being cleared, where the *Dichopsis* will be placed as soon as they are large enough; and as these will be planted at least 40 feet apart the space between will be planted with smaller growing plants.

Eucalypti.—Seeds of numerous varieties have been procured from Australia and forwarded to the Philippine Islands at the request of the Governor-General of the Colony through the Hon'ble the Colonial Secretary, Straits Settlements, and the Spanish Vice-Consul at Singapore.

When sown *in situ* they seem to thrive fairly well in Singapore, but do not appear to stand transplanting. *Eucalyptus siderophloia*, *Eucalyptus Baileyi*, and one or two other species are growing well in the nursery.

Ipecacuanha.—Our stock at the Gardens is now exhausted, and it is useless to attempt to persuade planters here to take up its cultivation, for reasons mentioned in former reports, and I would strongly urge the Committee to recommend to Government the advisability of sending a lot to Mr. Low for his experimental Garden in Pêrak, as the stiff, tenacious soil of Singapore will not suit its requirements. It does well with Captain MURRAY at Sungei Ujong. If the land on Gûnong Hîjau near Thaipeng in Lârut is not yet taken up, I feel convinced that no better place could be found in the Peninsula for the cultivation of this drug.

Iron Wood of Brazil (Caesalpinia ferrea).—A quantity of seeds of this tree has been received from Kew, and a number of plants raised; but as yet I have been unable to get any information as to its habit, height, or uses. It appears to have a straggling, weedy habit here.

Tea.—A quantity of the Chinese tea is ready to go out on the new land, and Dr. KING has promised to send a large quantity of seeds of Assam hybrid, and promises of plants have been received from Pêrak.

The latter variety, I am convinced, is the only one likely to succeed here, an opinion which is held by all the planters who have tried tea cultivation in Ceylon who have visited the Gardens, and its introduction into Johor promises to turn out most successful, the young plants, now six months old, having made good growth, and they possess every appearance of health.

Teosinté (Euchlœna luxurians).—This grass, although useful, does not bear out its reputation in the Straits. Large quantities of seeds have been distributed, but all accounts from the Native States state that it pays far better to grow maize, as the same ground that will grow *Teosinté* will produce excellent maize.

Maize.—The American varieties introduced by Major STUDER, United States Consul in Singapore, have proved a great success everywhere, and very flattering reports continue to come in from Borneo and the Native States.

Sugar Cane.—Several additional varieties have been introduced from Fiji, the Sandwich Islands, Borneo, and New Guinea, and considerable interest is taken by sugar planters in the collection now at the Gardens. Cuttings have been sent to Pêrak, Klang, Province Wellesley, Penang, Kêdah, and Borneo.

The *Outamite* cane from Fiji is much admired by planters.

Mahogany.—Several plants have been raised from seeds forwarded from Ceylon, and also of the *Star Apple (Chrysophyllum cainito)* from seeds sent from Jamaica.

Mango.—The varieties received from Calcutta and Manila have made good growth, but no applications for inarched plants have been received. The mango does not appear to have a good reputation in the Straits.

BUILDINGS.—The Superintendent's house, the house and out-houses formerly occupied by the Head Gardener, and Superintendent's office, have been repaired, and put in good order; both Javanese coolie sheds repaired and re-attapped, a new shed for the Chinese coolies built on the new reserve, and a new house for the Road-Mandore built; in addition to a packing shed and plant sheds before mentioned.

Library.—Nothing beyond the usual periodicals have been received from England, but a set of Standard Works, the cost of which amounts to upwards of £13, has been ordered and will soon arrive.

The thanks of the Committee are due to the Indian Government for copies of all their Forest Reports, to Dr. O. BECCARI for his valuable "Malesia;" so far as yet published, and

to Dr. SCHOMBURGK, Adelaide, and L. A. BERNAYS, Esq., Brisbane, for numerous brochures bearing on botanical subjects.

Herbarium.—This now comprises over 3,000 determined species. Consignments have, from time to time, been sent to Kew for identification, and a large consignment is now ready for forwarding.

A good deal of information has been collected about Malayan plant medicines and poisons, and my thanks are due to Dr. LITTLE and R. JAMIE, Esq., for their kindness in forwarding specimens for identification, with particulars of uses, mode of preparation, &c.

No replies have yet been received to the Circulars sent to the Native States, by order of the Hon'ble J. DOUGLAS, 20th May, 1878.

A collection of one hundred specimens was presented to the *Vega* expedition, a list of which is appended.

Papers are in course of preparation on the Malay and Botanical names of our indigenous fruits, and also on native timbers, of which a good collection is being got together.

It has been suggested by several visitors to the Gardens that if a place for exhibiting these were provided, they would prove very interesting, and add materially to the attractions of the Gardens, and I would suggest that the late Head Gardener's house be converted into an office, and the present office used as a kind of wood museum, as it is much too damp for books and papers.

Labels.—A quantity of wooden labels has been substituted for the slate ones, but they have not yet undergone a sufficiently long trial to justify a report being made on them.

Mr. W. Fox arrived in August to take up his appointment as Head Gardener, and a fresh staff has been engaged to keep the roads and walks in repair.

Our exchanges continue satisfactory, as will be seen by the appendices, and the correspondence in connection with the establishment is steadily increasing.

A list of subscribers is also appended. A subscription of \$12 per annum entitles any Member of the Community to obtain cut flowers from the Gardens.

A catalogue of the plants under cultivation has been published, and an appendix bringing it up to 31st December, 1879, is in the printers' hands. About five hundred species have been added during the year.

The flower ground planted last year has helped to supply flowers to subscribers, but not to such an extent as had been anticipated.

As our collection of plants is now assuming large dimensions, sometimes rendering the task of finding a particular plant, a difficult one, I would beg to suggest to the Committee the propriety of setting apart a piece of land near the nursery, or on the ground near the site proposed for the Head Gardener's house, as a stock ground where one or two plants of each species could be planted in regular order, and so prevent the species being lost altogether.

The thanks of the Committee are due to the Agents in Singapore:—for the P. & O. Co.; Messrs. JARDINE, MATHESON & Co.; Messrs. APCAR & Co.; the British India, Netherlands India, and Burmah Steam-ship Co.s, and specially to Messrs. GUTHRIE & Co., for their kindness and courtesy in taking plants to and from Singapore free of freight.

In May last I took a short trip some miles up the Muar river, and brought back several rare plants not previously represented in our collection.

A Flower Show was held in the Gardens on 30th and 31st December, and a fine collection of plants was brought together, but, in consequence of the unpropitious weather, it proved a financial failure.

ZOOLOGICAL DEPARTMENT.

A deer fence has been erected on Garden Road side of the lake, and a strained wire fence around the lake to prevent the animals crossing over, but it has not answered its purpose, and the deer play sad havoc in the Botanical and neighbouring Gardens.

The old deer enclosure has been taken down, and also the porcupine enclosure. The porcupines have been sent to the Museum, and the bears, orang-outan, a monkey, two deer, one slow-paced loris, and one vulpine opossum have been sent to the Calcutta Zoological Gardens, in exchange for Indian birds.

The aviary is in need of extensive repairs.

A list of contributors to this department is appended, also an abstract of expenditure.

H. J. MURTON,
Superintendent.

APPENDIX No. I.

Abstract of Estimated and Actual Revenue and Expenditure for the Botanical and Zoological Gardens, for the year 1879.

REVENUE.		Estimated.		Actual.	
BOTANICAL GARDENS.					
		\$	c.	\$	c.
By Government Grant, ...		7,580	00	7,580	00
By Sale of Plants, &c., and Subscriptions, ...				370	00
ZOOLOGICAL GARDENS.					
By Government Grant, ...		2,400	00	2,400	00
	Total, ... \$	9,980	00	10,350	00
EXPENDITURE.					
SALARIES.					
Superintendent's Salary, ...		2,098	15	2,098	15
Head Gardener's Salary, ...		960	00	720	00
Bill Collector's Salary, ...		180	00	180	00
Contingent Expenses, ...		4,341	85		
Coolie-hire (General purposes), ...				3,013	49
Do. (Economic Garden), ...					
Road Mandore, ...				180	00
Manure, and Cartage, ...				281	39
Laterite, ...				616	12
Food for Animals, ...				540	81
Miscellaneous (Botanical), ...				1,882	75
Do. (Zoological), ...				679	79
	Total, ... \$	7,580	00	10,192	50
	Balance in favour, ... \$			\$157	50

APPENDIX No. II.

List of Subscribers to the Botanical and Zoological Gardens, for 1879.

Almeida, Mr. José d'.	Little, Dr. R.
Anson, H. E. Major-General A. E. H.	Lloyd, Mr. J.
Baumgarten, Mr. C.	Maack, Mr. H. F.
Behr, Mr. M.	Miller, Mr. J.
Bishop, Mr. F. C.	Neave, Mr. J.
Brasier, Mr. P.	Purvis, Mr. J. M.
Campbell, The Hon'ble R.	Read, The Hon'ble W. H.
Cheang Hong Lim, Mr.	Remé, Mr. G. A.
Currie, Mr. A.	Richards, Mr. R. P.
Edgar, Mr. G.	Ritter, Mr. E.
Emmerson, Mr. C.	Rowell, Dr. T. I.
Fraser, Mr. J.	Schutze, Mr. A. L.
Gentle, Mr. A.	Seah Cheo Seah, Mr.
Glass, Mr. L. R.	Siegfried, Mr. W. H.
Glinz, Mr. C.	Sohst, Mr. M.
Gunn, Mr. A. B.	Tan Beng Swee, Mr.
Hinnekindt, Mr. H.	Tan Seng Poh, Mr.
Koek, Mr. E.	Whampoa, The Hon'ble H. A. K., c.m.g.

APPENDIX No. III.

List of the principal Contributors to the Botanical Gardens, in 1879.

Agri.-Horti. Society, Alipore, Calcutta, ...	Ornamental Plants and Roses.
Basigoiti, Mr. J. P. de, Switzerland, ...	Dahlia Roots, &c.
Beddome, Lieut.-Colonel, Madras, ...	Indiau Seeds.
Bernays, Mr. L. A., Acclimatisation Society, } Brisbane, ... }	Large collections of Plants and Seeds.

Appendix No. III., continued.

Bowen Park Reserve Committee, ...	Australian Orchids.
Buchan, Mr. W. M., Johor, ...	Cinchona and Cardamom Seeds.
Cantley, Mr. N., Mauritius, ...	Seeds.
Carter & Co., Messrs., London, ...	Flower and Vegetable Seeds (purchased).
Cock, M. Jules de, France, ...	Seeds of Coniferae.
Dimsdale, Mr. F. H., Japan, per Mr. R. Jamie, ...	Japanese Coniferae.
Edgar, Mr. G., Rockhampton, ...	Australian Plants and Seeds.
Ford, Mr. C., Hongkong, ...	Succulents, Ferns, &c., &c., and Seeds.
Glass, Mr. L. R., Singapore, ...	Cacao Fruits.
Godefroy-Lebeuf, M., Argenteuil, France, ...	{ Very large collections of Oleanders, Orchids, Ferns, Bromeliads Marantas, Begonias, Gloxinias, Liliiums, Gladiolus, Ornament- al Plants, and Seeds.
Hardinge, Mr. H., New Zealand, ...	Plants and Seeds.
Hill, Mr. W., Brisbane, ...	Large consignments of Plants and Seeds.
Hooker, Sir J. D., C.B., K.C.S.I., &c., Kew, ...	{ Valuable Ornamental and Economic Plants and Seeds.
Hose, The Ven. Archdeacon, Singapore, ...	Ferns, &c.
Isemonger, Mr. E. E., Province Wellesley, ...	Amorphophallus and Ferns.
Jamie, Mr. R., Singapore, ...	Plants and Seeds.
Jenman, Mr. G. S., Jamaica, ...	Palm Seeds.
Kehding, Mr. F., Singapore, ...	Palm Seeds.
King, Dr., Calcutta, ...	{ Numerous consignments of Orchids, &c., and Seeds.
Koek, Mr. E., Singapore, ...	Plants and Seeds.
Longden, Lady, Ceylon, ...	Valuable collection of Ceylon Ferns.
McNair, The Hon. Maj. J. F. A., C.M.G., Singapore, ...	Seeds and Ferns.
Murray, Captain, Sungei Ujong, ...	Plants.
Murton, Mr. J., England, ...	Plants and Seeds.
O'Brien, Mr. H. A., per H.E. the Administrator, ...	Plants of Tecoma venusta from Penang Hill.
Piltzer, Mr. L. J., Borneo, ...	Seeds.
Read, The Hon'ble W. H., Singapore, ...	Seeds, &c.
Ross, Captain J. D., Singapore, ...	Ferns, Orchids, Rare Palms, and Seeds.
Sachs, Mr. E. F., Sumatra, ...	A tuber of Amorphophallus Titanum.
Scheffer, Dr., Java, ...	Large consignments of Plants and Seeds.
Schomburgk, Dr., Adelaide, ...	A large consignment of Seeds.
Shaw, Mr. H. F., Fiji, ...	Seeds and Ferns.
Siam, H. M. the King of, ...	Two cases of Plants.
Squirrel, Major, 74th Highlanders, Malacca, ...	Bulbs, &c., &c.
Studer, Major, U. S. Consul, Singapore, ...	Seeds of Catalpa, Indian Corn, &c.
Sutton & Co., London, per Messrs. John Little & Co., Singapore, ...	{ Flower and Vegetable Seeds.
Thwaites, Dr. C. M. G., Ceylon, ...	Seeds and Plants.
Veitch & Sons, Messrs. J., Chelsea, London, ...	Two consignments of Rare Plants.
Vidal, Señor Don S., Manila, ...	Orchids, &c.
Whampoa, The Hon. H. A. K., C.M.G., Singapore, ...	Plants and Seeds.
Wickam, Mr. H. W., Townsville, ...	Seeds, &c.

APPENDIX No. IV.

*List of the principal Recipients of Plants and Seeds from the Botanical Gardens,
during 1879.*

Agri.-Horti. Society, Calcutta.	Kew, The Royal Gardens.
Beccari, Dr. O., Florence.	King, Dr., Calcutta.
Bernays, Mr. L. A. Brisbane.	Koek, Mr. E., Singapore.
Bowen Park Reserve Trustees.	Linden, Chevalier, Brussels.
Bull, Mr. W., Chelsea.	Longden, Lady, Ceylon.
Cantley, Mr. N., Mauritius.	Low, Mr. H., C.M.G., Pérak.
Festa, Chevalier, Singapore.	Maharajah of Johor, H. H. the, Singapore.
Fiji Government.	McNair, The Hon. Maj. J. F. A., C.M.G., Singapore.
Ford, Mr. C., Hongkong.	Murton, Mr. J., England.
Gilbert, Mr. R., Rangoon.	Murray, Captain, Sungei Ujong.
Glass, Mr. L. R., Singapore.	Read, The Hon'ble W. H., Singapore.
Godefroy-Lebeuf, M., Argenteuil, France.	Ross, Captain, Singapore.
Government House, Singapore.	Rowell, Dr. T. I., P.C.M.O., Singapore.
Hospital, General, Singapore.	Scheffer, Dr., Java.
Hospital, Tan Tock Seng's, Singapore.	Schomburgk, Dr., Adelaide.
Hardinge, Mr. J. Coles, Rangoon.	Shaw, Mr. H. T., Fiji.
Hill, Mr. W., Brisbane.	Spooner, Mr. E., Lahore.
Hose, The Ven. Archdeacon, Singapore.	Tampassak Experimental Garden, Borneo.
Jamie, Mr. R., Singapore.	Thwaites, Dr. C.M.G., Ceylon.
Jenman, Mr. G. S., Jamaica.	Vidal, Dr., Manila.
Kehding, Mr. F., for Botanical Gardens, Lyons.	Whampoa, The Hon. H. A. K., C.M.G., Singapore.

STRAITS SETTLEMENTS.

Paper laid before the Legislative Council by Command
of His Excellency the Governor.

FRIDAY, 10TH DECEMBER, 1883.

Annual Report on the Botanic Gardens, Singapore, for the year 1882.

[No. 100.]

SIR,—I have the honour to forward herewith my Report on operations carried out in the Botanic Gardens during the year 1882.

I have, &c.,

N. CANTLEY,
Superintendent.

R E P O R T .

This being my first Report on the Botanic Gardens, Singapore, I would beg to preface the details of work accomplished during the year by a few general remarks which will lead to a clearer understanding of what has been done.

2.—On assuming charge of the Gardens, in November, 1880, I set about a careful enquiry into all the circumstances and details affecting them. Their contents, their inward organization, capabilities and scope, with reference to public utility—a task which my just previously having relinquished charge of a Botanic Garden in full working order rendered comparatively easy.

3.—After due consideration, I recommended to the Committee the following, which being approved, has since been my aim and object to effect and which I hope will lay a foundation for general usefulness not hitherto laid, viz. :—

- 1st. The formation of a suitable Nursery for the propagation of trees and shrubs.
- 2nd.—The formation of a Nursery for the propagation of ornamental foliage plants, and delicate plants generally, under shade.
- 3rd.—The construction of a suitable Plant-house in a convenient part of the Garden for the general collection of pot plants of every description.
- 4th.—The erection of a suitable Office for the general clerical work of the Gardens and for the accommodation of the Gardens books, in a position convenient to visitors, &c. .
- 5th.—The erection of an Herbarium, or Hortus Siccus, to contain a general dried named collection of plants arranged in their natural families for reference.

6th.—The formation of a Library of useful books on Horticultural and Botanical subjects.

7th.—The erection of a Store-house for the accommodation of the Garden Tools and general Stores.

8th.—The sale of plants from the Gardens to the public at nominal rates, or such as will cover cost of propagation.

9th.—The establishment in the grounds of a named collection of Herbaceous plants and trees arranged in their natural orders for the purpose of instruction.

10th.—The naming and better arrangement of trees and shrubs on the lawns.

11th.—The revision and alteration of the Garden Bye-Laws and Regulations.

12th.—The establishment of day and night Police for protection, and the location of the Constables within the Gardens.

13th.—A complete revision of the working staff, and the appointment of additional Officers of the lower grade.

14th.—The completion of the Economic Garden commenced by the late Mr. MURTON, but on a modified plan.

15th.—The location of the Garden Coolie-houses in a certain secluded position in the back grounds, and the removal of the Coolie-sheds scattered over the Gardens.

16th.—The institution of a proper system of book-keeping and office work generally.

17th.—Also the following:—The appointment of a Clerk for assistance in the Office; a Chief Mandore able to write and read; a Propagator with the same accomplishments; a Mason, a Printer, a Carpenter, and a Plant Collector to assist in the general work of the Gardens.

4.—I will now detail how far I have been able to carry out the above during 1882, and as attention has been mainly directed to these, I need hardly observe that the work of the year has been chiefly of a departmental nature.

5.—**Visitors.**—The number of Visitors to the Gardens during the year cannot be correctly stated, but they have been very numerous, the Gardens being very popular and a favourite place of resort.

6.—**Buildings.**—The permanent buildings connected with the department are in good order.

NEW INSTITUTIONS.

7.—**Erection of an Office and Herbarium.**—A new Office and Herbarium have been erected at a cost of \$1,500. The Office has been fitted up with desks, tables, and book-cases and the walls hung with useful maps and time-tables. On the principal table is fixed a large map of the Island on rollers, which is found very useful for reference.

8.—More urgent work has prevented money being spent on Herbarium fittings further than the purchase of four small cabinets after the Kew pattern, which have been sufficient to accommodate the specimens collected during the year. The paper for the mounted specimens and

cabinet shelves is the same size as that of the Kew Herbarium, which admits of exchanges being made without inconvenience. The internal areas of these new structures are as follows:—Herbarium, 650 square feet; Office, 300 square feet; Drying-room, 200 square feet.

9.—**Construction of Propagation Plant-House.**—A space of 1,500 square yards has been levelled on the edge of the jungle on the North side of the Garden. The ground having previously a gentle slope, about 500 cubic yards of soil had to be excavated in the levelling. Over this ground three lines of staging, each 183 feet long by 10 feet broad, have been put down. Between the rows of staging, paths six feet in width have been made and metalled with laterite. On each side of the staging a table has been placed. These tables are about 160 feet long by 9 feet broad.

10.—The stage supports in this house are composed of masonry over which planks of Singapore Cedar have been laid for the accommodation of the pot plants. Along the centre of each line of staging, trees have been planted 20 feet apart for the purpose of shade, which does away with the necessity of a roof and consequently saves expenditure on roofing.

11.—The area of the house is sufficient to accommodate from 4,000 to 8,000 plants in pots according to size. Such of the old collection of pot plants as were considered advisable to retain have been deposited in this house, where the additional light and air have very much revived them. These, however, were only sufficient to fill but a small proportion of the house, which has been completely stocked, during the year by the aid of propagation, introduction of new plants, &c.

12.—In the construction of this house, and that of all other works of the year, permanency and the suppression of up-keep expenses have been kept in sight, as far as possible, with which view parts of the staging and all the tables have been cut out of the soil and bricked over, thus giving the work a solidity and permanency which reduces up-keep expenses to a minimum.

13.—When finished, the house was enclosed by 230 yards of unclimbable iron fencing selected by the Hon'ble Captain H. E. McCALLUM, R.E., and obtained from England.

14.—**Construction of an Exhibition House.**—The Committee having decided that accommodation for the annual Flower Show should be provided within the Gardens, I drew up a plan of a house, and the work was proceeded with on a spot selected near the aviaries, where paths and staging have been cut out in the soil (sunk work).

The staging thus formed has been bricked over with flooring tiles laid in cement, and everything in the shape of wood-work done away with.

15.—The area of this house is 4,200 square yards. In its formation, about 6,000 cubic yards of soil had to be excavated. It contains 4 large triangular blocks of staging; one round centre piece, 4 tables, and 3 lines of staging round the outside path.

16.—The breadth of the paths separating the stage work is 6 feet, and of these the house contains 300 yards. The whole work, as far as completed within the year, costs \$617.

17.—It is intended to fill this house with the more choice, interesting specimens of pot and basket plants. Where they will remain all the year round except on the days required for the general exhibition.

18.—This house, together with that previously mentioned, gives the Gardens an immense additional accommodation for plants, which, if properly taken advantage of, cannot fail to raise them to a position of great public utility, the want of accommodation and system being heretofore the chief impediments to progress.

19.—**General Store-house.**—A Tool Store and general Store-house has been procured by arrangements which admitted of the Garden Mandore's quarters being converted into a store-room and the Mandore quartered elsewhere.

20.—**Formation of a Nursery for Ornamental Foliage and Delicate Plants generally.**—The utility of the Gardens has been much enhanced by the creation of a Nursery for the propagation of fancy and delicate plants. Such plants were, up to the date of my arrival, propagated only to a limited extent, chiefly in wine cases and pots.

21.—The Nursery created for their propagation adjoins the plant-house first mentioned, is about an acre in extent, and was formerly under jungle.

22.—In the formation of this Nursery, care was taken to open out the leaf canopy of the jungle so as to admit the requisite amount of light without admitting the direct deteriorating rays of the sun. Paths have been made through the ground, and beds formed edged with moss. In these beds plants of all the more delicate kinds have been propagated throughout the year with great success, and the Nursery being of a kind new to the Gardens has been much admired by visitors.

23.—In this Nursery plants are found to take root in nearly half the time required in the more open ground, and even Crotons and the more hardy plants follow the same rule.

24.—About 10,000 plants have been reared during the year in this Nursery alone and disposed of in various ways, see para. 75.

25.—**Forest Tree Nursery.**—During the year, the Forest Tree Nursery has been extended over the greater portion of the marshy land lying below the Nursery formed last year, which being composed for the most part of vegetable matter washed down from the surrounding hill slopes has proved better suited to the growth of seeds and plants than the land previously cleared.

26.—The number of trees raised and sent out from this Nursery is given at para. 74.

27.—**Formation of a Reserve for Cut Flowers.**—A flower reserve has been created at the extreme west corner of the Gardens. The area of this reserve is about 3 acres, and has been planted with about 3,000 selected flowering shrubs. The reserve has been found useful in meeting the demand for cut flowers, and preventing the flower beds on the lawns being denuded.

28.—Propagation in the houses has almost ceased, owing to the better accommodation for such work elsewhere, except in the case of a few particularly delicate plants, for which a wooden frame covered with glass has been made by the Garden Carpenter. This frame has three large moveable glass sashes and covers a space of about 110 square feet and has been found very useful during the year in dealing with the class of plants just named.

OFFICE.

29.—**Garden Bye-Laws and Regulations.**—The Garden Bye-Laws and Regulations have been, at my request, entirely revised and made sufficiently flexible to cover all the altered circumstances and conditions under which the Gardens are being now worked.

30.—**Prosecutions under the new Bye-Laws.**—There have been three prosecutions during the year, one for theft and two for cutting and destroying plants. In each case the parties were convicted.

31.—**Protective Staff.**—A great improvement has been effected in the efficiency of the protective staff by the quartering of three special Police Constables within the Gardens, instead of their having to walk all the way from the Orchard Road Police Station and arriving at the Gardens late in the evening for night duty, the Garden being unprotected during the day.

32.—These three Constables, being now quartered on the spot, take each 4 hours on duty day and night, thus admitting of one man being constantly on guard. Since the inauguration of this system, the Gardens have been but little disturbed by depredators.

33.—**Office Work.**—A better system of office work has been instituted. To the three books formerly in use (Expenditure and Wardian Case Books) the following have been added :—

1. Garden Ledger.
2. Cash-Book.
3. Subsidiary Cash-Book.
4. Day Book
5. Home Correspondence Book.
6. Foreign " "
7. Store Book.
8. Propagation or Stock Book ; and several minor accessories.

34.—The three books found in use were kept without any system, but have now been reduced to a practicable form which has both shortened and simplified the work.

35.—The Committee have been good enough to sanction the services of a Clerk to assist in the office work and make himself generally useful in the Herbarium. Also a Chief Mandore, Propagator, Printer, Carpenter, Plant Collector and Mason—all of whom have worked well during the year.

36.—**Printer's Work.**—The Printer was quite ignorant of his duties when he joined the Gardens, but observing he took an interest in the work, I persevered in my instructions, and he now prints in a very creditable manner and has gone over most of the labels of the collection.

37.—**Carpenter's Work.**—The Carpenter has been fully occupied during the year in the construction of plant cases, labels, and the fitting up of the staging in the new plant house, in which work he was assisted by an additional carpenter for some time.

38.—**Mason's Work.**—The Mason has been occupied in the construction of the masonry in the new plant houses.

39.—**Collector's Work.**—The Plant Collector has brought in some hundreds of herbarium specimens from the jungles, but has taken some considerable time to learn how to dry them properly, but having at last got his hand in, he now performs his work very satisfactorily.

40.—**Library.**—The Garden Library is contained in one large case with glass doors which I had constructed for the purpose at a cost of \$35, and has been placed for the present in the Garden Office. For list of books added during the year, see Appendix *B*.

41.—**Sale of Plants, &c., from the Gardens.**—The opening of sale of plants from the Garden at nominal rates is much appreciated by the public, who have largely availed themselves of the privilege. For the number of plants sold during the year, see para. 75 and for receipts of sales, see Appendix *A*.

IMPROVEMENTS IN THE GROUNDS.

42.—**Clearing and Levelling.**—The chief improvements to the grounds during the year have been the clearing away of the old plant house erected in the centre of the Garden, a Coolie-house, and another old building from same quarter which had been condemned as unfit for use as well as occupying a very objectionable position.

43.—These being removed the sites were found very uneven and had to be cut down and remodelled over a space of 9,000 square yards. The whole of which being got into the necessary shape of slope and terrace was turfed over with grass, a work which occupied the majority of the effective staff for several months.

44.—This work has removed one of the most objectionable features of the Gardens, and opened up to view at the same time some fine clumps of Mascarine palms and other objects of interest previously hidden; while the addition made to the grass lawn has been an extensive one and affords room for the formation of a Rosary which has been made during the present year.

45.—**West Entrance.**—The corner shrubbery at West Entrance which always presented an unsightly spectacle was taken in hand about the middle of the year, a grass verge laid down in front, behind which the soil was raised about 1 foot over a superficies of 50 square yards and mostly planted with ferns—plants which the heavy shade afforded by the surrounding trees made particularly suitable. The ferns have grown well and the corner from being one of the most unsightly has now reverted to the opposite extreme.

46.—**Improvements to Lawn North of North Boundary Walk.**—The lawn north of North Boundary Walk which passes the aviary has been slightly raised over its whole surface, and closely turfed over. The area of the ground thus covered is about 400 square yards, and extends the whole length of the walk.

47.—**New Shrubberies.**—Behind this lawn a shrubbery border has been made to form a back ground and line the edge of the jungle passing between the lawn and plant houses. This shrubbery has been planted with a variety of introduced trees and shrubs.

48.—**Planting out of Specimen Plants.**—On the removal of the collection of foliage plants from the old plant house, advantage was taken to plant out one specimen of each kind of Croton contained in the collection. These form a line on each side of the terrace walk near the Bandstand, and have been labelled with printed slate labels. The plants have taken away the bare unfurnished appearance which this walk previously presented, and their bright coloured leaves make a pleasing contrast with the heavy dark green of their surroundings.

49.—Many other trees which the late Superintendent reported were being “starved in pots for want of some safe place to plant them” have been planted out in the shrubberies and lawns—a course which has been rendered safe by the present system of protection.

50.—The progress made by the majority of these trees has been very great, some of them having already attained a height of over 15 feet.

51.—**Flower Beds.**—The extension of floral ornamentation which the Gardens so much required, has received careful attention, and a general system of flower beds has been planned. These commence at the old croquet lawn in front of the aviaries and extend along the Terrace immediately below the Bandstand as far as the West Entrance, but as more urgent work had to be first undertaken, little more than a commencement could be effected before the close of the year; this consisted in laying down a neat design on the old croquet lawn just mentioned. The carpet bedding which has been so much admired is the work of 1883, and does not, therefore, fall to the share of this Report.

52.—**Ornamental Lakes.**—The ornamental lakes have several times been cleared of weeds during the year, and otherwise maintained in good order. The small lake has been given up entirely to the Nymphæas and smaller Water Lilies; and the Victoria Regia Lily has been accommodated in a special lake where it has grown and flowered very freely.

53.—**Labelling.**—The Garden collection has been labelled nearly throughout during the year with large labels carrying white letters on a black ground. The printing has been done chiefly by the Garden Printer.

54.—**Bandstand.**—In no part of the Garden perhaps, are improvements more noticeable than on and in vicinity of the Bandstand, which occupies the top of a hill in the centre of the Garden and from which the grounds fall in a series of terraces and gentle slopes till the main lawn adjoining the ornamental lake is reached. These terraces as well as the ground plan of the Gardens are the work of the late Mr. NIVEN and do much credit to his horticultural skill.

55.—Improvements to the Bandstand and surroundings was a desire early expressed to me by the Gardens Committee, and I commenced the work by removing some large Crotons and other plants which had been placed on the stand in tubs, most of which had fallen into a dilapidated condition. A suitable place for these being found on the opposite side of the broad walk which surrounds the stand, they were replaced by handsome vases ordered from China, these have been filled with plants of an ornamental and suitable description.

56.—Between the vases at suitable distance young Auricarias and Crotons have been planted, which being in keeping with the size and nature of their surroundings have presented a pleasing and graceful appearance.

57.—The flower-beds which the stand previously possessed have been considerably modified and planted with interesting flowering plants received from abroad.

58.—These improvements being completed, garden seats of an ornamental and comfortable nature were placed on the stand. These

seats were specially selected for the Garden by me when on leave of absence in England and are after the pattern in use in Battersea Park, London.

59.—**Aviaries.**—The Aviaries have been painted during the year to preserve the wood and iron work, and in each cage a square of grass of about 18 square feet has been planted, which the birds seem to much enjoy. Several birds have been killed during the year by snakes, especially by *Python reticulatum*. For the names of birds added to the collection during the year, see Appendix B.

60.—**Grass Lawns and Hedges.**—The grass lawns have been kept closely mown during the year and the boundary bamboo hedges neatly cut.

61.—A logwood hedge has been raised from seed sown along 100 yards of west boundary which until now has remained unprotected. Logwood when raised from seed closely sown makes an excellent hedge, compact and prickly, and in every way superior to the bamboo hedge so much in use for defensive purposes in Singapore.

62.—Several trees which had become ant-eaten and dangerous have been removed from the lawns and replaced by others of an ornamental nature.

63.—**Walk leading to Aviary.**—A great deal of hard work has been got through during the year in improving the condition of the walks and roads. The 10-foot broad walk which bounds the Garden on the north side has been raised about one foot over its whole surface for a length of about 127 yards and closely metalled with laterite. A large tree—*Castanopsis* sp.—which occupied its centre opposite the west entrance has been removed and thus some fine plants of *Caryota Wallichii* have been brought into view which were formerly hidden behind this worthless tree.

64.—This walk was previously impassable in wet weather; its low situation brought down upon it mud and other debris from the adjoining grass slopes and having no side drainage it soon got into a puddle. In its new formation a catchment drain has been put down to carry off surface water. Its direction, too, with respect to curve, had to be much altered for the sake of ornamental effect, and in this alteration the adjoining grass banks had to be brought forward, which necessitated a good deal of labour.

65.—**West Entrance Walk.**—The 24 feet broad West Entrance Walk which the heavy rains had washed out of shape has been remodelled, and the sides laid down with rough laterite over a distance of 150 yards.

66.—**Walk by Lake.**—The 8 feet walk which runs by the ornamental lake to where the old plant house stood has been raised about 6 inches over its whole surface for a length of about 150 yards and covered with fine laterite.

67.—The other principal Walks and Roads have been extensively repaired. Such patchwork may be estimated at about 400 square yards, and the whole work accomplished at about 16,000 square yards.

68.—**Vegetable Garden.**—An experimental Vegetable Garden was opened during the year on Bukit Timah, but funds becoming exhausted shortly after its commencement, operations were suspended in consequence.

69.—During the present year, another Vegetable Nursery has been opened on Crown land near the Botanic Gardens, and is now in working order.

Details of results will be given in next year's Report.

INTRODUCTION AND PROPAGATION OF PLANTS.

70.—**Exchange of Plants and Seeds.**—The exchange of plants and seeds with Botanic Gardens and other Establishments abroad has been well attended to, as will be seen from the list of contributors and introductions in Appendix C, the more important plants being marked with an asterisk. The plants received number 310, and packets of seeds 450.

71.—**Number of Plants and quantity of Seeds sent abroad.**—The number of plants sent abroad during the year number 1,160, in 28 Wardian cases, and the number of packets of seeds 560, weighing approximately 82 lbs. For list of Recipients, see Appendix C.

72.—**Plants brought in from the Jungles.**—The number of plants brought in from the various forests and jungles of the Settlements, and chiefly collected by myself while travelling on forest duty, may be roughly estimated at 2,000.

73.—**Plants purchased.**—The plants purchased in the Colony during the year include Ferns, Orchids, Chrysanthemums, Begonias, Dahlias, Geraniums, Anthuriums, Eucharis, Selaginellas, &c., &c., &c. Purchases made in England include many plants of Economic value, and useful plants generally, see Appendices.

74.—**Number of Plants propagated in the Garden Nurseries.**—The number of plants propagated during the year in the various Nurseries of the department may be roughly estimated as under:—

Forest Tree Nursery, forest trees,	...	...	30,000	70,000
General Nursery, various kinds,	...	...	28,000	
Fancy Plant Nursery, do. do.,	...	...	10,000	
Plant Houses, do. do.,	...	...	2,260	
		Total,	60,260	

75.—These have been disposed of as follows:—

Sold to the Public, assorted kinds,	...	...	2,000
Planted in Forests, forest trees,	...	...	20,000
Supplied to Government Institutions, various kinds,	...	...	7,000
Given in exchange (Colonial),	...	...	100
Sent abroad in exchange, assorted kinds,	...	...	1,160
Used in ornamenting the Gardens, flowering kinds chiefly,	...	...	5,000
Retained as Nursery Stock, various,	...	...	20,000
Retained as Stock for new plant houses, ornamental and economic plants,	...	...	5,000
		Total,	60,260

76.—There has been one Auction sale during the year, when about 800 surplus plants were sent into the Town of Singapore and sold to the highest bidder. The sale realised \$163.00 which left the Gardens a sufficient margin of profit to cover propagation and other expenses.

77.—**Economic Plants.**—The chief economic plants which call for a brief reference are the following :—

The new varieties of Cacao received from the West Indies have grown well, and are now bushes of about 3 feet in height with large crowns. They have been pruned during the year and everything to encourage rapid growth has been attended to.

78.—Plants of the old varieties have been raised from seed and are in demand among planters in Singapore and Johor, where large plantations have been made, and where, under proper treatment, the plant thrives well and gives good returns to the cultivators.

79.—**Liberian Coffee.**—Seed of Liberian Coffee has been much in demand during the year, and the Garden has disposed of the whole crop.

80.—The plant thrives admirably on some of the adjoining islands and in many places on the mainland.

81.—Some planters advocate shade for this plant, but I have not heard of its having proved beneficial in the wide sense of the term. My experience goes to prove that the plant is better without shade, which only seems to retard the ripening of the fruit, and planting at too high elevation has the same effect.

82.—**Arabian Coffee.**—The planting of Arabian Coffee has almost ceased except at high elevation in the Native States, where at about 3,000 feet it thrives well and is remarkably free from the Hemileia or leaf-disease.

83.—**Maragogipie Coffee.**—While I write I have before me seed of a new Coffee from Brazil (Maragogipie Coffee) upon the qualities of which I am informed the Brazilian Minister has very favourably reported, the plant being now largely cultivated in that country.

84.—From a drawing of leaf forwarded me, it would seem about the size of the Liberian variety. The cherries, however, are not so large. This coffee will form the subject of future experiment and report.

85.—**Café Nain.**—Café Nain is an exceedingly dwarf and very prolific variety of Coffee from the island of Réunion where it is believed to be a hybrid raised by a Mr. NAIN. The cherries are much less in size than those of *Coffea Arabica*, but are produced in greater abundance. The plant is largely grown in Mauritius, where its qualities are held in high repute.

86.—Seeds of this variety were received during the year, but did not germinate. A further supply has been requested.

87.—**Tea.**—Tea was for some time largely planted on Gunong Pulai hill on the Johor side, and the quality of the produce equalled the best Siam production, but the plant was found to yield leaves in too limited quantity to sufficiently remunerate planters.

88.—**Paraguan Tea.**—The plants of Paraguan Tea planted in the Gardens some three years ago continue to grow well. This plant does not belong to the Tea family, but is a Holly (*Ilex*). The plant is largely cultivated in Paragua for the Tea produced from the leaves. Dr. BYASSON states that the prepared leaves contain as much coffeine as the best Chinese tea, and is used in Brazil by about 12,000,000 people, the annual consumption being about 8,000,000 lbs.

89.—**Pepper.**—Pepper plants, especially Cubebs, have been much in demand during the year. Several cases of *Piper nigrum* have been sent to Ceylon at the request of the Director of the Gardens there, the Singapore variety being considered the best.

90.—**Cardamums.**—Requests for supply of Cardamums have been received from home planters and others in the Colonies, but our stock being very low, we were unable to fully meet the demand.

91.—**Nutmegs and Cloves.**—Spice trees, Nutmegs and Cloves especially, have been much in request during the year and have been largely supplied. The inhabitants of Penang have taken to planting these trees extensively, the plantations made look well and people are in hopes of the Island regaining its former position among the spice producing islands of the world. The other Settlements would do well to try a similar experiment, see para. 54 of Report on Forests where the cause of the nutmeg failure in years past is discussed.

92.—**Cinchona.**—Orders for Cinchona plants and seed have been received, but the temperature at the Gardens here being much too high for the cultivation of the plant it is not kept in stock, but this will be remedied as soon as the new Garden in Penang is opened, where an elevation of over 2,550 feet can be had, and where many useful plants not now in our collection can be grown and acclimatised for cultivation on the lower plains.

93.—**Cinnamon and Allspice.**—Cinnamon and Allspice grow admirably in the Gardens, but are not much in demand.

94.—**Cassia Bark.**—During the year, a Wardian case of plants said to be the true Cassia Bark of commerce (*Cassia lignea*) was received from the Botanic Gardens, Hongkong, accompanied by an able report on the cultivation and propagation of the plants.

95.—These plants have been planted out, have grown well, and may ultimately add to the commercial products of the Settlements.

96.—**Bread-nut Tree.**—Plants of the tree which produces the Bread-nut of Jamaica have been planted out in soil of average quality, in which they have made admirable growth and shew every sign of becoming acclimatised in the Colony.

97.—**Other Fruit Trees.**—Among other fruit trees introduced during the year have been the Mauritius variety of Mangoes which are supposed to be the best procurable; the Madagascar Grape; the Litchi of China; Queensland Nut; Star Apple; Mabola fruit; Chinese Apricot and Oranges in variety.

98.—**Sago.**—The large Sago trees (*Sagus Rumphii*) growing near the Lake have produced seed in abundance, which have been supplied in quantity to various planters, and a considerable number sown for stock purposes.

99.—**Malay Camphor.**—Several cases of the tree which produces the Malay Camphor have been supplied to the Government of Mauritius chiefly for the production of timber, of which the tree produces an excellent quality. The Camphor produced by the tree is chiefly in demand in China where it fetches a high price. A collection of young plants of our best forest trees has also been forwarded to Mauritius.

100.—**Sugar Cane.**—The collection of Sugar Cane has been replanted during the year in order to preserve the varieties. Sugar Cane for planting purposes is not much in demand in Singapore; and it is proposed to remove the collection to the Penang Garden where they can be more conveniently inspected by the sugar planters of Province Wellesley.

101.—**Calumba Root.**—Plants of the Calumba Root have been obtained from the Mauritius and have grown with great vigour.

102.—**Caoutchouc and India-rubber Plants.**—For information regarding the introduction to the Gardens of foreign and native rubbers, see Appendix C. The trees of *Hevea Braziliensis* have grown well considering the soil in which they have been planted by the late Superintendent and an early crop of seed is looked forward to.

103.—The Panama Rubber (*Castilloa elastica*) has flowered during the year, but did not produce fruit. The African Landolphas introduced have also grown well and have been extensively propagated from cuttings. *Manihot Glaziovii* has also made fair progress. *Cyrtostegia grandiflora* introduced some years ago grows remarkably well. Seed of *Hancornia speciosa* received from Mr. CHRISTE, London, did not germinate in the Garden nor with planters who also received a supply.

104.—**Fibre producing plants.**—The growth made by various introduced fibre producing plants is very encouraging and would seem only to await manufacturers. The growth of Mauritius Hemp, *Fourcraea gigantea*, is especially good.

105.—**Ipecacuanha.**—This valuable medicinal plant has been kept in pots during the year. It is not much in demand, being very difficult to manage in almost any situation, but prefers a moist shady position with a still atmosphere. Its cultivation in this part of the world is looked upon by planters with disfavour.

106.—**Bois Immortelle.**—Plants of *Erythrina umbrosa*, or Bois Immortelle, received last year from the Botanic Gardens, Ceylon, have been largely propagated, as it is said to be an excellent shade tree for chocolate, coffee, &c. The Gardens are now in a position to meet demands for this tree.

107.—**Cow Tree.**—Plants of *Pola de Vaca*, or Cow Tree, (*Galactodendron utile*) which is said to produce milk of as good a quality as that from the cow, were received from the Royal Gardens, Kew, and have been kept in pots up to date, the plants not being considered strong enough as yet to plant in the open ground.

108.—**Rain Tree.**—Seeds of the Rain Tree (*Inga Saman*) have been received in quantity and made very rapid growth, completely outstripping all other kinds.

109.—**Pilocarpus pinnatifolius.**—In this tree, some plants of which have been planted in the Gardens, a new substance called Pilocarpine has been discovered and said to be very efficacious as a cure for snake poison. The plants planted have made very slow progress.

110.—**Chinese Camphor.**—The plant of Chinese Camphor (*Camphora officinarum*) planted in the Economic Garden some three years ago has made very fair growth; apart from its utility as a camphor producing tree, it also yields excellent timber of large dimensions, and its growth has been watched with a view to its taking part in the afforestation of the waste lands of the Settlements now commenced.

111.—**Cotton.**—Seeds of varieties of Cotton forwarded me, have been planted in pots and have produced fine ball of cotton, but the heavy rain of the Settlements will, I am afraid, prove too much for the successful cultivation of this plant.

GENERAL.

112.—**Work in the Herbarium.**—On taking over charge of the Gardens, one of my first duties was to ascertain the nature of their contents; a catalogue purporting to be a list of plants contained in the Gardens was published in 1879, and a supplement in 1880; and on taking over charge in November of year last named, it might have been expected, that I should have but little trouble in arriving at a correct idea of their contents. But on my referring to the Catalogue for the names of the trees they could not to be found: I next sought for the plants contained in the list, and with the exception of a few was equally unsuccessful.

113.—Of the few plants labelled on the lawns fully one half were wrongly named; many of them being labelled with names of plants not to be found in the Gardens. Having enquired as to the manner in which the Catalogue of 1879 had been compiled, I have been informed that it was drawn up from list of plants contained in the record of Wardian cases received, which contains the list of receipts, but does not account for the plants that may have died, or seeds which may not have grown.

114.—The supplement published in 1880 was founded chiefly upon lists of names of specimen received from Kew, and my since having found the great number of these, not in the Gardens, but in the outside jungles, there is strong reason for believing that the specimens sent to Kew had been collected there.

115.—The work which thus presented itself as necessary to be undertaken before the Garden collection could be placed on a satisfactory footing as regards labelling was certainly not of a trifling nature. My first attack was to grub up all the labels of plants which I knew to be wrongly named, and next to determine microscopically the remainder of the collection as far as possible. The Garden contents have been now labelled almost throughout; the few not yet named are those which have not flowered and consequently not supplied the necessary material for their determination.

116.—As the work of naming of the plants progressed, every day revealed some new discovery of plants not hitherto known to exist within the Garden boundary, and these have now multiplied to such an extent, that it has been considered advisable to suppress altogether the catalogues mentioned and to issue a new and more reliable production. The compilation of which is in hand.

His Excellency the Governor having ordered early in the year, that a Report on the Forests should be drawn up with as much despatch as possible, the work was early proceeded with; during its progress 300 herbarium determinations were made of plants from the hitherto little known jungles of the Settlements, the names of which will be found in Appendices to forest report, with corresponding local names as far as possible. This work led to the discovery of some new plants, as also did the naming of the Garden collection.

117.—The New Herbarium, however, was at this time not yet erected, the work was chiefly accomplished in a room in the Superintendent's quarters which I had converted into an Herbarium. The Director of the Royal Gardens, Kew, also kindly sent a list of names of things forwarded him during my forest inspection tour, many of which, from the nature of the circumstance at the time, were but very roughly prepared.

118.—The report on forests being completed, an investigation into the source of the Rubber supply of the Peninsula was next taken in

hand, to which my attention was specially drawn by Professor DYER, C.M.G., of the Royal Gardens, Kew. This work was commenced as the year closed and has been prosecuted with vigour during 1883. Much new information has been got together and will early appear in a separate report on the subject.

118.—**Government House Grounds, Improvements.**—During the year, the Government House Grounds have been placed under the direction of this department and the improvements effected have been those planned chiefly by His Excellency the Governor, and which consist mainly in the removal of the shrubbery designs from the two squares of grass lawn in front of the house, which had become overgrown, unsightly and otherwise inappropriate for the position. The plants being removed, the lawn was levelled and closely grassed over over an extent of 1,000 square yards.

119.—This work was in progress when Prince ALBERT and Prince GEORGE OF WALES paid the Colony a visit, and at the request of His Excellency the Governor each planted a plant of the beautiful Peru Palm, *Martinezia caryotaefolia*, one in the centre of each of the grass squares just mentioned. These plants have grown well, suit the position and have been surrounded by strong iron protectors.

120.—The next chief improvements lie to the east of the house where the long grass slope on that side has been terraced. The first of which consists of a walk 70 yards long and 2 yards broad. This walk has been metalled with laterite, provided with side drains in brick, and covered with wooden trellis work its whole length. The trellis is covered by a selection of flowering creepers, the colours of which have been so arranged in the planting as to bring the flowers in bloom in bouquet order. The creepers have now covered the trellis work and form a shady bower in which one can walk during any hour of the day protected from the scorching rays of a tropical sun.

121.—Immediately below this bower comes a design in coloured leaves on the carpet bedding style; below this a small walk, 3 feet broad, and behind this again a mixed border of flowering shrubs backed by a bamboo hedge which forms the boundary and outline of the whole system. The design has looked well throughout the year.

122.—Several other improvements have been made throughout the lawns in the way of planting specimen plants and removing unsightly objects. The lawn tennis grounds have been top-dressed.

123.—To receive the various plants removed in the course of these improvements as well as to assist in keeping up a supply of cut flowers, a nursery has been formed in an excluded position near the Coolie-houses.

124.—The grass lawns and walks have been kept in good order throughout the year. But there is still much room for improvement in the way of grouping trees and shrubs in landscape order, and destroying the straight monotonous lines which form the Malay ideal of picturesque-ness.

125.—**Forests.**—A grant of \$1,200 for tree planting and other expenses was passed by the Government during the year. Of this sum about \$500 were expended in travelling and procuring information for forest report published in July of the present year.

126.—In planting young Teak trees at Bukit Timah, \$228 were expended in putting down about 18,000 plants, and \$42 in nursery work. About 2,000 young native Forest trees were planted on Military Reserve, Tanglin, at an approximate cost of \$30, leaving an unexpended balance of \$400. The money being granted late in the year it could not be fully taken advantage of before the year closed, but has been expended in planting various trees for experimental purpose early in the present year.

127.—Forest operations will in future be detailed in a separate Report.

128.—**Revenue and Expenditure.**—A statement of the Revenue and Expenditure of the year under review is given in Appendix *A*, from which it will be seen that the Revenue from sale of plants and flowers has amounted to \$627.96, the largest amount ever reached and which has been received during the year in small sums requiring much careful attention in book-keeping and otherwise.

129.—The total expenditure of the year has been \$13,583.80, and the total receipts \$15,027.90, which leaves a balance of \$1,444.10 on the side of receipts. This balance is owing to the salary of the establishment for December having been paid in January, 1883, instead of on 31st December, 1882, as was at one time intended.

N. CANTLEY,
Superintendent.

APPENDIX A.

Expenditure of the Botanic Gardens during the year 1882.

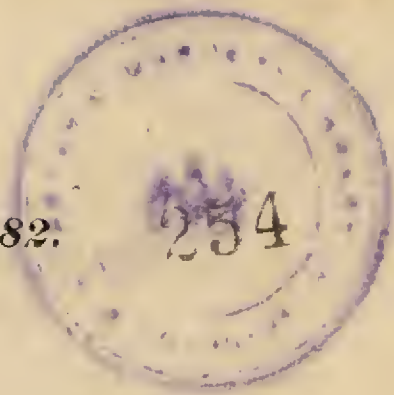
RECEIPTS.		EXPENDITURE.	
	\$ c.	SALARIES.	\$ c.
Balance in Bank 1st January, ..	3,094.64	Superintendent, (a) ..	2,512.93
Government Grant, ..	10,000.00	Head Gardener, (b) ..	1,039.19
Grant for Tree-planting, ..	1,200.00	Clerk, ..	30.00
Sale of Plants & Flowers, ..	627.96	Chief Mandore, ..	115.06
Other Receipts, ..	105.30	Printer, ..	93.80
		Plant Collector, ..	180.19
		Mason, ..	180.19
		Extra Mason, ..	45.08
		Carpenter, ..	161.15
		Extra Carpenter, ..	102.69
		Propagator, ..	79.41
		Chinese Mandore, ..	66 33
		Aviary Keeper, ..	83.95
		Garden Police ..	165.00
		Javanese Coolies, ..	1,582.65
		Chinese Coolies, ..	1,225.70
		Coolies employed planting Trees, Bukit Timah, ..	228.84
		Coolies employed in Forest Tree Nursery, ..	339.89
			<u>8,232.05</u>
		GENERAL EXPENDITURE.	
		Erection of Office and Herbarium, ..	1,500.00
		Construction of Propagation Plant House, ..	230.35
		Construction of Exhibition Plant House, ..	617.00
		Repairs to Buildings, ..	72.88
		Purchase of Plants and Seeds, ..	208.92
		Purchase of Botanical Books, ..	234.10
		Purchase of Tools, ..	253.50
		Repairs to do., ..	34.00
		Manure and Cartage, ..	215.15
		Food for Animals, ..	209.05
		Office and Herbarium Fittings, ..	25.00
		Construction of Wardian Cases, ..	72.59
		Freight on cases of Plants, ..	76.88
		Purchase of Birds, ..	6.75
		Purchase of Flower Pots, ..	88.34
		Superintendent's Transport Expenses, ..	164.50
		Head Gardener's Transport Expenses, ..	181.56
		Wood for Constructive Purposes, ..	136.20
		Petty Expenses, ..	298.83
		Travelling Expenses on Forest Duty, S.S., ..	469.40
		Miscellaneous, ..	255.75
			<u>5,351.75</u>
			13,583.80
		Balance on 31st Dec., 1882,	1,444.10
			<u>\$15,027.90</u>
	<u>\$15,027</u>		<u>90</u>

(a) Includes half Salary while on leave of absence in previous year.

(b) Includes \$419 drawn while Acting Superintendent.

N. CANTLEY,
Superintendent.

APPENDIX B.

List of Additions to Garden Aviaries in 1882.

LOCAL NAME.	SYSTEMATIC NAME.	REMARKS.
Argus Pheasant,	Argussianus giganteus,	.. Presented by Mr. N.
Purple-capped Lory,	Lorius domicella,	.. Purchased. [DENISON.
Java Sparrow,	Loxia ovygiorra,	.. Do.
Rose-crested Cockatoo,	Plyctolophus rosaceus,	.. Do.
Red-crested Quail,	Rollulus Roul Roul,	.. Presented by Mr. N.
Rhinoceros Hornbill,	Bucheros rhinoceros,	.. Do. [DENISON.
Helmet Hornbill,	Bucheros galeatus,	.. Do.
Common Hornbill,	Bucheros gracilis,	.. Do.
Pêrak Pheasant,	Pheasanus Sp.	.. Do.
Peacock Pheasant,	Polyplectrou Malaccense,	.. Do.
Bronze Ground Dove,	Chalcophaps Indica,	.. Purchased.
Sulphur-crested Cockatoo,	Cacatus sulphurea,	.. Do.
Lesser do. do.,	Cacatus sulphurea minor,	.. Presented by Mr. Fox.
Blue-banded Lorikeet,	Trichoglossus cyanogrammus,	.. Purchased.
Guinea Fowl, vars.,	Numida meliagris,	.. Do.
Fan-tailed Pigeon,	Columbo liviæ,	.. Do.
Common Quail,	Coturnix communis,	.. Do.
Long-billed Partridge,	Rhizothera longirosteres,	.. Do.
Pencilled Pheasant,	Euplrecomus nycthemerus,	.. Do.
Rufous-tailed Pheasant,	Alectrophasis erythrophthalmous,	.. Do.
Purple-necked Lory,	Electus Linnae,	.. Do.
Indian Fruit Pigeon	Carpophaca sylvatica,	.. Do.
Malayan Dial,	Copsyclus musicans,	.. Captured.
Chattering Lory,	Lorius garrulus,	.. Purchased.

*List of Books purchased for the Botanic Gardens Library
during the year 1882.*

BLUME'S Rumphia, complete.
 BLUME'S Floræ Javæ, complete.
 Plantæ Javanicæ Rariores, by HORSFIELD.
 GRIFFITH'S Works, complete.
 Flora van Nederlandish Indie, by MIGUEL, complete.
 BLUME'S Museum Botanicum, vols. I & II.
 Sumatra Zifne Plantenevereld, by MIGUEL.
 A Manual of Indian Timbers, by GAMBLE, 1881.
 Flora of Tropical Africa, by OLIVER, vols. I, II, & III.
 Monographiæ Prodromi Continuatio, vols. I & II, by DE'CANDOLLE.
 Flora of British India, by Sir J. D. HOOKER, K.C.S.I., &c., as far as published.
 ROXBURGH'S Flora Indica, (presented by C. B. CLARKE, Esquire, Kew, to Garden Library.)

*List of Books received from Raffles Library with permission
of the Government.*

Select Orchidaceous plants, by WARNER WILLIAMS, vols. I & II.
 Annales Musei Botanice Lug. Bat. by MIGUEL, 3 vols.
 Illustrations of Indian Botany, by WRIGHT, 2 vols.
 Bamboo and its Use, by KURZ.
 Domestic Botany, by SMITH.
 HOOKER'S Flora of British India as far as published.
 BENTHAM'S Flora Hongkongensis with Supplement, by H. F. HANCE.

20/02

APPENDIX B.—Continued.

List of Books received from Raffles Library, &c.,—(Continued.)

- Plants Indigenous to the Colony of Victoria, by MUELLER.
 Flora Sylvatica of Southern India, by BEDDOME, vols. I & II.
 The Ferns of Southern India, by BEDDOME.
 MIER'S Illustrations, vols. I & II.
 HOOKER'S Botanical Miscellany.
 HOOKER'S Niger Flora.
 HOOKER'S Icones Plantarum.
 MIER'S Contributions to Botany, vols. I, II & III.
 Orchids and How to Grow Them, by JENNINGS.
 Index to Names of Eastern Plants and Products.
 Species Fillcum, by HOOKER, vols. I, II, III, IV & V.
 The Forester, by JAMES BROWN.
 DRURY'S Useful Plants of India.
 LINDLEY'S Vegetable Kingdom.
 Vegetable Teratology, by M. T. MASTERS.
 Laws of Botanical Nomenclature, by DE CONDOLLE.
 OLIVER'S Indian Botany.
 Flora Indica, J. D. HOOKER and T. THOMPSON, vol. I.
 The Timber Trees of India, by BALFOUR.
 Flora of British Burmah, by KURZ.
 Flora Australiensis, by BENTHAM.

APPENDIX C.

List of the Principal Recipients of Plants and Seeds in 1882.

	PLANTS. No.	SEEDS. Packets.
Director, Botanic Gardens, Hongkong, ...	100	31
“ “ “ Ceylon, ...	40	30
“ “ “ Calcutta, ...	...	30
“ “ “ Kew, London, ...	13	8
“ “ “ Cambrige, England, ...	...	29
“ “ “ Jamaica, ...	...	28
“ “ “ Trinidad, ...	...	25
“ “ “ British Guiana, ...	...	29
“ “ “ Cape of Good Hope, ...	...	30
“ “ “ Natal, ...	...	29
“ “ “ Mauritius, ...	600	30
“ “ “ Melbourne, ...	...	29
“ “ “ Sydney, ...	...	34
“ “ “ Adelaide, ...	...	31
“ “ “ Brisbane, ...	...	30
The Imperial Gardens, Berlin, ...	50	20
The Chief Civil Commissioner, Seychelles, ...	30	19
The Hon'ble The Colonial Secretary, Fiji, ...	...	23
The Acclimatisation Society, Mauritius, ...	...	26
H. B. M.'s Consul, Amoy, ...	30	2
Under-Secretary, Lands Department, Brisbane, ...	30	1
The Right Revd. Bishop of Singapore and Sarawak, ...	24	...
L. Von DONOP, Esquire, Borneo, ...	141	1
W. BULL, Esquire, Chelsea, London, ...	17	1 box
The Royal Society of Arts and Science, Mauritius, ...	...	30
Messrs. HAAGE AND SCHMIDT, Erfurt, Prussia, ...	7	1
Mr. J. F. ROBERTS, Nurseryman, Australia, ...	42	...
Mr. CHATERJEE, Nurseryman, Calcutta, ...	31	...
His Highness the Maharaja of Johor, ...	5	...
Total, ...	1,160	560

APPENDIX C.—Continued.

List of the Principal Contributors of Seeds and Plants in 1882.

The Gardens are indebted to the undermentioned for contributions of Seeds and Plants during the year, viz. :—

	PLANTS. No.	SEEDS. Packets.
Director, Botanic Gardens, Melbourne, ...	...	200
" " " Adelaide, ...	...	69
" " " Brisbane, ...	13	...
" " " Mauritius, ...	85	...
" " " Kew, London, ...	20	...
" " " Natal, ...	...	12
" " " Trinidad, ...	...	7
" " " Jamaica, ...	...	3
" " " Calcutta, ...	...	1
" " " Java, ...	...	20
" " " Ceylon, ...	...	12
" " " Hongkong, ...	28	10
J. CAMERON Esq., Bangalore, ...	...	40
The Hon'ble the Colonial Secretary, Fiji, ...	...	5
Mr. ROBERTS, Nurseryman, Kew, Australia, ...	30	5
Conservator of Forests, British Burmah, ...	...	47
Conservator of Forests, Seychelles, ...	...	5
India Forest Department, ...	...	1
Mr. CHATTERJEE, Nurseryman, Calcutta, ...	50	...
HOME CONTRIBUTORS.		
Resident Councillor, Malacca, ...	50	...
E. KOEK, Esquire, ...	...	3
The Hon'ble Major McNAIR, C.M.G., Penang, ...	...	1
Sir HUGH LOW, K.C.M.G., Pêrak, ...	...	...
Colonel DEARE, ...	10	...
Late Mr. CHESTERTON, ...	...	3
R. RICHARDS, Esquire, ...	...	1
J. D'ALMEIDA, Esquire, ...	...	1
R. JAMIE, Esquire, ...	10	...
R. LIDDLELOW, Esquire, ...	...	1
KENG SWEE, Esquire, ...	4	...
Dr. N. B. DENNYS, ...	10	...
J. LARKEN, Esquire, Johor, ...	...	3
Totals, ...	280	445

List of the Principal Caoutchouc and India-Rubber plants introduced during the year.

LOCAL NAME.	SYSTEMATIC NAME.	NATIVE COUNTRY.
Para Rubber, ..	.. Hevea brasiliensis,	.. Brazil.
Ceara Rubber,..	.. Manihot Glaziovii,	.. Brazil.
Panama Rubber,	.. Castilloa elastica,	.. Central America.
Gëtah Limah Kitam	.. Streptocaulon Wallichii,	.. Këdah.
Gëtah Cherei Morei,	.. Willoughbeia Sp. (?)	.. Province Wellesley.
Gëtah Singgarip Getan,	.. Willoughbeia firma,	.. Malacca & Singapore.
Gëtah Singgarip Puteh,	.. Asclepiadaceæ, ..	.. Malacca & Singapore.
Gëtah Singgarip Hitam,	.. Willoughbeia martabanica,	.. Malacca & Singapore.
Gëtah Singgarip Merah,	.. Leuconotis Sp., ..	.. Malacca & Singapore.
Gëtah Jelutong,	.. Dyera costulata, ..	.. Malacca & Singapore.
Gëtah Pulei, ..	.. Alstonia scholaris, Var.,	.. Malacca & Singapore.
Gëtah Ujil, ..	.. Chilocarpus Sp. (?)	.. Malacca & Singapore.
Gëtah Sundek or Puteh,	.. Isonandra, or Payena.	.. Pêrak.
Gëtah Rambong,	.. Ficus elastica, ..	.. Pêrak & Siam.
Gëtah Taban or Percha,	.. Dichopsis gutta, ..	.. Malay Peninsula.
Gëtah Akar Garroh,	.. Leuconotis eugenifolius,	.. Këdah.
Gëtah Susu, ..	.. Ficus Sp., ..	.. Pêrak.
Gëtah Kledang,	.. Artocarpus Sp., ..	.. Malacca & Singapore.
Gëtah Kledang Hitam,	.. Artocarpus Sp., ..	.. Malacca & Singapore.
Gëtah Trap, ..	.. Artocarpus Sp., ..	.. Malacca & Singapore.
Gëtah Kapor, ..	.. ..	.. Malacca & Singapore.

*List of Plants and Seeds introduced during the year 1882,
arranged in their Natural Families.*

LOCAL NAME.	SYSTEMATIC NAME AND ORDER.	REMARKS.
DICOTYLEDONS.		
ORD. RANUNCULACEÆ.		
Virgin's Bower, ...	<i>Clematis aristata</i> , <i>R. Br.</i> , Australia. Do. <i>microphylla</i> , <i>D. C.</i> , S. Australia.	
ORD. MAGNOLIACEÆ.		
Magnolia, ...	<i>Magnolia fuscata</i> , <i>Andr.</i> , China.	
Tulip Tree, ...	<i>Liriodendron tulipiferum</i> , India.	
Champac, ...	<i>Michelia champaca</i> , <i>Rheed</i> , Moluccas.	
ORD. MENISPERMACEÆ.		
Calumba Root, ...	* <i>Cocculus palmatus</i> , <i>D. C.</i> , Mozambique.	
ORD. NELUMBIACEÆ.		
Sacred Lotus, ...	<i>Nelumbium Leichardtii</i> .	
ORD. CAPPARIDACEÆ.		
	<i>Cratœva Roxburghii</i> , <i>Linn.</i> , India.	
	<i>Cleome speciosa</i> .	
	<i>Capparis Mitchellii</i> .	
ORD. PITTOSPOREÆ		
	<i>Hymenosporum flavum</i> , <i>T. Mull.</i> , E. Australia.	
	<i>Pittosporum Buchanii</i> .	
	Do. <i>Colensoi</i> , <i>Hook. fil.</i> , N. Zealand.	
	Do. <i>crassifolium</i> , <i>Banks</i> , N. Zealand.	
	Do. <i>eugenoides</i> , <i>Cunn.</i> , N. Zealand.	
	Do. <i>Ralphii</i> .	
	Do. <i>revolutum</i> , <i>Ait.</i> , Australia.	
Australia Box, ...	<i>Bursaria spinosa</i> , <i>Cav.</i> , Australia.	
ORD. GUTTIFEREÆ.		
Iron Tree, ...	<i>Mesua ferrea</i> , <i>Linn.</i> , East Indies.	
Prickly Mangosteen,	<i>Garcinia echnocarpa</i> .	
ORD. DIPTEROCARPEÆ.		
	<i>Shorea obtusa</i> , <i>Wall.</i> , East Indies.	
Sal, ...	Do. <i>robusta</i> , <i>Gaertn.</i> , East Indies.	
ORD. MALVACEÆ.		
Shoe Flower or Bunga Spatu, ...	<i>Hibiscus discolor</i> .	
	Do. <i>criocarpus</i> .	
	Do. <i>mutabilis</i> , <i>Linn.</i> , East Indies.	
	Do. <i>Huegelii</i> .	
	Do. <i>splendens</i> , <i>Fras.</i> , E. Australia.	
	Do. <i>Colleri</i> .	
	Do. <i>zebrinus</i> .	
	Do. <i>cannabium</i> .	
	Do. <i>Sp.</i>	

*List of Plants and Seeds introduced during the year 1882,
arranged in their Natural Families,—Continued.*

LOCAL NAME.	SYSTEMATIC NAME AND ORDER.	REMARKS.
DICOTYLEDONS,—Continued.		
ORD. MALVACEÆ,—Continued.		
	Abutilon asiaticum, <i>G. Don.</i> , Asia.	
	Lagunaria Patersonii.	
Ribbon Tree of Otago,	Lavateria arborea, <i>Linn.</i> , S. Europe.	
	Plagianthus betulinus, <i>A. Cunn.</i> , New Zealand.	
ORD. STERCULIACEÆ.		
	Sterculia ramiflora, <i>Benth.</i> , N. Australia.	
	Do. trifida.	
Victorian Bottle Tree,	Do. diversifolia, <i>Don.</i> , N. S. W.	
	Do. guttata.	
	Brachychiton acerifolium, <i>R. Br.</i> , N. S. W.	
	Lasiopetalum Bauerii, <i>Steels</i> , Australia.	
Nagyès,	... Pterospermum semisagittatum.	
Cotton Tree,	... Bombax malabaricum, <i>D. C.</i> , East Indies.	
Cola Nut,	... *Cola acuminata.	
Dungun,	... Heritiera littoralis, <i>Ait.</i> , East Indies.	
Jamaica Bastard Cedar, ar, ...	... Guazuma tomentosa, <i>Humb. & Bonpl.</i> , S. America.	
	Abroma augusta.	
ORD. LINACEÆ.		
Coca Leaf,	... Erythroxylon coca, <i>L.</i> , Peru.	
ORD. TILIACEÆ.		
Victorian Olive-berry Tree,	... Elæocarpus cyaneus, <i>R. Br.</i> , Australia.	
Bracelet Tree,	... Do. dentatus, <i>Vahl</i> , New Zealand.	
	Grewia columnaris.	
ORD. MALPIGHIACEÆ.		
	Malpighia coccifera, <i>L.</i> , Trop. America.	
Laiza,	... Lagerstrœmia tomentosa.	
Bongor,	... Do. Reginœ, <i>Roxb.</i> , East Indies.	
	Do. indica alba, East Indies.	
ORD. ZYGOPHYLLÆ.		
Lignum Vitæ,	... *Guaicum officinale, <i>Linn.</i> , Trop. America.	
ORD. POLYGONEÆ.		
Sea-side Grape,	... Coccoloba ovigera.	
ORD. RUTACEÆ.		
	Correa speciosa, <i>Ait.</i> , Australia.	
	Melicope ternata. <i>Forstr.</i> , New Zealand.	
Cape Chestnut,	... Calodendron, <i>Thun Capense</i> .	
	Murraya Sp.	
Australian Orange Tree,	... Citrus australasicus, <i>T. Mull.</i> , E. Australia.	
Bæl,	... Ægle marmelos, <i>Corr.</i> , India.	

*List of Plants and Seeds introduced during the year 1882,
arranged in their Natural Families,—Continued.*

LOCAL NAME.	SYSTEMATIC NAME AND ORDER.	REMARKS.
DICOTYLEDONS,— <i>Continued.</i>		
ORD. SIMARUBEÆ.		
	Spathelia simplex, India.	
	Harrisonia Bennetii, India.	
ORD. MELIACEÆ.		
White Cedar,	... *Melia azederach, <i>Linn.</i> , East Indies.	
Rasp Pod,	... Flindersia australis, <i>R. Br.</i> , E. Australia.	
Toon,	... *Cedrela toona, <i>Roxb.</i> , India.	
	Turrea heterophylla.	
Mahogany,	... *Swietenia mahogani, <i>Linn.</i> , S. America.	
ORD. ILLICINEÆ.		
Holly,	... Ilex aquifolia, <i>Linn.</i> , Europe.	
	Do. cassanoides, <i>Link.</i> , Carolina.	
	Do. opaca, <i>H. K.</i> , Carolina.	
	Do. verticillata.	
ORD. CELASTRINEÆ.		
Olive Wood,	... Elæodendron australe, <i>Forst.</i> , E. Australia.	
	Do. orientale, <i>Jacq.</i> , India.	
ORD. SAPINDACEÆ.		
Soap Berry,	... Sapindus trifoliatus, India.	
	Nephelium lencocarpum.	
Litchi,	... * Do. Litchi, <i>Desf.</i> , China.	
Longan,	... Do. Longan, <i>Lam.</i> , China.	
Gyoo,	... *Schleichera trijuga, India.	
Bladder Tree,	... Dodonaea viscosa, <i>R. Br.</i> , Tropics.	
ORD. ANACARDIACEÆ.		
Hog Plum,	... Spondias mangifera, India.	
Mango,	... *Mangifera Vars, Mauritius.	
Sitsei,	... Melanorrhœa usitatissima.	
Sumah,	... Rhus discolor.	
ORD. LEGUMINOSEÆ.		
Logwood,	... * Hæmatoxylon campechianum, <i>L. S.</i> , America.	
Honey Locust Tree,	Gleditschia horrida, <i>Willd.</i> , China.	
Jerusalem Thorn of Jamaica,	... Parkinsonia aculeata, <i>Linn.</i> , West Australia.	
	Cæsalpinia coriaria, <i>Willd.</i> , S. America.	
Sappan,	... Do. Sappan, <i>L.</i> , Tropics.	
Burton's Pea Bush,	Burtonia scabra, <i>R. Br.</i> , Australia.	
Victorian Lilac,	... Hardenbergia monophylla, <i>Benth.</i> , Australia.	
	Do. alba, <i>Hort.</i>	
Butea,	... Butea superba, <i>Roxb.</i> , Asia.	
	Kennedyia prostrata, <i>R. Br.</i> , Australia.	
	Do. Comptoniana, <i>Link.</i> , Australia.	
Large-leaved Bean Flower,	... Do. macrophylla, <i>Benth.</i> , Australia.	
	Milletia pulchra, <i>Kz.</i> , India.	
	Do. megasperma, <i>F. Muell.</i> , Australia.	
Pongam,	... Pongamia glabra, <i>Vent.</i> , India.	

*List of Plants and Seeds introduced during the year 1882,
arranged in their Natural Families,—Continued.*

LOCAL NAME.	SYSTEMATIC NAME AND ORDER.	REMARKS.
	DICOTYLEDONS,—Continued.	
	ORD. LEGUMINOSEÆ,—Contd.	
	Mucuna Sp.	
	Dalbergia glauca, <i>Wall.</i>	
	Do. Sp.	
	Barkleya syringifolia, <i>F. Mull.</i> , N. Australia.	
	Indigofera australis, <i>Willd.</i> , Australia.	
Glory Pea, ...	Clianthus punicens, <i>Soland.</i> , N. Zealand.	
Stuart's Pea, ...	Do. Dampieri, <i>A. Cunn.</i> , S. Australia.	
	Hovea celsi, <i>Bonpl.</i> , W. Australia.	
	Bossinea cinerea, <i>R. Br.</i> , N. S. Wales.	
	Goodia lotifolia, <i>Salisb.</i> , Australia.	
	Brachysema subcordata, <i>Benth.</i> , Australia.	
	Do. latifolium, <i>R. Br.</i> , Australia.	
	Oxylobium callistachys, <i>Benth.</i> , Australia.	
	Chorlizema cordata, <i>Lindl.</i> , N. Australia.	
	Do. scandens, <i>Smith.</i> , Australia.	
	Do. varium, <i>Benth.</i> , W. Australia.	
	Dillioynia mollissima.	
	Cassia grandis, <i>L. fl.</i>	
Indian Laburnum, ...	Do. fistula, <i>L.</i> , E. Indies.	
	Do. siamica, <i>Lam.</i> , Siam.	
	Do. eremophylla, <i>A. Cunn.</i> , Australia.	
	Do. marginatus, <i>Willd.</i>	
	Petalostyles labichoides, <i>R. Br.</i> , India.	
Banhinia, ...	Banhinia racemosa, <i>Lam.</i>	
	Do. Richardsonia, India.	
	Do. Hookerii.	
	Do. tomentosa, <i>L.</i>	
	Do. purpurea, <i>Linn.</i> , India.	
Gum Copal, ...	Hymenæe courbaril, <i>Lim.</i> , S. America.	
	Schotia latifolia, <i>Jacq.</i> , C. Good Hope.	
Australian Coval Bush, ...	Templetonia retusa, <i>R. Br.</i> , S. Australia.	
Irapu, ...	*Cynometra ramiflora, <i>Linn.</i> , S. India.	
Andaman Redwood, ...	*Pterocarpus indicus, <i>Willd.</i> , India.	
	*Pithecalobium saman, <i>Willd.</i> , S. America.	
	Do. dulcis, <i>Benth.</i> , Trop. America.	
Bois Noir, ...	*Albizzia lebbek, <i>Benth.</i> , India.	
	Do. lophantha, <i>Benth.</i> , W. Australia.	
Burda, ...	Do. procera, <i>Benth.</i> , India.	
Kabal, ...	Do. stipulata, <i>Boiv.</i> , India.	
Manjati, ...	Adinandra pavonina, <i>L.</i> , India.	
Catechu, ...	Acacia Catechu, <i>Bedd.</i>	
	Do. concinna, <i>D. C.</i> , Mauritius.	
	Do. neriifolia, <i>A. Cunn.</i> , S. Australia.	
Wattle, ...	Do. pycnantha, <i>Benth.</i> , S. Australia.	
Victorian Wattle, ...	Do. melanoxyton, <i>R. Br.</i>	
	Do. salicina, <i>Lindl.</i> , Australia.	
Black Wattle, ...	Do. decurrens, <i>Willd.</i> , Australia.	
	Do. cyanophylla, <i>Lindl.</i> , W. Australia.	
	Do. saligna, <i>Wendl.</i> , W. Australia.	

ORD. SAXIFRAGACEÆ.

Ceratapetalum gumniferum, *Sm.*, Australia.

ORD. BREXIACEÆ.

Brexia heterophylla.

B. madagascarienses, *Thouars.*, Madagascar.

*List of Plants and Seeds introduced during the year 1882,
arranged in their Natural Families,—Continued.*

LOCAL NAME.	SYSTEMATIC NAME AND ORDER.	REMARKS.
DICOTYLEDONS,—Continued.		
ORD. HAMAMELIDÆ.		
	Rhodoleia championæ, <i>Hook.</i> , Hongkong.	
ORD. COMBRETACEÆ.		
	Combretum densiflorum, India.	
	Terminalia belerica, <i>Roeb.</i> , India.	
	Do. tomentella, <i>Kz.</i> , India.	
	Do. pyrifolia, <i>Kz.</i> , India.	
	Do. alata, <i>Rob.</i> , India.	
ORD. MYRTACEÆ.		
Victorian Bastard Box,	Eucalyptus bicolor, <i>A. Cunn.</i> , Australia.	
	Do. longifolia, <i>F. Mull.</i> , Australia.	
Spotted Gum of Towof-		
old Bay, ...	Do. goniocalyx, <i>F. Mull.</i> , Australia.	
Stringy Bark, ...	Do. obliqua, <i>D. C.</i> , Australia.	
Yellow Box, ...	Do. melliadora, <i>A. Cunn.</i> , Australia.	
	Do. pilularis, <i>D. C.</i> , Australia.	
Blue Gum, ...	Do. viminalis, <i>Labill.</i> , Australia.	
Do. ...	Do. globulus, <i>Labill.</i> , Australia.	
Red Gum, ...	Do. calophylla, <i>R. Br.</i> , W. Australia.	
	Do. hæmiphloia, <i>F. Muell.</i> , Australia.	
	Do. Gunnii, <i>Hook. fil.</i> , Australia.	
Black Butt, ...	Do. hæmastoma, <i>S. M.</i> , E. Australia.	
Den Tree, ...	Do. polyanthemos, <i>Johan.</i> , Australia.	
Yellow Gum, ...	Do. Stuartina, <i>F. Mull.</i> , Australia.	
Peppermint Tree, ...	Do. piperita, <i>S. M.</i> , E. Australia.	
Red Gum of Queens-		
land, ...	Do. tereticornis, <i>S. M.</i> , Australia.	
Swamp Mahogany,	Do. robusta, <i>S. W.</i> , Australia.	
Yarra, ...	Do. marginata, <i>S. M.</i> , W. Australia.	
Sugary Eucalypt, ...	Do. corynocalyx, <i>F. Mull.</i> , Australia.	
Iron Bark, ...	Do. paniculata, <i>S. M.</i> , Australia.	
	Do. saligna, <i>S. M.</i> , Australia.	
Spotted Gum, ...	Do. citriodora, <i>Hook.</i> , Australia.	
White Gum, ... *	Do. rostrata, <i>Schl.</i> , Australia.	
Queensland Iron Bark *	Do. siderophloia, <i>Benth.</i> , Australia.	
Weeping Gum, ...	Do. urnigera, <i>Hook. fil.</i> , Australia.	
	Do. resinifera, <i>S. M.</i> , Australia.	
Yeit, ...	Do. cornuta, <i>Dum. Cours.</i> , Australia.	
Yarra, ...	.....
White Gum, ...	Do. coriacea, <i>A. Cunn.</i> , Australia.	
Port Jackson Red		
Gum, ...	Do. ficifolia, <i>F. Mull.</i> , Australia.	
	Do. punctata, <i>D. C.</i> , Australia.	
Victorian Iron Bark,	Do. leucoxyton, <i>F. Mull.</i> , Australia.	
	Do. Lehmannii, <i>Preiss.</i> , Australia.	
Giant Tree, ... *	Do. amygdalina, <i>Schau.</i> , Australia.	
	Do. diversicolor, <i>Boul.</i> , Australia.	
	Do. platypus, <i>Borh.</i> , W. Australia.	
West Australian Blue		
Gum, ...	Do. megacarpa, <i>F. Mull.</i> , Australia.	
Bottle Brush, ...	Callistemon calliandrus.	
	Do. coccineus, <i>F. Mull.</i> , Australia.	
	Do. lanceolatus, <i>D. C.</i> , Australia.	
	Do. linearis, <i>D. C.</i> , Australia.	

*List of Plants and Seeds introduced during the year 1882,
arranged in their Natural Families,—Continued.*

LOCAL NAME.	SYSTEMATIC NAME AND ORDER.	REMARKS.
DICOTYLEDONS,—Continued.		
ORD. MYRTACEÆ,—Continued.		
Bottle Brush, ...	Callistemon rigidus, <i>R. Br.</i> , Australia.	
	Do. rugulosus, <i>D. C.</i> , Australia.	
	Do. salignus, <i>D. C.</i> , Australia.	
	Do. speciosus, <i>D. C.</i> , Australia.	
Australian Tea Tree,	Melaleuca armillaris, <i>S. M.</i> , Australia.	
	Do. ericifolia, <i>S. M.</i> , Australia.	
Iron Wood of Queens- land, ...	Do. genistifolia, <i>S. M.</i> , Australia.	
	Do. hypericifolia, <i>S. M.</i> , Australia.	
	Do. densa, <i>Colla.</i> , Australia.	
	Do. incana, <i>R. Br.</i> , Australia.	
	Do. parviflora, <i>Sindl.</i> , Australia.	
	Eugenia Smithii, <i>Poir.</i> , Australia.	
Australian Rose Ap- ple, ...	Do. myrtifolia, <i>Ker</i> , N. S. W.	
Jambo, ...	Do.	
	Do. fruticosa, Australia.	
Allspice, ...	Pimenta vulgaris, <i>Sindl.</i> , W. Australia.	
	Leptospermum ericoides.	
	Do. flavescens, <i>S. M.</i> , Australia.	
Coast Tea Tree, ...	Do. lævigatum, <i>F. Mull.</i> , Australia.	
Broom Tea Tree, ...	Do. scoparium, <i>Forst.</i> , Australia.	
	Metrosideros florida.	
Rata, ...	Do. robusta, <i>A. Cunn.</i> , New Zealand.	
Queensland Box Tree,	Tristania conferta, <i>R. Br.</i> , Australia.	
Gum Myrtle, ...	Angophora lanceolata, <i>Car.</i> , Australia.	
Willow Myrtle, ...	Agonis flexuoso, <i>Schau.</i> , Australia.	
N. S. W. Turpentine Tree, ...	Syncarpia laurifolia, <i>Ten.</i> , Australia.	
Net Bush, ...	Calothamnus quadrifidus, <i>R. Br.</i> , Australia.	
	Do. var. suberosus, <i>Schau.</i> , Australia.	
	Do. sanguineus, <i>Labill.</i> , Australia.	
Hair Cup Flower, ..	Calytrix tetragona, <i>Labill.</i> , Australia.	
New Zealand Broom,	Carmichaelia australis, Australia.	
ORD. LECYTHIDACEÆ.		
	Lecythis minor, Brazil.	
Cannon-ball Tree, ...	Couripita guineensis, British Guiana.	
ORD.—BARRINGTONACEÆ.		
Showy Barringtonia,	Barringtonia speciosa, Seychelles.	
Great Gustava, ...	gustavia augusta, <i>Linn.</i>	
ORD. MELASTOMACEÆ.		
	Melastoma repens, Hongkong.	
	Bertalonia Van Houttei.	
ORD. PASSIFLOREÆ.		
Passion Flower, ...	Passiflora macrocarpa.	
Do.	Do. scandens.	
Do.	Do. tetrandra.	
ORD. FLACOURTIACEÆ.		
Madagascar Grape,	Flacourtia ramontchi, <i>L'Herit.</i> , Madagascar.	

*List of Plants and Seeds introduced during the year 1882,
arranged in their Natural Families,—Continued.*

LOCAL NAME.	SYSTEMATIC NAME AND ORDER.	REMARKS.
DICOTYLEDONS,— <i>Continued.</i>		
ORD. MORINGACEÆ.		
Horse-radish Tree,...	<i>Moringa pterygosperma</i> , India.	
ORD. BEGONIACEÆ.		
Begonia,	... <i>Begonia lucida</i> .	
Do.,	Do. <i>malabarica</i> , India.	
Do.,	Do. <i>metallica</i> , <i>W.</i> , Jamaica.	
ORD. FICOIDEÆ.		
Edible Fig Marigold,	<i>Mesembryanthemum edule</i> , <i>Lin.</i> , C. Good Hope.	
ORD. ARALIACEÆ.		
Angelica Tree,	... <i>Aralia crassifolia</i> .	
	Do. <i>papyrifera</i> .	
	<i>Panax elegans</i> .	
Umbrella Tree,	... <i>Brassia actinophylla</i> .	
Elderberry Leea,	... <i>Leea sambucina</i> .	
ORD. RUBIACEÆ.		
Burning Bush,	... <i>Ixora bella</i> .	
Do.,	Do. <i>eximia</i> .	
Do.,	Do. <i>illustris</i> .	
Do.,	Do. <i>picturatus</i> .	
Do.,	Do. <i>splendens</i> .	
	<i>Gardenia globosa</i> , <i>Hook.</i> , Natal.	
	Do. <i>Thunbergia</i> , <i>Linn.</i> , C. Good Hope.	
Manja Kadambe,	... <i>Nauclea cordifolia</i> , <i>Roxb.</i> , E. Indies.	
Buta Kadambe,	... Do. <i>parviflora</i> , <i>Roxb.</i> , E. Indies.	
	Do. <i>rotundifolia</i> , <i>Roxb.</i> , E. Indies.	
	Do. <i>sessiflora</i> , <i>Roxb.</i> , E. Indies.	
	<i>Randia Kraussii</i> .	
Wagatta,	... Do. <i>ulignosa</i> , <i>D. C.</i> , E. Indies.	
	<i>Caprosma hirtella</i> , <i>Labill.</i> , Australia.	
	Do. <i>lucida</i> .	
	Do. <i>robusta</i> .	
	<i>Pavetta laurifolia</i> .	
	<i>Psychotria cyanococcus</i> .	
	<i>Mussaenda frondosa</i> , <i>Linn.</i> , E. Indies.	
ORD. COMPOSITEÆ.		
	<i>Hebeclinum ianthinum</i> , <i>Hook.</i> , Brazil.	
ORD. EPACRIDEÆ.		
Carrot Wood,	... <i>Leucopogon Richei</i> , <i>R. Br.</i> , Australia.	
ORD. MYRSINEÆ.		
'Tipan, ...	... <i>Myrsine D'Urvillei</i> , <i>De Candolle</i> , Australia.	
	<i>Theophrasta imperiales</i> , <i>Lindl.</i> , New Granada.	

*List of Plants and Seeds introduced during the year 1882,
arranged in their Natural Families,—Continued.*

LOCAL NAME.	SYSTEMATIC NAME AND ORDER.	REMARKS.
DICOTYLEDONS,—Continued.		
ORD. SAPOTACEÆ.		
Illipi,	... * <i>Bassia longifolia</i> , E. Indies. <i>Cargillea australis</i> , Australia.	
Iron Wood,	... <i>Sideroxylon tomentosum</i> , <i>Roxb.</i> , E. Indies.	
ORD. EBENACEÆ.		
Mabolo,	... * <i>Diospyros discolor</i> , <i>Willd.</i> , Madagascar. Do. <i>burmanica</i> , Burmah. Do. <i>chrysophyllus</i> , <i>Poir.</i> , Mauritius. * Do. <i>versicolor</i> , Mauritius.	
ORD. OLEACEÆ.		
Olive,	... <i>Olea europea</i> , <i>Linn.</i> , Europe. Do. <i>verrucosa</i> <i>Thunb.</i> , C. Good Hope.	
Ash,	... <i>Fraxinus excelsior</i> , <i>Linn.</i> , Europe. Do. <i>ornus</i> , <i>Linn.</i> , S. Europe. Do. <i>quadrangulata</i> .	
ORD. APOCYNACEÆ.		
	<i>Beaumontia grandifolia</i> , <i>Wall.</i> , E. Indies. <i>Tabernæmontana pubescens</i> , <i>R. Br.</i> , Tropics. * <i>Landolphia florida</i> , <i>Beauc.</i> * Do. <i>Watsonii</i> . * Do. <i>Petersiana</i> .	
Madagascar Rubber,	* <i>Vahea madagascariensis</i> , <i>Lam.</i> , Madagascar. <i>Dipladenia carissima</i> . <i>Carissa grandiflora</i> .	
Dye Wood,	... <i>Wrightia tinctoria</i> , <i>Roth.</i> , E. Indies. <i>Jasminium Sambac</i> , <i>Ait.</i> , E. Indies.	
Gëtah Garroh,	... <i>Leuconotis eugenifolius</i> .	
Do. Singgarip Me- rah,	... Do. Sp.	
ORD. ASCLEPIADACEÆ.		
Wild Ipecacuanha,	... <i>Asclepias curassavica</i> , <i>Linn.</i> , S. America. <i>Gonolobus condurango</i> .	
Gëtah Lemah Kitam,	<i>Streptocaulou Wallichii</i> , Kedah.	
ORD. CORDIACEÆ.		
Thanai,	... <i>Cordia grandifolia</i> , <i>Dorr.</i> , Tropics.	
ORD. LAGANIACEÆ.		
Strychnine,	... <i>Strychnos nux-vomica</i> , <i>Linn.</i> , Ceylon.	
ORD. CONVULVULACEÆ.		
	<i>Ipomæa tuberosa</i> , <i>Linn.</i> , Jamaica.	
ORD. SOLANACEÆ.		
Datura,	... <i>Solandra grandiflora</i> , <i>Sw.</i> , S. America. <i>Datura arborea</i> , <i>L.</i> , Tropics.	

*List of Plants and Seeds introduced during the year 1882,
arranged in their Natural Families,—Continued.*

LOCAL NAME.	SYSTEMATIC NAME AND ORDER.	REMARKS.
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DICOTYLEDONS,—*Continued.*

ORD. SCROPHULARIACEÆ.

Lophospermum scandens, *G. Don.*, Mexico.

ORD. CRESCENTIACEÆ.

Trinidad Candle Tree, *Parmentiera cerifera*, *Seem.*, T. America.

ORD. BIGNONIACEÆ.

Bignonia or Trump- et Flower,	...	<i>Bignonia chelonides</i> , <i>Linn.</i> , E. Indies. Do. <i>magnifica</i> . Do. <i>indica</i> , <i>Lour.</i> , E. Indies. Do. <i>xylocarpa</i> , <i>Roxb.</i> , S. America.
Spathodea,	...	<i>Spathodea</i> , Hongkong. <i>Sterospermum fimbriatum</i> .
Tecoma,	...	<i>Tecoma australis</i> , <i>R. Br.</i> , E. Australia. Do. <i>leucoxydon</i> , <i>W. Indies</i> . Do. <i>rosea</i> , <i>H. et B.</i>

ORD. ACANTHACEÆ.

Dipterocanthus Herbstii, *Hook.*
Thunbergia lutea, *Hort.*, S. America.
Do. *laurifolia*, *Lindl.*, E. Indies.
Mackaya bella, *Harr.*, S. Africa.

ORD. VERBENACEÆ.

Sky Flower,	...	<i>Gmelina arborea</i> , <i>Roxb.</i> , India. Do. <i>Rheedi</i> . <i>Clerodendron orientale</i> . Do. <i>coccineum</i> , Madagascar. Do. <i>inerme</i> , <i>L.</i> Do. <i>speciosum</i> , <i>Hort.</i> , China.
Chaste Tree, Teak or Jati,	... ...	<i>Duranta Ellisii</i> , <i>Jack.</i> , Mexico. <i>Holmskioldia sanguinea</i> , <i>Retz.</i> , Java. <i>Vitex leucoxydon</i> , <i>L. fil.</i> , Tropics. * <i>Tectona grandis</i> , <i>L. fil.</i> , Burmah.

ORD. AMARANTHACEÆ.

Immortelle, ... *Gomphrena globosa*, *Willd.*, E. Indies.

ORD. NYCTAGINEÆ.

Bougainvillea, ... *Bougainvillea braziliensis*, *Willd.*, Brazil.

ORD. CHENOPODIACEÆ.

Chenopodium oleracea, *F. Mull.*, Australia.
Atriplex nummularia, *Lindl.*, Australia.

*List of Plants and Seeds introduced during the year 1882,
arranged in their Natural Families,—Continued.*

LOCAL NAME.	SYSTEMATIC NAME AND ORDER.	REMARKS.
DICOTYLEDONS,—Continued.		
ORD. ARISTOLOCHIACEÆ.		
Birthwort,	.. <i>Aristolochia ornithocephala</i> , Brazil.	
ORD. PIPERACEÆ.		
Cubebs,	.. * <i>Piper Cubeba</i> , <i>L. Fil.</i> , E. Tropics.	
ORD. MYRISTICÆÆ.		
Long Nutmeg,	.. * <i>Myristica madagascariensis</i> , <i>Lank.</i> * <i>Do.</i> Sp. from Banda, <i>Hort.</i>	
ORD. MONIMIACEÆ.		
Australian Mulberry,	<i>Hedycarpa angustifolia</i> , <i>A. Cunn.</i> , Australia.	
ORD. LAURINEÆ.		
Sweet Bay,	.. * <i>Laurus nobilis</i> , <i>Linn.</i> , S. Europe.	
Camphor,	.. * <i>Camphora officinarum</i> , <i>Willd.</i> , Japan.	
Ravensana,	.. * <i>Agathophyllum aromaticum</i> , <i>Willd.</i> , Madagascar.	
Cassia Bark,	.. * <i>Cinnamomum Cassia</i> , China. <i>Cassytha melantha</i> , <i>R. Br.</i> , Australia.	
ORD. PROTEACEÆ.		
	<i>Hakea aricularis</i> , <i>R. Br.</i> , Australia.	
	<i>Do. laurina</i> , <i>R. Br.</i> , W. Australia.	
	<i>Do. multilineata</i> , <i>Meisn.</i> , S. Australia.	
	<i>Do. pugioniformis</i> , <i>Cav.</i> , E. Australia.	
	<i>Do. saligna</i> , <i>Knight.</i> , S. Australia.	
	<i>Grevillea Banksii</i> , <i>R. Br.</i> , N. Australia.	
	<i>Stenocarpus salignus</i> , <i>Cunn.</i> , E. Australia.	
	<i>Dryandra floribunda</i> , <i>R. Br.</i> , N. Australia.	
Silver Tree,	.. <i>Lencadendron argentea</i> , C. Good Hope.	
Queensland Nut,	.. <i>Macadamia ternifolia</i> , <i>Linn.</i> , Queensland.	
ORD. SANTALACEÆ.		
	<i>Leptomeria aphylla</i> , <i>R. Br.</i> , Australia.	
ORD. ARTOCARPEÆ.		
Para Rubber,	.. <i>Hevea braziliensis</i> , <i>Mull.</i> , Brazil.	
Myank Loak,	.. <i>Artocarpus Lokoocha</i> , <i>Roxb.</i> , Burmah.	
ORD. EUPHORBIACEÆ.		
	* <i>Codiaeum</i> , (Fifty-one new varieties.)	
Croton Oil Plant,	.. * <i>Croton tiglium</i> , <i>L.</i> , Australia & E. Indies. <i>Trewia nudiflora</i> , <i>Rottlera tinctoria</i> , <i>Roxb.</i> , Australia.	
Physic Nut,	.. * <i>Jatropha podagrica</i> , <i>Hook.</i> , S. Australia.	
Box Tree,	.. <i>Buxus sempervirens</i> , <i>Linn.</i> , Europe.	

*List of Plants and Seeds introduced during the year 1882,
arranged in their Natural Families,—Continued.*

NAME.	SYSTEMATIC NAME AND ORDER.	REMARKS.
DICOTYLEDONS,—Continued.		
ORD. CASUARINEÆ.		
	Casuarina stricta, <i>Ait.</i> , Australia.	
	Do. quadrivalvis, <i>Labill.</i> , Australia.	
	Do. tephrosperma, <i>Hort.</i> , Australia.	
ORD. CUPULIFEREÆ.		
Oak Tree,	.. Quercus solicina, <i>Bl.</i> , Hongkong.	
Beech,	.. Fagus sylvatica, <i>W.</i> , Europe.	
Chestnut,	.. Castanea perma.	
ORD. GUETACEÆ.		
	Guetum edule.	
ORD. CONIFEREÆ.		
Bunya Bunya Pine,	Aracuaria Bidwellii, <i>Hook.</i> , E. Australia.	
Norfolk Island Pine,	Do. excelsa, <i>R. Br.</i> , Norfolk Island.	
Moreton Bay Pine,	Do. Cunninghamii, <i>Ait.</i> , Australia.	
Rueli's Pine, ..	Do. Rulei, <i>F. Mull.</i> , New Caledonia.	
Cook's Pine, ..	Do. Cookii, <i>R. Br.</i> , New Caledonia.	
Californian Red-wood,	Taxodium sempervirens.	
	Frenela columellaris, <i>F. Mull.</i> , Australia.	
Australian Pine, ..	Do. robusta, <i>Cunn.</i> , Australia.	
	Glyptostrobus heterophylla.	
Chinese Pine, ..	Pinus sinensis, China.	
	Ostrya virginica.	
Cypress, ..	Cupressus aromaticus.	
	Podocarpus neriifolia, <i>G. Don.</i> , E. Indies.	
Queensland Kauri Pine,	.. Dammara robusta, E. Australia.	
ORD. CYCADACEÆ.		
Sago, ..	.. Cycas eircinalis, <i>Linn.</i> , Madagascar.	
	Do. media, <i>R. Br.</i> , E. Australia.	
	Do. revoluta, <i>Thumb.</i> , Japan.	
	Bowenia spectabilis, <i>Hook.</i> , N. Australia.	
MONOCOTYLEDONS.		
ORD. ORCHIDEÆ.		
	Cypripedium barbatum, <i>Lidl.</i> , Kedah.	
	Phalaenopsis Luddemanniana, <i>Rehb.</i> , Philippines.	
	Saccolabium Harrisonii, <i>Rehb.</i> , Malay Islands.	
ORD. BROMELIACEÆ.		
Pine Apple, ..	Ananassa sativa Var.	
	Pitcairnia alata.	
	Do. platyphylla.	
	Tillandsia Lindenii vera, S. America.	

*List of Plants and Seeds introduced during the year 1882,
arranged in their Natural Families,—Continued.*

LOCAL NAME.	SYSTEMATIC NAME AND ORDER.	REMARKS.
MONOCOTYLEDONS,—Continued.		
ORD. IRIDEÆ.		
	<i>Ixia amoena</i> ,	
	<i>Pardanthus chinensis</i> , <i>Ker.</i> , China.	
	<i>Marica Northiana</i> , <i>Gaert.</i> , Brazil.	
ORD. MUSACEÆ.		
Banana,	... <i>Musa uranocospes</i> .	
Manila Hemp,	... <i>Musa textilis</i>	
	<i>Heliconia sanguinolenta</i> .	
ORD. AMARYLLIDEÆ.		
	<i>Bomarea Carderi</i> , S. America.	
	<i>Doryanthes palmieri</i> , <i>Hill</i> , N. Australia.	
	<i>Eurycles Cunninghami</i> , <i>Ait.</i> , N. Australia.	
Mauritius Hemp,	... <i>Fourcroya gigantea</i> , <i>Vent.</i> , S. America.	
ORD. MARANTACEÆ.		
	<i>Maranta Massangeana</i> .	
	Do. <i>Kerchoviana</i> .	
ORD. LILIACEÆ.		
	<i>Dracæna</i> . (Seventeen new varieties.)	
	<i>Hemerocallis flava</i> , <i>Ait.</i> , Siberia.	
	<i>Agapanthus umbellatus</i> , <i>L. Rint.</i> , C. Good Hope.	
	<i>Eucharis candida</i> .	
New Zealand Flax,	<i>Phormium tenax</i> , <i>Forst.</i> , New Zealand.	
Adam's Needle, ..	<i>Yucca gloriosa</i> , <i>Linn.</i> , S. America.	
	Do. <i>filamentosa</i> , <i>Linn.</i> , Virginia.	
	Do. <i>aloefolia</i> .	
ORD. JUNCAGINACEÆ.		
Lattice Leaf Plant,	<i>Ouvirandra fenestralis</i> , Madagascar.	
ORD. PALMEÆ.		
Palmyra Palm, ..	<i>Borassus flabelliformis</i> , <i>W.</i> , W. Indies.	
	<i>Dæmonorops marginatus</i> .	
	<i>Cocos plumosa</i> .	
	Do. <i>oleracea</i> .	
	<i>Heterospathe alata</i> .	
	<i>Arenga Wendlandiana</i> .	
	<i>Livistona subglobosa</i> .	
	<i>Pinanga Kechlii</i> .	
	<i>Areca glandiformis</i> .	
	<i>Syagurus sancona</i> .	
	<i>Calyptrocalyx spicatus</i> , <i>Bl.</i> , Banka.	
	<i>Ænocarpus bacaba</i> .	

*List of Plants and Seeds introduced during the year 1882,
arranged in their Natural Families,—Continued.*

LOCAL NAME. SYSTEMATIC NAME AND ORDER. REMARKS.

MONOCOTYLEDONS,—*Continued.*

ORD. PALMEÆ,—*Continued.*

		Kentia costata.
		Ptychosperma Sp. from Fiji.
		Kentia exorrhiza.
Coco de Mer or Double Cocoa-nut, ...		Lodoicea seychellarum, <i>Labill.</i> , Seychelles.
		Thrinax parviflora, <i>Sm.</i> , West Indies.
		Licuala horrida.
Asia Palm, ...		Euterpe edulis, <i>Mart.</i> , S. America.
		Ænocarpus Sp. from Java.
		Calyptronoma Swartzii.
Cabbage Palm, ...		Oreodoxa regia, <i>Humb. & Bonpln.</i> , Cuba.
		Latania glaucophylla, <i>Duncan</i> , Mauritius.
		Cocas australis, Australia.
		Sabal umbraculifera, <i>Mart.</i> , West Indies.
		Seaforthia elegans, <i>R. Br.</i> , N. S. W.
Fan Palm, ...		Livistona sinensis, China.
		Phoenix reclinata, <i>Jacq.</i> , S. Africa.
		Diplothemium caudescens.
		Areca lutescens, <i>Bory</i> , Mauritius.
		Acanthophoenix monostachya.
		Do. crinita, <i>Wendl.</i> , Mauritius.
		Areca sapida, <i>Forst.</i> , New Zealand.
		Stevensonia grandifolia, <i>Duncan</i> , Seychelles.
		Cocos flexuosus, <i>Mart.</i> , Brazil.
		Diplothemium maritimum.
		Ptychosperma alexandrae, <i>T. Mull.</i> , N. Australia.
		Pritchardia pacifica, <i>Seem.</i> , S. S. Islands.
		Livistona humilis, <i>R. Br.</i> , Australia.
		Hyophorbe amaricaulis, <i>Mart.</i> , Mauritius.
		Acanthophoenix rubra, <i>Wendl.</i> , Mauritius.
		Hyphæne Sp. from Zululand.
		Verschaffellia splendida, <i>Wendl.</i> , Seychelles.

ORD.—PANDANÆ.

Screw Pine, ...		Pandanus odoratissimus, <i>Lim.</i> , Mauritius.
Vacoa, ...		Pandanus javanicus variegatus.
Sugar Mat Plant, ...		*Pandanus utilis, <i>Bong.</i> , Madagascar.

ORD.—AROIDEÆ.

		Anthurium Andreanum.
		Do. candidum, <i>Hort.</i> , Columbia.
		Do. Dechardii.
		Do. magnificum, <i>Lindl.</i> , S. America.
		Do. nymphæ folium.
		Do. nobile.
		Do. Warogueanum.
		Do. insigne.
		Alocasia gigantea, <i>Work</i> , E. Indies.
		Do. hybrida, <i>Hort.</i>
		Do. illustris, <i>Hort.</i>
		Do. Johnsonii.

*List of Plants and Seeds introduced during the year 1882,
arranged in their Natural Families,—Continued.*

MONOCOTYLEDONS,—Continued.

LOCAL NAME.	SYSTEMATIC NAME AND ORDER.	REMARKS.
	ORD.—AROIDEÆ,—Continued.	
Dumb Cane,	... Dieffenbachia costata.	
	Do. insignis.	
	Do. nitida.	
	Do. Carderi.	
	Do. Leopoldi.	
	Do. splendens.	
	Philodendron daguense, Lindl., Brazil.	
	Do. Carderi.	
	Phyllotaenium Lindeni.	
Yellow Pothos,	... Pothos aurea.	

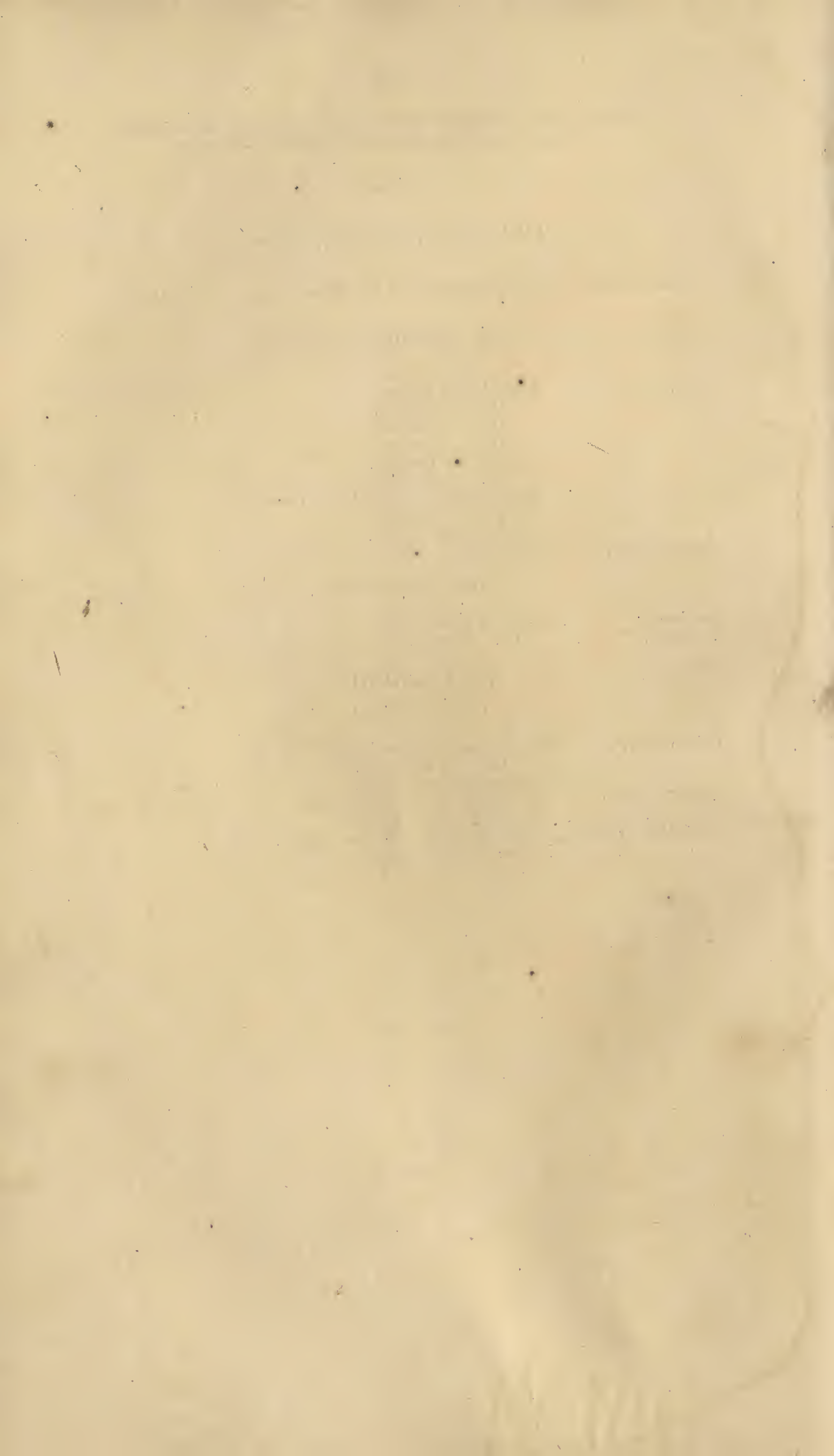
ORD. GRAMINEÆ.

Bamboo,	... Bambusa affinis, India,
Thaikwah,	... Do. tulda, India.

ACOTYLEDONS.

ORD. FILICES.

Golden Fern,	... Gymnogramma chrysophylla.
	Do. Peruviana.
	Cibotium barometz, China.
Elk's Horn Fern,	... Platycerium alcicorne, Madagascar.
	Lomaria Australis, Australia.
New Zealand Tree Fern,	Cyathea dealbata, Sm., New Zealand.
	Pteris albo-lineata, Siam.



No. 27.

STRAITS SETTLEMENTS.

REPORT

ON THE

BOTANIC GARDENS,

SINGAPORE,

FOR THE YEAR

1884,

BY

N. CANTLEY,

SUPERINTENDENT OF THE BOTANIC GARDENS.

LAI D BEFORE THE LEGISLATIVE COUNCIL BY COMMAND OF HIS EXCELLENCY
THE OFFICER ADMINISTERING THE GOVERNMENT.



SINGAPORE:

PRINTED AT THE GOVERNMENT PRINTING OFFICE STRAITS SETTLEMENTS.

1885.

20/51

**Annual Report on the Botanic Gardens, Singapore,
for the year 1884.**

The principal works carried out during the year in the Botanic Gardens and in other places connected with the gardens are, with some additional items of interest, detailed below.

2.—**Visitors.**—Visitors during the year have been apparently as numerous as in previous years. The precise number has not been ascertained, but carriages and riders on horse-back are seen to be most numerous in the mornings and evenings, and strangers upon Mail days.

3.—**Buildings.**—The permanent buildings connected with the Department were observed, towards the close of the year, to require some petty repairs, and have been taken in hand by the Public Works Department.

4.—The following new quarters have been erected, viz.:—One large coolie house, which accommodates all the Javanese employés; a station for the garden constables; a small shed for the Chinese coolies; a carpenter's shop; and a large potting shed. The quarters erected some time ago for the accommodation of a European employé have been put in order and made available for the Garden Clerk. The construction of a new aviary was commenced before the year closed.

5.—**Introduction and Propagation of Plants.**—The great demand for plants during the year has prevented any auction sales of surplus stock. Orders for plants to the number of half a million were received as the year closed, chiefly for Mauritius hemp.

6.—The numbers of plants propagated, during the year were approximately as under:—

Forest tree nursery,	...	... 70,000
General do.,	...	... 50,000
Fancy plant do.,	...	... 40,000
Plant-house, ...	...	... 3,000
		163,000

7.—These have been disposed of as follows:—

Sent to the Forests, Singapore,	...	60,000
" " Malacca,	...	4,000
" P. W. D., Province Wellesley,	...	6,000
" British Resident, Pêrak,	...	6,000
" Resident Councillor, Malacca,	...	1,000
Sold to the Public,	...	38,000
Retained as Nursery Stock,...	...	48,000
		Total, ...163,000

8.—The trees sent to the forest consisted of Teak, Mahogany, Serayah, Gum Copal, Merbau, Toon, Illipi, Rain tree, and mixed native trees. Of the plants sold to the public, a large number were *Fourcroya gigantea* or Mauritius hemp; the remainder were principally ornamental trees, shrubs, orchids, &c.

9.—**Plant and Seed Exchanges.**—The foreign exchanges in plants and seeds were as under:—

Received, ...	...	{ 1,000 plants
		{ 200 lbs. seeds
Forwarded,...	...	{ 1,500 plants
		{ 150 lbs. seeds

The plants brought in from the jungles numbered about 3,000, collected chiefly by myself when travelling on forest inspection duty, and have been utilised in various ways.

10.—Of the plants introduced in previous years, the following shew signs of accommodating themselves to the soil and climate of the country viz.:—"Coca" (*Erythroxylon coca*) which has flowered and fruited freely during the year. From this plant is produced an alkaloid called "Cocaine," used in the treatment of asthma, &c., and at present attracting much attention among medical men. I think it might be grown in the Colony with profit.

11.—The plant which produces the so-called Mauritius hemp is a native of South America, and is well adapted for cultivation here. Some planters who have tried it have sent large orders for a further supply, and have, I believe, ordered machinery from England for its manufacture.

12.—The plants of *Cinnamomum cassia*, which produces the Cassia bark of commerce, grow very freely in the experimental nursery, and will probably become one of the Colonial products in course of time.

13.—One of two varieties of Cardamum, introduced during the year from Java, has flowered and fruited very freely, and would no doubt pay cultivation well. Liberian coffee has now been carried by cultivators beyond the limit of experiment, and I refer to it only as among the plants introduced into the Colony by this establishment. The Panama rubbers, so admirably cultivated by Sir HUGH LOW, were also first introduced by the Botanic Gardens.

14.—Plants of the African "Kola nut," planted in the experimental nursery, have grown well in the alluvial soil there. The plants of

“Avocada pear,” planted out in the Economic Garden some years ago, where their growth stood almost stationary, have been removed to the nursery just named, and have grown with extraordinary rapidity.

15.—Plants from seed of the Lima Bean of Brazil have been grown in the nursery with great success, and form a desirable addition to our vegetable supply. The names of other vegetables which have succeeded in the nursery were given in last year’s report and need not be repeated here.

16.—A number of useful and interesting economic plants were received during the year from the Royal Gardens, Kew, but as these are still small and have so far been kept in pots for safety, it is too soon to make any special reference to their likely merits.

17.—A quantity of nutmegs and cloves have been introduced from their native habitat as fresh stock for experimental purposes. Plants of Peach, Apricot, Grape Vine, Olives, and Figs in variety have been ordered from Sydney, but the season of the year there when the order arrived not admitting of the despatch of the plants, they were not received within the year, and therefore fall to the share of next year’s report.

18.—I may be permitted to mention in this connexion that, although there are some good specimen plants in the gardens, a point is not being made of growing such plants to the exclusion of propagation, the object of the gardens being to introduce desirable plants into the Colony and cultivate them for such length of time only as will demonstrate their adaptability or otherwise for cultivation in the soil and climate of the Settlements, and to propagate such as appear suitable, for distribution to cultivators and specimen growers.

19.—**Improvements in the Grounds.**—Having, under this heading, to refer to the Exhibition House, I would make brief mention of the Flower Show held in January of the year under report, the plants and other objects sent to which, were, for the first time, accommodated here. The ground design of the house looked well when filled with the various exhibits.

20.—The show was in itself a great success, notwithstanding the inclement state of the weather which prevailed during the Exhibition. The illumination of the show by electric and other lights was very effective.

21.—After the show, the roof put up for sheltering the exhibits was so modified as to admit of the house being temporarily filled with pot plants, and although these are now being removed to make way for the construction of a permanent roof, it is sufficiently proved that the design meets well the double purpose for which it was made.

22.—**Roads and Walks.**—Early in the year, the new approach to the Exhibition house was heavily coated with laterite over its whole surface and rolled to solidity by the aid of a heavy four-bullock roller, kindly lent by the Municipality. The paths in the house were also metalled in the same way. A temporary stair, partly in wood, has been put down in the grass bank opposite the entrance to the house. The unclimbable iron railing which surrounded the propagation nursery has been removed and placed around the exhibition building, being substituted in its former position by a bamboo hedge.

23.—The front entrance walk, which has a breadth of twenty-two feet, has been dug up, levelled, remodelled and well laid with laterite over an area of 7,800 square yards.

24.—About 1,100 square yards of the public road which passes through the garden has been levelled. A water channel on each side put down in brick, and the adjacent land reduced to a regular gradient. The laterite used in re-modelling this road was supplied by the Municipality as well as the labour in putting it down. The cost of the bricks and labour of levelling were borne by the Gardens. The levelling being finished, ornamental palms were planted fifteen feet apart on each side of the road, with a view to shading and improving its appearance.

25.—The broad walk leading from the office towards the Band-stand has undergone extensive repairs and the smaller walks have received attention where required.

26.—**Lakes.**—The Lily lake was thoroughly cleaned out during the year, deepened, manured, and re-planted. In this operation a great deal of mud had to be removed, which occupied all the coolies for about a month.

27.—The Victoria lily, planted in the small lake last year, has grown and flowered well, and seems to enjoy its new quarters.

The ravenous and worthless fish with which the large lake teems prevent any ornamental water-plants growing there. These fish should, I think, be destroyed, and a more useful or ornamental kind substituted, and such as will not prevent some portion of the water being decorated with lilies, &c.

28.—**Flower Beds and Fernery.**—The flower beds throughout the grounds have several times been planted during the year; time could not be found to alter the design of the previous year, but as it is intended at an early date to overhaul the grounds generally, any alteration for the sake of change or effect will be considered.

29.—The sale of flowers keep the beds denuded as usual. Until such sales are abolished, the gardens will always wear a flowerless appearance. The small sum annually received for flowers is, I think, but a poor compensation for the amount of pleasure a denuded public garden must deny a whole community.

30.—A number of large trees, especially in the vicinity of the Band-stand, have been pruned into pyramidal shape, chiefly with a view to ridding them of parasitical growths. A good many dead trees and shrubs, killed chiefly by white ants, have been removed from the grounds. On examination, the ants were found to have attacked the roots first, and when a tree shewed signs of being attacked, it was generally too late to apply a remedy. The trees lost in this way include some fine specimens of Araucaria, which grew near the front entrance.

31.—The Fernery which remained unfinished from last year has been completed, but not fully planted. I anticipate much trouble from the roots of the jungle trees which absorb the soil intended for the nourishment of the ferns.

32.—The forest tree nursery was closed during the year, owing to the removal of forest operations to a distance.

33.—**Economic Gardens.**—Through want of funds, the planting in the economic garden was not gone on with, and I have had to content

myself up to the close of the year with getting plants together for planting. I believe a portion of next year's vote will be specially set aside for this work.

34.—**Herbaceous Garden.**—The Herbaceous Garden referred to in my last year's report has been planted with as large a variety of plants as could be got together. The plants are arranged in their natural families and will be a great convenience to all interested in plant classification as well as to the employés of the gardens themselves.

35.—**Labelling.**—The plants on the lawns and grounds have been kept well labelled. The work has had the constant attention throughout the year of one man, and labelling is now possibly better attended to than it has ever been previously.

36.—**Lawns.**—The grass lawns which occupy about two-thirds of the total area of the gardens has been maintained in good order at the expense of much cutting and sweeping. The leaf fall in the gardens is particularly heavy, but notwithstanding this, I venture to think that a little less sweeping might be done with a view to making available a larger share of the small annual grant furnished by Government.

37.—**Office and Herbarium.**—After a good deal of difficulty, a suitable Clerk has at last been found for the Garden Office in the person of Mr. EDWARD BREWER, who entered upon his duties on the 1st September of the year under report. He has given me much satisfaction.

38.—The Garden Police have attended well to their duties throughout the year, nothing having been stolen to my knowledge, and there has been no prosecution.

39.—The Printer has been occupied as explained under paragraph 35.

40.—The Carpenter has been fully occupied in works of a very miscellaneous nature, such as making plant-cases, plant-labels, painting garden seats, &c.

41.—The Herbarium Keeper has been employed curing herbarium specimens, mounting specimens, and attending to the wants of the Library.

42.—The Herbarium, which occupies the largest portion of the building which contains the office, has received during the year an addition of eighteen cabinets and two tables. The plant-cabinets have nearly all been filled with specimens collected during the year, chiefly by the Collectors working under the supervision of the Forest Department. (See Forest Report.) A book is kept in the Herbarium, in which is entered the number of every specimen received, its native name, and purpose for which used.

43.—Herbarium Specimens sent to the Gardens to be named should be forwarded in duplicate or numbered when not required to be returned.

44.—The additions made to the Library during the year is shewn in Appendix E. Twenty-five volumes comprising various books and reports received in previous years have been bound and put in place. It is found that a small stove is required to keep away damp from the books, as well as from the herbarium specimens.

EX-ESTABLISHMENT.

45.—**Government House Grounds.**—The year has seen a complete transformation of the old plant-houses and system of housing plants, so long practised at Government House.

46.—The whole plant collection has been transferred to a new nursery opened at a reasonable distance from the House. In this nursery, four new plant sheds have been erected, on an improved principle, and in these the ferns and other plants thrive well.

47.—The nursery made is about an acre in extent and has been filled with a variety of plants useful for cut-flowers, ornament, &c. Small walks have been made through the nursery connected at certain points by terrace stairs in brick. A walk about thirty yards in length and six feet in breadth has been made to connect the nursery with the approach leading to Government House from the back entrance and planted on each side with Bidwell's Pine. This walk, together with the principal walks throughout the nursery, have been coated with laterite.

48.—A large assortment of Chinese green-ware pots has been purchased, and the whole collection of plants re-potted. A considerable number of crotons and other ornamental foliage plants suitable for internal decoration have been purchased, in addition to collections of similar plants supplied from the Botanic Gardens.

49.—The flower-bed design below the bower has been re-modelled.

50.—A number of shrubs which had become overgrown and leggy have been removed from the lawns, and re-placed by more ornamental specimens. The lawn tennis grounds have been top-dressed and the adjoining flower beds re-planted and re-designed. Two large fig trees on the lawn which obstructed the view of the harbour from the house have been topped. The walks and lawns have been maintained in good order throughout the year.

51.—During the visit of H. R. H. Prince OSCAR of Sweden, he planted, at the request of H. E. the Acting Governor, a palm tree (*Caryota urens*) near the position of those planted last year by Princes EDWARD and GEORGE OF WALES.

52.—**Esplanade.**—That portion of the Esplanade lying between the road and the sea, and extending from near Raffles Institution to Cavenagh Bridge, has been levelled, reduced to a regular slope seawards, and closely laid with turf. In this work, upwards of 2,000 cart-loads of soil were used, and 1,000 cart-loads of grass. The levelling being completed, the pillars along the footpath were removed and placed further back to widen the path and thereby render it a more useful and agreeable promenade. To finish, a number of garden benches were distributed in shady positions beneath trees over the lawn.

53.—**Public Offices.**—The grounds surrounding the extension of the Colonial Secretary's Office and new Harbour Office have been levelled, turfed, and decorated with flower-beds involving considerable work.

54.—**Dhoby Green.**—Dhoby Green has undergone a complete change during the year. Its condition had for some time been considered unsatisfactory, and in the early part of the year the Government

ordered it to be taken in hand by the Botanic Department. Owing to the damp nature of the site, thirty-two drains were run transversely across the ground, and laid with four-inch tile pipes. These have removed the superfluous water which checked the growth of plants and gave the place a dreary appearance.

55.—After filling in the drains and levelling the surface, the necessary authority was obtained by the "Ladies' Tennis Club" to occupy the ground. The design as modified is composed of lawn, flower-beds, and curvilinear walks, and although considerable ornamental effect had to be sacrificed in order to leave sufficient space for a number of tennis courts, the place has been greatly improved.

56.—**Revenue and Expenditure.**—The receipts and expenditure of the year will be found detailed in Appendix A. The total receipts amounted to \$10,809.78, and the expenditure to \$10,608.83; this leaves a balance on the side of receipts of \$200.95.

N. CANTLEY,
Superintendent of the Botanic Gardens.

APPENDIX A.

*Revenue and Expenditure of the Botanic Gardens, during
the year 1884.*

RECEIPTS.	\$ c.	EXPENDITURE.	\$ c.	\$ c.
Balance from previous year,	53.56	SALARIES.		
Government Grant, ...	10,000 00	Superintendent, ...	2,160.00	
Sale of Plants and Flowers,...	503.15	Head Gardener, ...	1,260.00	
Special Receipts, ...	253.07	Clerk, ...	494.81	
		Propagator, ...	165.00	
		Mason, ...	179.70	
		Carpenter, ...	160.30	
		Chief Mandor, ...	93.00	
		Printer, ...	120.12	
		Aviary Keeper, ...	84.18	
		Garden Police, ...	270.00	
		Javanese Coolies, ...	1,715.35	
		Chinese Coolies, ...	343.25	
		Plant Collectors, ...	115.06	
		Herbarium Keeper, ...	15.00	
			7,175.77	
		BILLS.		
		Superintendent's Trans-		
		port, ...	150.00	
		Head Gardener's do.,	180.00	
		Manure and Cartage,...	158.75	
		Food for Birds, ...	208.80	
		Flower Pots, ...	103.10	
		Herbarium Fittings,...	332.66	
		Botanic Books, ...	62.50	
		Purchase of Tools, ...	261.61	
		Wood for Constructive		
		Purposes, ...	109.22	
		Freight on Plants, ...	14.04	
		Laterite,...	235.50	
		Purchase of Plants, ...	345.61	
		Purchase of Wardian		
		Cases, ...	49.50	
		Roof for Exhibition		
		House, ...	300.00	
		Petty Expenses, ...	155.40	
		Erection of Coolie		
		houses, ...	267.00	
		General Store and Ma-		
		terials, ...	213.16	
		Sundries, ...	45.25	
		Covering Potting Shed,	10.96	
		Collecting of Guttah		
		Juice, ...	30.00	
		Advances, ...	200.00	
			\$3,433.06	
			10,608.83	
		Balance in Bank, ...		200.95
				\$10,809.78
	\$10,809.78		Total, ...	\$10,809.78

N. CANTLEY,

Superintendent.

APPENDIX B.

*List of Contributors of Plants and Seeds, in 1884.**Foreign Contributors.*

	PLANTS.	SEEDS. lbs.
Director of Botanic Gardens, Java, ...	{ 250 } { 500 }	20
" " " Jamaica, ...	...	25
" " " Ceylon, ...	...	1
" " " Hongkong, ...	34	16
" " " British Guiana, ...	...	12
" " " Adelaide, ...	...	11
" Royal Gardens, Kew, London, ...	45	3
" " " Trinidad, ...	35	51
" " " Cape Town, ...	...	1
" " " Durban, Natal, ...	...	...
" " " Mauritius, ...	25	60
H. ALABASTER, Esquire, Siam, ...	20	...
T. VARMBOLD, Esquire, Buitenzorg, ...	...	...
E. E. ABRAHAMSON, Esquire, Borneo, ...	40	...
Mr. CONOLLY, ...	30	...
Mr. R. ROBERTS, Kew, Australia, ...	...	...

Home Contributors.

H. E. the Acting Governor, ...	...	...
H. H. the Maharaja of Johor, ...	1	...
The Hon'ble H. TROTTER, ...	...	...
The Hon'ble J. M. B. VERMONT, Penang, ...	1	...
The Hon'ble the Resident Councillor of Malacca, ...	...	...
Dr. LITTLE, Singapore, ...	19	...
Total, ...	1,000	200

APPENDIX C.

List of the Principal Recipients of Plants and Seeds, in 1884.

	PLANTS.	SEEDS. Packets.
Director of Botanic Gardens, Hongkong, ...	33	10
" " " Ceylon, ...	...	7
" " " Calcutta, ...	...	7
" " " Kew, London ...	105	10
" " " Cambridge, England, ...	...	5
" " " Jamaica, ...	...	7
" " " Trinidad, ...	150	10
" " " British Guiana, ...	...	5
" " " Cape of Good Hope, ...	...	6
" " " Natal, ...	...	7
" " " Mauritius, ...	...	20
" " " Sydney, ...	...	10
" " " Adelaide, ...	...	7
" " " Melbourne, ...	...	7
" " " Brisbane, ...	...	7
The Agri-Horticultural Society, Lahore, ...	...	1
Carried forward, ...	288	126

=150 lbs.

APPENDIX C.—Continued.

List of the Principal Recipients of Plants and Seeds, in 1884.

	PLANTS.	SEEDS. Packets.
<i>Brought forward,</i>	288	126
J. C. BROWNING, Esquire, Forest Farm, Windsor,	45	...
The French Consul, Singapore,	600	...
H. ALABASTER, Esquire, Siam,	45	...
Major-General SARGEANT, Hongkong,	20	...
Lady WELD, England,	24	...
Lady BOWEN, Hongkong,	25	...
H. B. M. Consul, Amoy,	45	...
W. BULL, Esquire, London,	207	...
J. ALLEN, Esquire, Penang,	100	...
C. MARIES, Esquire, India,	31	...
E. E. ABRAHAMSON, Esquire, Borneo,	11	...
E. PRYOR, Esquire, Borneo,	20	...
	<hr/> 1,500	<hr/> 126

APPENDIX D.

List of Books received during the year 1884.

Medical Botany, (W. WOODVILLE, M.D.).
 Transactions of the Highland Society of Scotland, } Presented by Mr.
 Journal of Agriculture, } ROBERTS, Kew,
 Philosophical Magazine, } Australia.
 Paradisus Batavus, (PAULUS HERMANNUS, M.D.).
 Thesaurus Literaturæ Botanicæ, (PRITZEL).
 Monographie de la Famille des Lycopodiacees, (A. SPRING).
 Ferns of British India, (BEDDOME).

S. L. E. 1882
1883

STRAITS SETTLEMENTS.

Paper to be laid before the Legislative Council by Command
of His Excellency the Governor.

Report on the Forests of the Straits Settlements.

INTRODUCTION.

1. Having received instructions from His Excellency the Governor to draw up a Report on the Forests and Forest Lands of the Colony, and make recommendations for their better management, I commenced, in March 1882, a tour of inspection of the various districts comprised within the Settlements in order to make myself fully acquainted with the special circumstances and conditions prevailing in each.
2. With a view to giving a clear idea of these conditions, I have divided my Report into two parts; in the former will be found detailed the present state of the forests and circumstances which affect forest growth; and the latter contains my recommendations.
3. It is apparent that no sufficient attempts have been made to conserve the Government forest lands, and that nothing has been done towards utilising the extensive grass wastes that are to be seen throughout the Settlements. The present state of affairs is the result of a reckless, migratory cultivation carried on by the Chinese, and this extensive deforestation has brought with it its attendant evils. Our Timber supply has fallen far short of the demand, and the climate of the Colony is becoming sensibly affected.
4. It is not contended that the total Rainfall of the year has decreased, but owing to the removal of the tree covering—that great equaliser of Rainfall—showers have become less frequent and more local than formerly; and droughts of unprecedented length have occurred, thereby increasing the possibility of epidemics. Those fertilising showers which once watered the whole surface of the Settlements are now confined more frequently to the hill tops and higher elevations, the soil and the prospects of agriculture being thus impaired, and the temperature of the plains being raised. The hill streams run with greater irregularity and many of the smaller streams have become entirely dried up.
5. It has been said that, at home as well as in their Colonies, other nations pay earlier attention to the conservation of forests, than the English; and it is hard to conceive a more short-sighted policy than that which has suffered these Settlements to drift into their present condition of scarcity of forest and forest produce.
6. It has, however, remained for His Excellency the Governor to propose the inauguration of those remedial measures

20/00

which have proved effectual in other countries where similar evils have been dealt with, namely, the formation of plantations of forest timber, the re-wooding of waste lands, the establishment of well defined Reserves, and the protection of such patches of forest as are now existing.

7. It will be by these means that in years to come the climate and soil of the Colony will be improved; that a supply of Timber will be provided when those sources of supply now open are closed to us; and that the Settlements, through afforestation, will present a totally different aspect.

8. Many foreign species of trees have been recently introduced which, it is hoped, will prove to be admirably adapted for the re-forestation of waste lands, and the collection and cultivation of these, together with the best of the indigenous species, will form plantations all over the Settlements.

DESCRIPTIVE.

Topographical Features.

1. The island of Singapore lies at the southern extremity of the Malayan Peninsula, from which it is separated by a narrow strait of about three quarters of a mile in width, and it is situated in latitude $1^{\circ}16'13''$ north, and east longitude $103^{\circ}53'15''$. There are several small islands adjacent to it forming part of the Settlement which comprises an area of 145,000 acres. Its greatest length is 27 miles, and greatest breadth 14 miles.

2. For administrative and general purposes, the island is divided into twenty-nine districts, which will be seen on the annexed map. *See Appendix F.*

3. It may be roughly stated that about half of the island is under cultivation of all sorts, and the articles produced are chiefly gambier, pepper, tapioca, indigo, cocoanuts, pine apples, areca-nuts, Liberian coffee, cocoa, sago, lemon grass, native vegetables and fruits of all sorts.

4. The surface of the island is very irregular, being little other than a series of small hills with narrow alluvial valleys between, there being nowhere any large flats. The hills stretch in ramified systems in various directions. The highest, which is Bukit Timah, rises to an elevation of 530 feet above sea level, and occupies a position in the centre of the island, where, with Bukit Panjang and Bukit Kalang, a triangle is formed within which rests the chief highland of the Settlement, and from which, with two exceptions, the elevation gradually falls to the coast. The chief exception to this rule commences at Bukit Panjang, on the west of which the general elevation suddenly falls almost to sea level and forms the valley which stretches across the districts of Pandan, Jurong, West Bukit Timah and Lim Chu Kang, and through the bottom of which the Kranji and Jurong rivers (creeks) almost meet and form a separate Island. On the west of this valley at Peng Kang and Tengeh, the elevation gradually rises and attains its maximum height in a series of hills which stretch along the coast line in the extreme west of the island, and where some of the highest sea cliffs in the Settlement occur. The other exception is chiefly constituted by the Mount Faber range, which commences at the coast line a little to the west of the town of Singapore and runs for about three miles in a westerly direction. The highest land of this range rises to an elevation 291 feet above sea level, while 100 feet may be taken as a fair average of the smaller hills of the Island.

5. Of the less hilly districts, may be mentioned those which occupy the east end of the island, and those which occupy the Jurong valley.

6. Of the numerous watercourses which have been dignified by the term river, none are worthy of that name except, perhaps, the Kalang River, which is about seven miles in length and has its source on the highland which occupies the centre of the island; the others are more properly speaking creeks, and often terminate suddenly, receiving only a scanty rivulet of fresh water: they are numerous along the coast, the principal of them being the Jûrong, Pandan, Singapore, Saranggong, Ponggol, Selêtar, Sëmbâwang, Kranji, and Brih Rivers. The more useful fresh water streams are those which have their sources on the central highland of the Settlement and flow seaward; such streams are very numerous, but mostly run dry after a few days' absence of rain. Few of them have obtained names, and many of them are muddy and otherwise impure.

7. The island contains some good roads metalled with common laterite—a substance which enters very abundantly into the composition of the soil of the island and is found in great plenty in the small hills and surrounding islands. This substance, when properly applied, consolidates readily and makes a good durable road with a smooth surface. The chief highway stretches across the island from south to north, namely, from Singapore town to Kranji, which is only separated from Johor by the Straits, along this road the greater bulk of the traffic from the main part of the peninsula is conducted. The other principal roads lead to Changi, Saranggong, Pâsir Panjang and Selêtar.

8. For the purpose of this report, it is only necessary to give a general and rapid sketch of the Geology of the island; several districts in it, as well as the large island of Pûlau Ubin are composed, for the most part, of decomposed plutonic rock; these, consequently, contain the best soils with a greater depth than elsewhere, and are, therefore, better adapted for the growth of large timber. Geology

9. Sandstone clays chiefly occupy the coast line districts. The shale tracts include Tanjong Gul, part of Lim Chu Kang, West Bukit Timah, Jûrong, and Tanglin, while the districts of Kalang, Saglap, and Pandan are almost wholly alluvial.

10. Of the secondary minerals, the most abundant is felspar, which occurs largely throughout the plutonic area associated with hornblende, quartz, mica, &c. In the ferruginous rocks red coloured lamina, chiefly iron ore, is much developed, associated iron ore and quartz are occasionally found in large quantity, and localities where the iron predominates over the quartz are very numerous. A good instance is the laterite portion of Government Hill. The iron rock is generally a hydrous peroxide and different forms of hematite, compact and ochry. In most localities the proportion of iron varies much and is generally too small to entitle the rock to be called an ore, but patches and masses of ore occur abundantly.

11. The chocolate, violet and many-tinted clays of the sedimentary tract (a good example of which may be seen exposed on the side of Fort Canning hill in the town of Singapore) occupy a breadth of about one mile, and stretch from the town right across the island in the direction of North West by West. The plutonic clays, on the other hand, form a compact tract, of about sixty square miles, occupying the main body of the island as already mentioned, and have a remarkable uni-

formity of character. In some places, and particularly in the bottom of valleys where it is covered by vegetable mud, and has undergone a natural bleaching, is a pure white kaolin, as may be observed at the commencement of the new road now being made up Bukit Timah hill, but it generally imbeds quartz, granulates to some extent, and, at a few feet below the surface, is mottled with red and other colours with various degrees, but it is sometimes altogether of a dark-red hue; where this is the case, masses of half decomposed iron rock are found in it.

12. Iron rock is also found over the surface in amorphous cellular blocks and small pebbles, or below the surface at depths varying from a few inches to a few feet in layers and similar pebbles. Frequently, however, lumps of decomposing granite, patches of visicular jaspideous rock, procellaneous rock, &c., are also found in it, the only unchanged constituent of the original rock being the quartz, and even that, is sometimes penetrated by the iron.

13. The upper soil, or that which has been completely subjected to the influence of the atmosphere, is a clay with a greasy lustre, but oftener inclining to a dry friable appearance, in colour generally yellowish-brown; this, with the small proportion of quartz, distinguishes it from the granite clays of Penang.

14. The surface soil of the sandstone tract is a clay of a more sandy nature and poorer, owing to its containing a less proportion of iron in a free state. Clay soils absorb much water during showers, and contract and crack with dry weather. This contraction often tears asunder the roots of plants and free currents of dry air are admitted by the cracks and rents, which also injure the roots. To keep such soils in an equable condition, frequent showers are absolutely necessary, and anything which has a tendency to diminish the frequency of showers has consequently an injurious effect on the agriculture of the country.

15. All the valleys are alluvial, the bulk of which deposit has been formed by the action of salt water. These valleys contain, therefore, the best soil of the island, and are everywhere squatted upon by cultivators of vegetables, indigo, &c.

16. The climate of Singapore is remarkable for its uniformity of temperature and general salubrity, there is no hot or cold season, though it is observed that the months of November and December are generally a degree or so below the average temperature of the other months, which is due, in a great measure, to the increase of rainfall at that season.

Meteorology.

17. By the kindness of Dr. M. F. Simon, Colonial Surgeon, I have been put in possession of some valuable Meteorological Records. From those for 1876 it appears that the mean annual temperature of the air is 81.1° F., approximate temperature 79.9° , mean temperature of dew point 74.1° , highest temperature observed 91° , lowest 66° . See *Appendix D*.

A knowledge of these two latter is most important to the Forester, as it is the extremes of temperature which affects the possibility or otherwise of a plant succeeding. What is most striking, however, is the great humidity contained in the atmosphere, which, counting saturation at 100° , falls only to 78° during any month of the year, while it is often as high as 80° , and gives an annual average of 79.4° . It is this high state of humidity, and the heavy night dews, which chiefly maintain the luxuriant vegetation of the island in its present condition.

18. The island is subject to strong squalls at all times, but more frequently after the monsoons have fairly set in. These squalls often do much damage, although seldom of long duration. Native houses are frequently blown over by a strong wind of this description, which, as a rule, comes on very suddenly and gives but little time for preparation. The number of fallen trees and branches everywhere strewn about strongly remind me of what I have observed in Mauritius after a mild hurricane.

19. The mean annual Rainfall of the ten years preceding 1879, averages 91.66 inches, which shows no appreciable difference when compared with averages taken 30 years previously. I append an abstract of Rainfall observations taken at several stations within the town district, which show that as much as 6.25 inches fall in 24 hours, while a fall of from four to five inches in the same time is quite common, and the satisfactory sanitary condition of the island, and of its towns and villages in particular, depends upon these heavy rains, which flush the sewers and ditches, and wash away all pestilential matter; hence the saying amongst the inhabitants that dry weather is unhealthy.

See Appendix D.

20. Annexed also are tables shewing the number of rainy days in each month and year for over a period of twelve years from records kept at the Criminal Prison in the Town of Singapore and for a period of seventeen years from a gauge kept by Mr. Knight, at Thompson Road, about three miles from town. This latter gives an average of seventeen rainy days per month all the year round; smallest number in one month, fifteen days, in June; greatest, twenty-three days, in November; smallest number of rainy days in one year, one hundred and twenty-four, in 1877; greatest, two hundred and forty-four, in 1879; while at the Criminal Prison's gauge is found an annual average of fourteen-and-a-half rainy days for each month of the year, least number in one month, twelve days, namely, in June; greatest, twenty days, in November; smallest number in one year, one hundred and nine days, in 1877; greatest two hundred and twelve, in 1871. See Appendix D.

21. It will be observed, therefore, that Mr. Knight's gauge gives an average of thirty-four more rainy days in the year than has been recorded at the Criminal Prison, which may be accounted for by the fact of its being at a greater elevation above sea level than the other, and to its position being three miles nearer the hills or common watershed of the island.

22. It is very desirable that Rainfall records should be procurable from stations distributed over a greater extent of country, as, by such means, a fair estimate of the annual fall over the whole island could be obtained, more especially as showers are now well known to be more local than formerly, and to fall most abundantly in the districts of Bukit Timah, Upper Kalang and Amokiah.

23. Whether the extensive denudation of the primæval forests in Singapore has had any marked effect on the climate of the island, is a question of considerable interest to all concerned. That such clearings have had a decided effect, and often a disastrous one in other countries, is a fact which does not admit of any difference of opinion. Considering, however, the small area of Singapore and its being closely surrounded on two sides by the wooded territory of Johor, not to mention its insular position, it is to be expected that the effect of such clearings would be less felt than on a continent.

24. The position of the rain gauges from which the records at my disposal have been compiled, is badly selected for the determination of the phenomena of this nature, and there is reason to believe that the observations contained in the tables show but imperfectly the real extent of change which has taken place in the more remote districts. And, as the presence of forests considerably modifies the distribution of rainfall and economises the water supply after it has fallen, and as agriculture is principally dependent on these conditions, the presence of a certain amount of forests in a country is not only necessary, but of the first importance for this, and those climatic considerations which naturally follow.

25. Turning now to the tables in which are recorded the total Rainfall and number of rainy days throughout the year, and dividing the twelve years, over which the observations extend, into periods of four years each for the sake of comparison, by setting off the total Rainfall and number of days on which rain fell against each period, any change which may have taken place since the first period will become apparent; and, if apparent, it will be difficult to find any cause to which it can be ascribed other than to some local disturbance, or influence, which has been at work; and equally difficult to find any such disturbing agent except that which has been effected by man in the removal of the natural covering of the surface of the island, which is known to have taken place within the period in question, *viz.* :—

	Years.	Total Rainfall.	Number of days on which rain fell at Thompson Road.	Number of days on which rain fell at Criminal Prison.	
		Inches.	Days.	Days.	
First period ...	{ 1869 1870 1871 1872 }	398.62	901	787	
Second period,	{ 1873 1874 1875 1876 }	356.52	829	689	
		42.10	72	98	Decrease over first period.
Third period ...	{ 1877 1878 1879 1880 }	369.32	820	624	
			9	65	Continued decrease over second period.
		29.30	81	163	Total decrease over first period.

26. The above records shew a steady decrease in the number of rainy or showery days, and what is further remarkable is that, although the Rainfall of the last period shows a slight increase (12.80) over the second, the number of rainy

days has nevertheless steadily decreased throughout the whole of the three periods, thus shewing that the fall of the last period must have taken place in heavier showers, or torrents; or, to be still more explicit, that the fall of 398 inches of the first period seems to have been subject to some influence which distributed it over 717 days; while that of the last period, which is found to be only 10 inches less, seem to have lost this influence in a great measure and fell only on 624 days. The total loss in number of wet days, since the commencement of the first period is equal to about the average number of rainy days in one whole year.

27. In my description of the soil of Singapore, I have pointed out that it is of a peculiar nature, absorbing large quantities of water during showers, and having a strong tendency to crack and rent after even a short period of dry weather, and that frequent showers evenly distributed are necessary to keep it in a state fit for the growth of plants or agriculture, and this fact should not be lost sight of in connection with the great loss in the number of rainy days as shewn above.

28. There is yet another item, which I will refer to before closing my observations on the Meteorology of the Island, namely, the condensing power of forests on atmospheric vapour. Reliable experiments have shewn that more rain would be the result of greater shade and tree covering, and this is accounted for by the fact that when a cloud containing vapour comes in contact with the cool air over the forest or woodland, contraction takes place, the aqueous particles are forced together and fall in the shape of rain; whereas, were such a cloud to pass over the heated air over bare land, it would dissolve itself and vanish, and the chances of rain would be lessened.

29. The primæval forests of Singapore belong to that class known as evergreen tropical forests, which chiefly lie within the tropics and in countries subject to heavy annual rainfall, and a high state of atmospheric moisture. Many of the trees contained in these forests are, nevertheless, deciduous for a very limited period, which, in most cases, extend over a few days only. The island appears to have been covered with forests of this nature till quite recently. Forests

30. From what can be judged from some old trees which still remain on the island, and from what I have seen of the primæval forests in the adjacent territory of Johor, the forests of the island must have been very fine. Some of the old trees have trunks several feet in diameter, straight as arrows, and 60 to 70 feet to the first ramification of the branches. It is also observed that many of the districts of the island have derived their names from the abundance of the valuable kinds of timber found in them. Serayah-wood was abundantly produced, a species which always finds a ready market. In Australia its excellent qualities have obtained for it the name of "Singapore Cedar," and in Mauritius, where it is annually imported to the value of about £10,000, it is known as "Bois de Singapore," and for house-fitting and constructive works generally, where not exposed to the weather, it is one of the most easy to work and most durable of woods. This with most other valuable kinds is only to be found in very diminished quantities on the island.

31. Those species which are chiefly to be met with in the patches of forest remaining on the island, I have divided into lists, according to their importance or peculiarities. Where

the systematic name is not given, I have not met with a tree in blossom, and where the local name is omitted, it is owing to none of my guides being able to furnish me with the name. See Appendix A.

32. Such Crown forests as remain uncut are widely distributed in isolated patches over the island. These forest patches or clumps are of various sizes, from half an acre or so to about twenty-five acres, and of no particular shape; their distance from each other may average a quarter of a mile, though often exceeding a mile. The interspace is generally waste grass land which supports, as a rule, only strong-growing grass locally known as "*lalang*," (*Imperata Koenigii*), which chokes any seedlings of forest trees which might otherwise spring, and ultimately reforest such lands. The area of forest of this description is difficult to estimate, but I think that 5,000 acres would be about the proper figure to be termed approximate. Little timber of any particular value remains in the Government forest; some patches contain a few trees of fair size, but they produce wood of indifferent quality. Frequently, however, a tree of *serayah* or *meranti* may be met with in the larger forest clumps, where they have been spared owing to their occupying inaccessible positions, or to accident.

33. Around such trees may be found seedlings of the same kinds in limited numbers, and also at some little distance to which the winds have wafted the seed, but these constitute only a small proportion of the seedlings to be found in these forests; the majority being inferior species, and as these are preparing to form the forests of the future, it need hardly be said that they will not be very valuable when grown, unless assisted by regeneration cuttings, or, where that is likely to prove ineffectual, by artificial sowing or planting to the requisite extent.

Waste Lands.

34. This condition of things is not, I believe, generally understood in the Colony, where the opinion prevails that the waste lands only require attention; but much of the secondary growth which forms the greater proportion of the present forest of the island is, from a Forester's point of view, nearly as worthless as the waste lands themselves.

35. It is indeed difficult to properly account for the degenerate state in which the remaining forests of the island are found, and I can only surmise that the valuable trees which once covered the surface of the island must have been removed before they had made provision for reproduction by seed-shedding, and that the condition of the land when denuded must have been unfavourable to the growth of their progeny. I observed in one forest a band of men eagerly searching for young trees of *Tampinis* which were believed to grow there, and a little later I saw several trees cut over close to the ground. These were small plants not more than three inches in diameter, a fact which would seem to show that the destruction of the saplings in this way by natural selection, has been, perhaps, the chief agent in bringing about the present unsatisfactory condition of growth.

36. The trees, some of which are only now made known to science as growing in the Straits Settlements, and which compose such forest as remains uncut on the island, are given; but some are now so scarce that they may be looked upon as extinct for any useful purpose they now serve. There is yet another class to describe, viz., auxiliaries. These are the small trees and shrubs which form the undergrowth, and which, though

of little commercial value, are nevertheless important as keeping the forest in a compact state, and thereby preventing an over free circulation of air, which would be injurious to the germination of seeds, and even to the proper growth of the trees themselves. This undergrowth also assists in keeping the forest floor in a proper state for the reception of seed, and maintains the general humidity of the air by preventing too rapid absorption, and those species peculiar to the forests of the Settlements, so far as they have come to my notice, I have added to the Appendix with the names of the principal palms and plants of the fern tribe met with during my forest tour. *See Appendix A.*

37. I also give a list of creepers and other plants injurious to forest growth. The first of these which I will mention are those most commonly found, the stronger of which climb to the tops of the highest trees, and ultimately cover and kill them. Others grow less strongly, and are dangerous to the trees only during the first ten or twenty years of their existence. Others, again, are found chiefly on the outskirts of woods where they hang only to the lower branches. Others are peculiar as finding their way quickly upon land, which has been cultivated and lately abandoned. These latter generally give most trouble, as they lay hold of the young trees which spring from seed or such as are planted, and soon choke and kill them if not speedily removed by the Forester. *See Appendix A.*

38. There is also a tribe of plants very common in the forests of the island which are sometimes epiphytal, but more often parasitical, the roots of which penetrate the branches of the trees and feed upon the sap intended for the nourishment of the legitimate leaves and branches. I noticed some trees covered with these parasites in the forests of the island, sometimes to the exclusion of every leaf except those of the parasite itself. Trees so covered soon die. It is curious, too, to witness the great rapidity with which parasites of this nature travel from tree to tree; their rapid distribution is said to be facilitated by birds which feed upon the seeds and drop them undigested upon the branches. *See Appendix A.*

39. Having already made mention of the area of waste lands and the nature of their distribution, I refer to them here only to show how far protection without artificial planting is likely to be effectual in the afforestation of them. A list of the young trees found to have crept into some waste lands abandoned about five years ago is given, but I may mention that of the species enumerated only two kinds are worth protecting, and these occur but rarely. The only thing which seems to grow freely for sometime after gambier cultivation is simply grass (*lalang*), and the result is that there is hardly to be found any land, the forest growth on which would grow into a serviceable plantation with the aid of protection only. This is a great drawback, and shews the sad condition into which a wild and unrestrained cultivation has brought the island. But on the other hand, I have further examined these waste lands with a view to finding out the depth to which the impoverished soil extends, and found it to be only the surface covering of a depth of about a foot or so. Below this, the soil is of ordinary good quality, and when turned up grows crops satisfactorily, and there is, therefore, every hope of forests being established on such lands, and of the plants growing with their usual vigour, after the roots have penetrated beyond the surface covering, and with such a mode of cultivation, as would turn down the exhausted surface soil, and turn up that which underlies it, as is done in

See Appendix A.

Europe, ordinary agricultural crops might be grown much longer on the same spot than is now the case; nor is the *latang* grass so formidable an opponent of cultivation, as it is generally considered to be. It is easily destroyed by the shade of plants taller than itself when planted sufficiently near each other, and may, if desired, be grubbed out altogether. This grass may be looked upon as a valuable provision of nature in shading and protecting the waste lands which it covers from the deteriorating influence of the sun until suitable crops can be planted on them, or they are otherwise stocked by nature.

Disease, Insect and Animal Life.

40. The forest trees of the Island are remarkably free from fungoid disease and fungi generally. The climate seems unfavorable for the development of this tribe of plants, and I have no recollection of having met with any tree which could be called diseased, although many were attacked by insects.

41. Insect life is very numerous in this part of the world, the family of beetles and boring insects specially so; but white ants, with which some lands swarm, are perhaps the most destructive, and seem to prefer wood of a light open-grained nature. In the Botanical Gardens of the Colony they have shewn a decided preference for pine trees and Australian trees generally. In the forests I have noticed trees of *Litsea*, *Campnospermum*, *Quercus*, *Castanopsis*, &c., eaten over by them. It is most difficult to suggest a remedy for their ravages, but, in this direction I have used gas to the most success. They dislike any strong-smelling thing, and I have known them frightened away by a dose of guano water. There are, indeed, many substances and liquids which will kill them, but the difficulty is to get one that will destroy the ants without destroying the tree also, and one that will prevent their returning, and I believe no such remedy is at present known.

42. The Forests of this Colony are, as has been often remarked, singularly devoid of animal life; but of those animals and birds enumerated in the Appendix, all, except the Deer, which are not plentiful, are the cause of much injury or annoyance to the Forester. See *Appendix D*.

Regulations.

43. There are in Singapore absolutely no Forest Rules or Regulations, or Forest law of any kind. And it is most difficult to bring offenders to justice. The Forest Ranger staff of the island consists of two men only, who live in the town of Singapore, and visit such districts as the Collector of Land Revenue, under whose orders they are, sends them to, and at such times as he thinks proper.

44. Considering, therefore, the isolated nature of the forests, no attempt can be said to be made at protection, but only for the punishment of such offences as come to light. This is, I believe, the opposite to what should be aimed at, as it is opposed to the rules of good forest conservancy. There should always be a sufficiency in the Protection force to enable it to aim at prevention, as it is not the number of cases on the Magistrate's list which shew that the forests are being well-looked after, but rather the paucity of such. The amount of fines for forest destruction received in 1881 amounts to no less than \$2,653, which in itself will give some idea of what is going on in the way of forest clearing, and this sum, there is reason to believe, represents but a small part of the value of what is really destroyed. With this exception and that of the fees paid for cutting firewood, there is at present no revenue from forests properly so called, or expenditure on them.

45. I have endeavoured, by many means, to arrive at an approximate estimate of the amount of timber annually used in the island for constructive and other purposes, and give below the results of my enquiries. According to a rough estimate, the figures may be stated as under:—

Timber Consumption.

Used by the Public Works Department ...	80,600	c. ft.
Used by the Public	200,000	„
Used by Pepper Cultivators	530,400	„
	<hr/>	
Total	811,000	„
	<hr/>	

46. None of the above is the produce of the Settlements, but is reported to have been brought chiefly from Johor and the neighbouring Dutch islands. I am unable, as I should have wished, to give statistics of the Timber exports and imports: because as the Returns for the Colony deal with a passing trade I should not be able to produce accurate figures.

47. From figures supplied by the Land office, the number of permits issued for firewood-cutting in 1881 numbered 1,009, of which 609 were for a term of three months each, and 400 for two months each, which is equal to about 218 men cutting all the year round; but it is generally believed that from 300 to 400 men are annually engaged in this work. The Revenue received from permits of this description amounted in 1881 to \$1,020. It is difficult to arrive at correct figures of the annual amount of firewood used in the Settlement, but if it be assumed that 2lbs. per head of population are daily used as fuel—a quantity believed to be considerably under the actual consumption—there will be a total annual consumption of about 45,000 tons: of which amount 32,000 tons are consumed in the town of Singapore alone.

Firewood.

48. To the quantity used by the inhabitants in the country must be added the requirements of the gambier plantations, of which there are some 20 in the Island, each of which is believed to consume on an average 2,500 lbs. daily during the crop, which lasts for about six months of the year; and into this may be thrown the requirements of the pepper crop, the poles for new plantations excepted, as it must be understood that for the sake of keeping the coolies employed all the year round, and as a guard against a fall in prices, the gambier cultivators are also largely cultivators of pepper; and as the latter has a proper season for ripening its fruits, and the gambier no such season, the cultivators take the precaution to have the gambier plantations stripped by the time the pepper crop is ready to gather, so that no sooner are the boiler fires of the gambier preparers extinguished than those of the pepper kilns are lighted up. But again some cultivators prepare gambier all the year round when they possess a large plantation of such plants.

49. Much fuel is also used by the small coasting steamers and numerous steam launches, thirty-one of which burn wood exclusively, and others occasionally. These thirty-one boats have an average tonnage of 228 tons each, and consume monthly about 1,240 tons of wood.

50. The supply for this demand is drawn almost exclusively from the Dutch islands on the opposite side of the Straits, and is sold in the harbour of Singapore at an average

price of \$6½ per 1,000 pieces, or per 7,000 lbs. Ten years ago the same quantity could be obtained for \$4, but as wood is yearly becoming more difficult to procure, the price is also on the increase. The above figures may be tabulated as under. Approximate total annual consumption of firewood in Singapore:—

Drawn exclusively from the Forest of Singapore.	Drawn chiefly from Singapore and Dependencies.	Drawn almost entirely from Dutch Islands.	Total.	REMARKS.
Tons.	Tons.	Tons.	Tons.	
...	33,000	...	33,000	Consumed by inhabitants of chief town.
13,000	...	...	13,000	Consumed by inhabitants of country.
...	...	15,000	15,000	Consumed by coasting steamers.
40,000	...	...	40,000	Consumed by gambier planters.
53,000	33,000	15,000	101,000	

51. In addition to what has been stated, it should also be observed that gambier cultivators destroy annually about 10,000 tons of firewood in clearing for new plantations, the forest being cut down and set fire to. The average acreage annually cleared in this way is said to be about 390 acres.

Experimental Plantations.

52. Little has as yet been done to create plantations of young forest trees on the island, but the growth made by some introduced trees planted in an irregular way on some ground near the Botanical Gardens has far outstripped that of the better indigenous kinds and give results as under:—

	Age in years.	Height in feet.	Girth at one foot above ground.
Brazilian Iron-wood ...	2	7	8 ins.
Indian Teak ...	0½	3	3 „
Dammara Robusta ...	2	8	5 „
South American Mahogany ...	2	11	8 „

53. I wish to make a passing reference to the general collapse of the nutmeg trees on the island some years ago, when nearly all the plantations disappeared which had for years before succeeded admirably; I have been informed that the cause of this sudden blight remains a mystery until this day.

54. It is believed, nevertheless, that it is one of the laws of nature that, when a plant is introduced into a climate or soil which is not altogether congenial to its wants, although it may appear to flourish for a time, it will produce seed of a kind slightly inferior to that which the parent was raised from; and that that seed, if sown, will produce a tree still further degenerate, though still imperceptibly so to the eye, and so on until a general collapse ensues. The cure for this state

of things is, of course, to raise new plantations from introduced seed, and to avoid creating them from seed grown in the Settlement, and where this has been already done, a plant seems to grow with all its usual vigour.

55. The area of private forest land has been computed at about 5,000 acres scattered over the island in small holdings, and chiefly as firewood reserves in connection with gambier and pepper plantations. The largest private forest I have seen is situated a little to the west of Mount Faber range, and is owned by a Chinaman. This plantation is believed to be about 500 acres in extent, but contains only a small proportion of good timber. Owners of private forest in districts, where the Government forest has disappeared and plundering stopped in consequence, make good returns by the sale of timber, but such forests being of very limited extent, and no provision being made for reproduction, they will soon disappear.

Private Forest.

MALACCA.

56. Malacca is situated on the western coast of the Malayan Peninsula, at a distance of about 120 miles from Singapore, and has an area of 659 square miles. Its greatest length is 42 miles, and breadth from 8 to 21 miles. The chief town called Malacca is in 2.11" North Latitude, and 102.14 East Longitude.

Topographical Features.

57. For administrative and general purposes, it is divided into 34 districts, which, like those of Singapore are not properly defined. The number of acres under cultivation may be roughly stated at about 150,000, the chief agricultural products being tapioca and padi; quantity not known.

58. Malacca may be ranked among the flat countries of the Peninsula, broken only here and there by bold ranges of hills. The chief hills are the Bukit Punggor range at Nyalas, which forms a spur of the Ophir group, and which dips into the side of the forest reserve of Jus; the Panchor range which occupies a position in the centre of the territory and has a length of about three miles; the Rambau mountains which form part of the north boundary; the Bukit Brûang range near the town of Malacca, which has a length of about three miles, and is somewhat curvilinear in shape; there are also smaller hills at Sungei Tëbong and Pulau Sëbang. The average height of which may be computed at 200 feet.

59. The chief rivers which traverse the territory are as under:—Sungei Batang Malacca, which passes through the centre of the Settlement and town of Malacca, and has a length of 35 miles. The Dûyong river, which joins the sea point about three miles to the south of the latter, and is about eight miles in length. The Kësang river, which separates the territory of Malacca from that of Muar, takes its rise in the Bukit Singgeh range, and has a length of about 27 miles. The Chohong River, which rises from the Mount Ophir range. The Linggi river, which separates the territory on the west sides from that of Sungei Ujong, and is about seven miles in length; this river differs from most of the others in being navigable for boats for nearly its whole-length. There are numerous smaller streams along the coast, but none that call for particular mention.

60. Malacca is upon the whole well provided with roads. There are about 135 miles of first class, and 80 miles of second class roads in the Settlement.

Geology.

61. The rocks composing the Malacca hills are the same as those throughout the Peninsula generally, and are chiefly plutonic, together with quartz-ferruginous rock, sandstone rock, &c. At the lower elevations shale enters largely into their composition.

62. The surface soil is more sandy than that of Singapore, specially in the more elevated portions, hence the preference given to it by tapioca cultivators. The greater extent of the surface being alluvial is more or less swampy, and on such lands *padi* is the general crop. Below the surface tin-ore abounds and is being worked in some places. Hot springs exist near the centre of the Settlement, which show that the volcanic action that formed the Peninsula is not yet extinct.

Meteorology.

63. The temperature of the air, the direction and prevalence of the monsoons, &c., are for all ordinary purposes the same as in Singapore. The atmosphere is, however, believed to be less humid. From observations taken in Malacca during 1881, it appears that the total annual rainfall for that year amounted to 103.23 inches. The highest temperature was 88°.4 F. and the lowest 71°.02.

Forests.

64. The quantity of Government forest land remaining may be put in round numbers at say 40,000 acres. From what I have observed in the existing forests there is reason to believe that, with the exception of a very limited number of species, the primæval forests of Malacca were similar to those of Singapore. The species found peculiar to Malacca are the following, but they, too, may prove indigenous to Singapore on a closer inspection—

Local name.	Systematic name.	REMARKS.
Kayu Gaharu ...	Gonystylos Miquelianus	} Yield the garu resin of commerce.
	Aquillaria ovata ...	
	Aquillaria agallocha ...	
Kayu Manis ...	Cinnamomum Javanicum	} Used for walking sticks.
	Dehasia media	
	Medinella venosa ...	
Rotan Soemambu	Calamus ...	
Salak ...	C. edulis ...	Fruit edible.
	Myristica Sp. ...	Bears very large fruit.

65. Gaharu is known generally in commerce as Garu de Malacca, and the "Rotan Soemambu" as Malacca cane. It is more than probable that Malacca has, for a long period, supplied these in greater quantity than any of the other Settlements, or indeed than any other part of the East, and it still exports them to some small extent, but cane is now only found in anything like quantity in the jungles at Nyalas near the boundary, and is on the verge of extinction in the Settlement, while of old gaharu trees only one is said to remain within the boundary line.

66. The chief features in Malacca are its Forest reserves, which are six in number and of the undermentioned approximate areas, viz. :—

Jus Reserve ...	...	...	...	25,000
Paya Gēmok ...	...	...	...	2,000
Malaka Pindah	...	...	...	2,500
Kēsang. ...	...	...	...	2,000
Sungei Sīput	...	...	...	4,000
Sungei Udang	...	...	...	2,000
				37,500

There is also a large amount of unreserved Crown Forest.

67. The distribution of these reserves will be best understood by a reference to the annexed map of Malacca, the Jus reserve is found to contain comparatively little timber except in immediate vicinity of the Bukit Punggor Hill range. There is also a clump of high forest about the position of the word Jus as printed over the reserve on the map annexed. The North East side which fronts the cultivated land contains comparatively few trees of good size and quality. The amount of well-wooded land in the reserve does not exceed, I believe, one-third of the total area. Within the reserve boundary there are a large number of squatters, whose houses are thickly dotted over the comparatively denuded portions. They are allowed to cultivate *padi* in the swampy land of the reserve, and to plant fruit trees on more elevated portions, privileges of which they seem to have extensively availed themselves. The greater portion of the Kēsang reserve has been under tapioca cultivation with the exception of a narrow belt along the outside, which seems to have been left as a screen. There is, therefore, but little timber of value left in this reserve, and as the denuded portion contains only stray plants of tapioca, it will have to be re-stocked artificially by planting. Gâdek reserve has also been under cultivation to a large extent at a comparatively recent date, and has been much denuded, the remaining trees being chiefly secondary growth, and brush-wood, but I am of opinion that they require little else than protection to form a good forest. The Sungei Sîput reserve at Brîsu was cultivated over the north half within the memory of the presents quatters who are found within the reserve in considerable numbers; the remainder of the reserve is stocked with good timber in fair proportion to the area. The reserve at Sungei Udang once famous for its arang trees and still known to the natives as the Kâyu Arang reserve contains at present but few ebony trees. This is another example of that location of certain species which is a peculiarity of Malayan forest, and the numerous localities that bear the names of trees further instance this peculiarity. The centre of the Sungei-Udang reserve is found well stocked with trees of fair size, but they grow less in number as the outside of the reserve is approached. In some parts of Jus, Paya Gēmok and Sungei Udang reserve I found the state of reproduction from seed of useful timbers in fair condition; but the reserves at Kēsang, Gâdek and Sungei Sîput are not satisfactory in this respect.

68. The extent of waste land in Malacca is very small when compared with Singapore, and may amount to 10,000 acres. These lands do not remain in that bare condition which is so common in Singapore, and therefore I conclude that tapioca cultivation does not destroy as much as gambier the chances of reproduction of trees from seed. I have given considerable attention to this subject, and I give a list of trees, creepers, &c., observed to occur on those waste lands. See *Appendix A*.

Waste Lands.

69. The system of protection in Malacca is as meagre as in Singapore. The forest rangers are under the control of the Collector of Land Revenue and like those in Singapore reside in the chief town; but Malacca is peculiar as being the only Settlement in which I found any forest rules or regulations. These consist of a Government notice posted up in the streets and villages prohibiting the removal of timber and mineral produce from the forest reserves. The amount of fines imposed for breaches of these rules amounted in 1831 to \$1,536, which contrasts favourably with the sum received in Singapore during the same year. Payment is made to the Government of 10ths from wood oil, and there is a royalty on timber; but, besides

Regulations.

this there is at present no revenue from forests properly so called, or expenditure on them.

Private Forest.

70. It would be very difficult to estimate correctly the extent of private forest in Malacca, but from what I have seen I consider 8,000 acres would about cover what exists. Little of this contains timber of any value, the general custom being to work out as early as possible such timber as is worth removing, and next to cut down a certain proportion annually for the extension of cultivation. In this operation the trees are generally cut over about four feet from the ground and then set fire to and burnt off.

PENANG.

Topographical Features.

71. The island of Penang is situated on the West coast of the Malayan Peninsula in 5° North latitude and 100° 21' east longitude. Its greatest length is about 15 miles and breadth about 9 miles, area 107 square miles. Penang has not been, so far as I am informed, regularly divided into districts. Penang is the most hilly of all the Settlements, the ranges ramify from near the centre of the Island in all directions. West hill is situated in the interior of the island and has an elevation of 2,713 feet above sea-level; Government Hill, better known as Flagstaff hill, situated immediately behind George Town has an elevation of 2,550 feet; Mount Olivia which is a spur of the latter, lies three miles to the East of George Town, and has an elevation of 819 feet; Mount Aira situated in the interior of the Island rises to 2,384 feet; the "Highlands" lying between Government Hill and George Town is 819 feet high; these mountain ranges are traversed by narrow passes, bold valleys stretch from the coast into the interior and terminate in the general axis of the hill system. On the West and North patches of flat land occur, interrupted only by occasional small hills or abrupt spurs of the smaller hill chains. The most extensive plain is that in which George Town is situated, and which with the others are believed to be recent formations and not to have belonged to the island originally. The elevation of these plains is only slightly above sea level.

72. The mountainous nature of the surface does not admit of a proper series of good roads throughout the island, and those which exist are connected in some places by bridle paths. The chief roads are those which traverse the plain behind George Town and are kept in excellent order.

73. None of the water courses of the island are sufficiently large to earn the name of rivers, though they are generally so called, the most important is that which traverses the plain near George Town and from which the town supply of water is procured; but the volume of water of this river has been of late much reduced, and is in no small degree polluted by extensive removals of the natural covering of its watershed and by cultivation.

Geology.

74. The island is generally and rightly looked upon as a mass of granite rock, with granite soil as a necessary consequence, and which with a slight coating of vegetable humus, formed of decayed branches and leaves, clothes all the highlands and upper portions of the valleys, the alluvial soils being confined entirely to the plains and bottoms of the valleys. In some places where landslips have exhibited sections of the hill sides, soils of various colours are seen to occur; where quartz predominated in the original rock a sandy gritty soil is the result; where felspar prevailed a whitish clay is produced, and where mica was in excess a reddish or brownish soil is to be

observed. In some places these soils have a great depth even on steep hill sides, as may be seen from cuttings made in the formation of a road up Government Hill, where the soil is of a reddish yellow or brownish colour, the path being covered by a large number of felspar pebbles showing that the granite which formed this soil contained felspar and mica in abundance. Decomposed rock of this description forms the best soils; and this is apparent from the luxuriant forest growth which clothes this hill side.

75. The climates of Penang and Province Wellesley differ in some respects, but both are adapted to all the purposes of intertropical agriculture. Hurricanes have never visited either of these places, though strong squalls have occasionally done much mischief in plantations. Droughts of considerable duration occur at intervals. The atmosphere of Penang is more loaded with aqueous vapour than that of Province Wellesley, owing to the latter being more removed from proximity to the hills. The average temperature of Penang is about a degree higher than the Province: the dews are heavier perhaps in the Province. The northern half of the Province is swept by a strong wind during the day and generally by a cool land wind at night. The climate of Province Wellesley is generally believed to be more healthy than that of Penang plain, which is attributed to its being more ventilated. The temperature in Province Wellesley has been known to fall to 65° F., mean temperature of Penang plain about $80\frac{1}{2}^{\circ}$; Province Wellesley $79\frac{1}{2}^{\circ}$. The mean annual rainfall of Penang plain during the three years prior to 1882 was 107.72 inches. The mean temperature for the same period 88.8° and the mean minimum 75° .

Meteorology.

76. The composition of the primæval forests of Penang differs but little from the other Settlements with the exception of a few species which are also found to occur in British Bumah. And in reference to this it is to be noticed, that as we proceed northward, the Burmese and East Indian species gradually become more plentiful in the Malayan forests. The hill ranges formerly contained some very fine timber, but little of this now remains, though secondary growth of considerable size, and even patches of good forest, still clothe some of the ravine sides. Here a tree of *Dyera Costulata* recently existed, known as the great tree, and, from its position on the hill top, was a landmark to Mariners. This tree had a clear stem of 110 feet to the first branch, its base was 30 feet in circumference, and 20 feet at a height of 110 feet above ground. There are still several good sized trees of this species in the same neighbourhood, one of which measures 77 feet to the lower branches and 18 feet in circumference. The wood of this species is white, light, easily worked and chiefly used by undertakers for coffins and by shoe-makers for clogs. The island contains also those valuable species of the Singapore and Malacca forests which I have already described.

Forests.

77. I estimate the area of existing Crown forests at about 12,000 acres, the greater bulk of which is distributed over the hill ranges in isolated patches, being most plentiful in the vicinity of Government Hill and the centre of the island generally. The hills and hill slopes adjoining the coasts contain but few trees, except such as belong to private parties. I would, however, except the neighbouring islands; Pulau Jërâjak, for instance, on which is situated the Leper Asylum, having an area of about nine square miles, is densely clothed with timber of small size.

78. On some hills, which have been completely denuded to their summits, landslips have occurred, and they illustrate on a small scale what has taken place in the Alps and other mountain chains in Europe, where similar deforestation has been effected. In some positions the roots of the trees form the natural binding which keeps the soil together, and which, when removed, exposes it to being swept into the valleys by heavy torrents of rain, and the underlying rock being thus laid bare afforestation becomes almost or altogether impossible either by natural or artificial means.

Consumption of Timber and Firewood.

79. It would be very difficult to make even an approximate estimate of the amount of timber and fuel annually used in Penang and Province Wellesley, but the amount is well known to be considerable; I would, however, only remark that the supply of firewood is said to be still abundant in the jungles along the coast of Province Wellesley. Timber is also observed to be brought in rafts down the chief rivers of the Province, and is said to come chiefly from beyond the Kedah boundary. As cultivation extends, however, these jungles will diminish and the supply will become exhausted.

Regulations.

80. Penang has one forest ranger and Province Wellesley two for the protection of the forests, but they reside in the chief town and are under the direction of the Land Officer. As in the other Settlements there is no forest revenue or expenditure properly so called.

Private Forest.

81. The estimated extent of private forest throughout the island is 8,000 acres, and, like the Crown forest, this is widely distributed, and is fast being cleared.

PROVINCE WELLESLEY.

Topographical Features.

82. Province Wellesley is separated from Penang by a narrow strait of from two to ten miles in breadth. The Settlement is forty-five miles in length, including ten miles of newly acquired territory to the south of the Krian river, and about eight miles in breadth; total area about 170,000 acres. The Province is divided into five districts, and the cultivation is chiefly padi and sugarcane.

83. With few exceptions, the whole Province is one vast plain, the principal exception being the Bukit Mertajam hill range, which, situated near the centre of the territory, runs in from the Kedah boundary for a distance of about three miles, and rises to an elevation of 1863 feet above sea-level. Near this range is situated a peculiar circular group of small hills about three miles in diameter, and about the same distance north of these the Ranjau hills occur; they also run in from the Kedah boundary for a distance of about three miles. In the extreme south are situated the Panchor hills, which form a club-shaped range, and are part of the boundary separating the Province from the territory of Kedah. In addition to these only a few isolated hills of little elevation or importance are met with.

84. The Province contains the largest rivers which occur in any of the Settlements, such as the Krian, Junjong, Juru, Prai, and Muda rivers, all of which are navigable for large vessels for many miles, and through which boats may pass to the Kedah boundary, or even further. These rivers traverse the Province from west to east and are distributed with wonderful regularity along its whole length.

85. In the northern half of the Settlement roads are generally good, but in the south their condition is less satisfactory. The total extent of roads may be put down at about 100 miles.

86. The composition of the hill ranges is, with little exception, the same as that of Penang, but the soil which covers them is generally considered to be of a more friable nature. The flat country (and it is mostly flat) is all alluvial deposit, and is said to have been at one time covered by the sea, the action in the tidal current, to which its elevation is due, is still going on. Its coast line receives from the sea annually an increment of mud, and in some places more than others the coast line is gradually being extended. These deposits are sometimes the cause of those peculiar phenomena on the south bank of the Krian River, which I was for some time much puzzled to account for. Looking over the tops of the mangrove trees at this point they seem to be clipped into terraces which descend by gradual steps towards the sea. The tops of the trees of the first, second and third series are all quite level with each other, as if cut over with great care, so as to have the top of each tree on a dead level with its neighbour. The breadth of these terraces may average 80 feet, their height is about six feet. The explanation of this phenomenon is, I presume, given in the fact that the silting up of mud along the outer edge of the swamp is continually going on; but as the seed crop of the trees is only once a year, there is an annual stocking of the new formations of mud with seed which causes about twelve months' difference in the age and height of the trees, and so gives a peculiar terrace-like appearance.

Geology.

87. The good forest remaining may be taken as amounting to about 20,000 acres; and this is to be found in the southern districts near the boundary which separates the Province from the territory of Kedah.

Forests.

88. There is less waste land in the Province than in any of the other Settlements; but I do not include the mangrove swamps, which contain too great a depth of water for the cultivation of rice.

Waste Lands.

RECOMMENDATIONS.

89. From what has been already said it will be obvious that the first important step to be taken towards bringing forest matters in the Settlements to a more satisfactory issue, is to secure the preservation of such forests as are worth retaining, especially such as occupy positions affecting the wood and water-supply. In Singapore no better position can be chosen for a forest reserve than the central ridge or high land which covers the interior of the island, and which contains the sources of all the more important streams, as shewn within the dark line on the annexed map. The growing scarcity of fuel and the exhaustion of the Bakau jungles along the coast, necessitate the formation of a reserve purpose for a permanent supply, and I would propose for this the reserve marked A, which is close to the chief town, and, therefore, to the centre of demand. This land comprises a series of hills and swamps, and is suitable for the growth of every variety of wood used for fuel, as well as of timber trees for general purposes. Included also within its area are more Bakau trees and jungle than can be found anywhere else in the island; wood from this reserve could be moved with facility along the road marked H, as well as by boats along

Singapore.

the coast. Its area would be about 6,000 acres, and it is, I believe, almost entirely Crown land.

90. I have referred to the absence of protection to the streams and water-courses of the island, the result of which is that, after even slight showers, they become discoloured and muddy. Belts of a few feet of thick jungle along their banks would prevent this in a great measure, by keeping back cultivation now carried to the water edge, and by acting as a natural filter for rainfall.

91. In regard to the present condition of the proposed reserves I have to remark that they contain very little timber, and will have to be stocked by artificial planting over the greater portion of their areas, a work that will occupy an active planting staff for some considerable time.

92. The advantages of protecting the spontaneous growth in the formation of forests so exceed those of artificial planting that the latter should only be resorted to when there is no hope of land becoming properly stocked without it. For the proper protection, working and general management of the forests, it is necessary that a small Forest Department be formed, and placed under a trained and responsible officer. Under him there should be a small Forest Police Force, who might be allotted quarters in the numerous police stations close to nearly all the existing and proposed reserves. By this means the cost of erecting quarters for a new force would be reduced to a minimum. A working staff of men employed in active forest operations, such as planting, weeding, felling, &c., and in nursery work, would also be necessary in such numbers as the annual plan of operations calls for. These men would be told off in gangs and would have to be provided with quarters, in the shape of atap-covered sheds costing but little. Over them should be placed overseers, the chief of whom would receive his instructions direct from the executive head of the department.

Malacca.

93. Having already described the condition of the various forest reserves throughout the Settlement of Malacca, I will now detail the particular treatment each should receive to make them useful in the production of timber. At present the reserves require a thorough overhaul, and in most cases re-adjustment, and much depends on the co-operation of the Land Office in putting a stop to exhaustive cultivation, and in preventing reckless destruction.

94. The first of the old reserves which claims attention is the extensive one covering the Jus and Bukit Singgeh districts, the immense area of which is certainly now more of an impediment to progress than an aid to it. Squatters have crept into the reserve in hundreds and have built villages and planted orchards to so great an extent that the southern half contains possibly more fruit trees than forest trees. The swampy land within the reserve boundary is under *padi* cultivation, and, excluding tapioca, there is really little or no difference between the lower half of the reserve and the unreserved country outside. I therefore strongly urge the re-adjustment of the reserve so as to throw the majority of the squatters and their villages outside such portions as it is necessary to retain. My modifications, which are shewn on the Map, will give the Government a reserve of sufficient size and of better timber than they have at present.

95. I have shewn that the Késang forest reserve is compa-

ratively worthless at present, having only a crust of forest around its boundary. To make this a good forest, its interior must be planted with useful young trees artificially. At the same time I would propose adding to it about 2,000 acres on the town side marked M; as this portion contains already some good trees. The position of this reserve is good, and every effort should be made to stock it with the trees most in demand.

96. The reserve at Merlimau contains at present an area of 2,000 acres of good forest, but this is much too small and the reserve should be doubled, and should cover, if possible, the portion marked N, on annexed map; but, if that be impracticable, it should be extended in the direction O and run back as far as the river. Both these portions contain good timber, and one or both should be reserved.

97. The Gading reserve is also comparatively worthless in its present state and position. It should take in Bukit Panchor Hill range, which is covered by forest to some extent, and the spontaneous growth on which should be encouraged as much as possible. Good water is scarce in this district, but, with the re-adjustment of the reserve as mentioned, it is hoped that springs of good water will be created near the foot of the hills, and that the sanitary condition of the district will be thereby improved.

98. The Sungei Siput reserve only requires protection, and I would propose adding to it the land marked V, which contains some good forest, and also that marked J, some of which is at present under tapioca cultivation, but which, looking to the natural configuration of the country, would be better retained under wood, as it contains many hills not shewn on the map. This reserve should be extended over the land marked I, and also for about half a mile over its north boundary to cover some valuable timber in that direction, and in the former to utilize the waste lands which lie on its western boundary, and to give the reserve a better sea-frontage for water carriage of timber.

99. Notwithstanding all that has been accomplished in the way of establishing convenient and useful forest reserves in Malacca, inconvenience is experienced in having to bring timber for the supply of town wants from long distances, but this would be remedied by the presence of a suitable reserve near town. I am of opinion that such a reserve must have existed at one time, and, if so, it must have covered the Bukit Bruang range, as it is scarcely possible that such a favourable and useful position for a reserve could have escaped the Dutch. In any case I would recommend the formation of a town reserve here, as it is only about three miles from the chief town, and covers an area of nearly 2,000 acres or thereabouts. This land appears to have been lately under cultivation, but it is fast becoming re-wooded by the spontaneous growth of young trees, especially over the Hill range which covers its interior. On the more level portions young trees are less numerous and would have to be assisted by planting to some extent to give the forest the necessary compactness and to fully utilize the land.

100. The rivers and principal streams should have a border of forest left along their banks or be planted to a breadth of from 25 to 50 feet according to the size and importance of the streams.

101. Many of the waste lands in Malacca will re-wood them-

selves by spontaneous reproduction if only properly protected, but few will become valuable forest owing to the preponderance of useless species among the growth mentioned, and they will therefore have to be assisted by artificial planting to some extent.

102. I cannot end my remarks upon this Settlement without referring to those valuable products found in its forest, *viz.*, Gaharu and Malacca cane. Gaharu, which is also known as Garu de Malacca, Calumbar, Aloe wood and Agallochum, is the most valuable product of the Malacca forest, and is yielded by at least two distant species of trees, *viz.*, *Aquillaria Malaccensis* and *A. Agallocha*. There is also a tree in Cochin China named *Alcexylon Agallochum* which yields a similar resinous aromatic wood, and which is believed to have been carried from Malacca to Cochin China, or, as some consider, from Cochin China to Malayan territory. Gaharu fetches in the market about \$188 per picul (133½lbs), which, according to the Straits Blue Book for the year 1881, is about thirty-seven times greater than the price paid for a similar quantity of Sandal wood. Gaharu producing trees should therefore find a liberal place in the planting operations of the present and future. Malacca cane, which, like Gaharu trees, is on the verge of extinction in the Settlement, has been hunted down all over the country, and is now only found in small quantities in the district of Nialas, and near Merat Ophir. The modifications I have proposed in the Jus reserve will take in a good many of these canes and so conserve them.

Penang.

103. The topographical features of Penang differ so much from the other Settlements that I have not attempted to show on the annexed map of the island any proposed forest reserves. The first thing that calls for attention in Penang is the proper distribution and regulation of the mountain forest reserves. Some of the hill slopes are very steep, while others again after being so for a certain height lose this character, and grow comparatively flat, causing as it were double table-land, one at a low elevation and the other higher up; other slopes extend from near the interior with considerable steepness to the sea-edge, having no level ground whatever at the bottom. It is not, therefore, possible to lay down any hard and fast rule as to the amount of forest which should be retained on each mountain crest. I think, however, that about one-third of the higher mountain slopes of the island should be kept under jungle. Such reserves once established should be kept clearly demarcated and constantly watched by the Forest Police.

104. Many of the denuded hill tops require to be planted, or sown with seeds in contouring bands, and this is the cheapest and quickest mode of establishing forests, and it can be largely acted upon on Penang Hill.

105. Nothing, however, requires more urgent attention than that portion which acts as the catchment area of the river feeding the town reservoir. The watershed has been allowed to be over-run by cultivation to a deplorable extent; but this must be put a stop to and the cultivators with their pigs and other "barang-barang" turned off. The watershed should be closely re-wooded by the encouragement of spontaneous growth, seed sowing, &c. The same remarks apply to the catchment areas of all important streams which should be kept under dense jungle in order to protect the purity of water. Such streams should also be protected by a belt of reserve jungle along their banks. Should any portions of the watershed be found to have been sold or granted away by the Land

Office, they should be resumed and handed over to the Forest Department.

106. I also recommend the formation of a series of nurseries for the propagation of forest trees.

107. Apart from the consideration of mountain and stream reserves, wood-supply, &c., I must urge that all possible efforts be made to stop the felling operations now going on in the private forests which clothe the hills, and by which the town is surrounded on two sides. If these forests are removed, the temperature of the town will be raised and made drier, and a change for the worse in its sanitary condition will be the result.

108. On the annexed map I have shewn which I consider the best positions for forest reserves under *present circumstances*, and of these Bukit Mertajam, as the most central, the most easy of access, and the nearest to the chief sources of demand, may be looked upon as the most important, though the reserves marked S and V may contain upon the whole more timber. Reserve R is only shewn as occupying a convenient position for the creation of a reserve or plantation. This land is at present under padi cultivation, but I think it should be planted up as timber is scarce in the locality, and its want will be more felt by and bye. To stock these reserves properly, a great deal of planting will be required in addition to what can be done in the way of protection and encouragement of spontaneous growth, but I will not deal with details here.

Province Wellesley.

109. Looking at the position of these reserves, it will be seen that they are approached by rivers which will facilitate transport of timber and other forest produce. The rivers of Province Wellesley are constantly flooded by the tide of the Straits, and it is therefore considered unnecessary to retain a reserve of jungle along their banks, and, as the mountain ranges lie wholly within the reserve boundaries, all consideration of mountain reserve lines are done away with.

110. I also recommend that the road sides in the Province which are bare of trees, and all similar roads in other Settlements, be planted with roadside trees at distances of about thirty feet apart, and with a view to this I give a list of trees suitable for roadside planting—See Appendix B.

111. The greater amount of timber shipped from the Straits of late years has been the produce of the Johor forests, but even there timber has now to be brought from long distances and, according to a statement made by the proprietors of the Johor Steam Saw Mills, it is yearly becoming more difficult to obtain. The reason of this is apparent, when it is considered that according to figures supplied by the Gambier and Pepper Society, there are no less than 4,000 Gambier and Pepper plantations in Johor, and that this number is being constantly added to. Under these circumstances it will be seen that the timber supply from Johor is, like most other sources of supply over which the Government has no control, very precarious.

CONCLUSION.

112. The measures which have been recommended in the foregoing pages may be briefly summarised thus:—

(a.) Preventing the felling of forests and the clearing of forest lands.

(b.) The redemption, by exchange or otherwise, of such land as is selected for planting with forest trees.

(c.) The survey and demarcation of such Crown forest lands as are still undetermined, and the preparation of good and reliable maps shewing the forests and the topographical features of the various lands throughout the Settlements. This is a desideratum that should be looked upon as a first duty of the Survey Department.

(d.) The formation of local forest reserves for the supply of wood for general purposes; and mountain and river reserves for protection where necessary.

(e.) The establishment of a Forest Department to take charge of all Crown Forests whether proclaimed as reserves or otherwise.

(f.) The marking of certain blocks of forest near the chief towns of each Settlement of a sufficient size to serve as reserves for the supply of fuel and small building wood.

(g.) The appointment of a body of Forest Police for protective purposes, to be quartered in the country districts throughout the Settlements.

(h.) The immediate collection of seeds of the best indigenous timber trees, and the formation of nurseries for the propagation of such seeds.

(i.) The introduction of an ordinance for the better conservation of the Crown forests.

113. In order to admit, however, of an immediate commencement being made, and as all great things have small beginnings, I would propose the taking up next year (1884) of a certain area of the denuded land in each Settlement as detailed below, viz.:—

	Area in acres.	Cost of planting operations and addi- tional protection for existing forests.
Singapore	200	\$7,000
Malacca	200	6,000
Penang and Province Wel- lesley	100	7,000
	TOTAL ...	<u>\$20,000</u>

No skilled assistance is considered necessary to aid in carrying out work next year, but as the work will annually gain in importance, the assistance of trained officers will be required later. It is not, I consider, necessary to detail here the particular manner in which the sum above-mentioned will be expended; such details fall more properly under the annual report on working operations.

APPENDIX A.

I.—List of large Indigenous Trees, a few of which are still to be found in Singapore.

Local Name.	Systematic Name.	
Těmběsu	... } Fagræa peregrina	... Used for piles and foundations.
Temūsu	... }	
Damar laut	... Canarium dichotomum	... " Constructive purposes.
Dûrian Bûrong	... Durio oxleyanus	... " Masts for ships.
Merbau	... Afzelia sp.	... " For furniture.
Jelutong	... Dyera costulata	... " Constructive purposes.
Sěnâ	... Pterocarpus indicus	... " "
Bûnut	... Urostigma sp.	... " "
Kayu kûlim	... Scorodocarpus Borneensis	... " "
Kayu kâpor	... Dryobalanops camphora	... " "
Klédang	... Artocarpus sp.	... " "
Berangan	... Castania and Castanopsis	... Not much used.
Changi	... Daphniphylopsis capitata	... Used for constructive purposes.
Kweng	... Dipterocarpus sp.	... Produces wood oil.
Katapang	... Terminalia catappa	... Constructive purposes.
Smarum	... Mimusops indica	... " "
Jambu utan	... Eugenia sp.	... " "
Těrentang	... Castanospermum auriculatum	... " "
Tengau	... Bruguiera parviflora	... " "
Bâlau	...	The best wood for sleepers.
Pětâling	... Strombosia Javanica	... For constructive purposes.
Rěsak	... Vatica Russah?	... " "
Tampinis	... Sæ sideroxylon	... Used for nearly all purposes.

II.—List of small Trees, very few of which now remain in Singapore.

Local Name.	Systematic Name.	
Meranti	... Hopea Meranti and Shorea	Used for constructive purposes.
Serâya	... Shorea sp. and Hopea sp.	do.
Glam Tikus	... Eugenia sp.	Constructive purposes.
Brûas	... Garcinia sp.	do.
Rěngas	... Gluta velutina	Furniture, &c.
Penâga	... Calophyllum inophyllum	Masts and spars of ships.
Kemâning	... Murraya exotic	Used by turners.
Kělat	... Eugenia Zeylanica	Constructive purposes.
Klédang	... Artocarpus sp.	"
Pâsal	... do. echinatus	"
Nîpis Kulit	...	"
Pûlei	... Alstonia scholaris var.	"
Rumania	... Bouea macrophylla	"
Medang Sěrei	... Litsaea lancifolia	"
Srian	... Canariopsis hispida	"
Jambu-Jambu	... Inocarpus edulis	"
Daru-Daru	... Sideroxylon lanceolatum var.	"
Tampang	... Artocarpus rigidus	"
Chěmpedak Ayer	... " varians	"
Mahang Wangi	...	"
Bakau	... Rhizophora mucronata	"
Těngau	... Heritiera littoralis	"
Lěban	...	"
Rambei daun	...	"
Mědang Kunyit	...	"
Mědang Lělin	...	"
Klapa laût	...	"

III.—List of Trees found growing on Hilly ground.

Local Name.	Systematic Name.	
Kayu Kélat	... <i>Eugenia zeylanica</i>	... Rare.
Serâya	... <i>Shorea, Hopea, Vatica, &c.</i>	... do.
Meranti	... <i>Hopea Meranti</i>	... do.
Mërbau	... <i>Afzelia</i> sp.	... do.
Rëngas	... <i>Gluta velutina</i>	... do.
Klédang	... <i>Diospyros fruticosus</i>	... do.
Pâsal	... <i>Artocarpus echinatus</i>	... do.
Changi	... <i>Daphniphylopsis capitata</i>	... do.
Mëdang Sërei	... <i>Litsæa lancifolia</i>	... do.
Kayu Kûlim	... <i>Scorodocarpus Borneensis</i>	... do.
Rësak	... <i>Vatica Russah</i>	... do.
Kemûning	... <i>Murraya exotica</i>	... do.
Kayu Manis	... <i>Cinnamomum</i> of sorts	... do.
Jelutong	... <i>Dyera costulata</i>	... do.
Pûlei	... <i>Alstonia scholaris</i> var.	... do.
Minyak Jantan	... <i>Dipterocarpus</i> sps.	... do.
Brangën	... <i>Castania</i> and <i>Castanopsis</i>	... Common.
Bëlutu	... <i>Randia anisophylla</i>	... do.
	... <i>Artocarpus</i> sps.	...
	... <i>Elæodendron glaucum</i>	... do.
Langut	... <i>Rhodannia trinervis</i>	... Very common.
Tiup-Tiup	... <i>Canarium rufum</i>	... Common, fruit eaten by Chinese.
Damar Utan	... <i>Canarium parvifolium</i>	...
	... <i>Cratoxylon polyanthum</i>	... Very plentiful.
	... <i>Evodia Roxburghiana</i>	... do.
Mapaga ?	... <i>Ixonanthes icosandra</i>	... do.
	... <i>Dillenia scabrella</i>	... Rare.
	... <i>Dillenia indica</i>	... do.
Jëring	... <i>Pithecolobium lobatum</i>	... Common, fruit eaten.
	... <i>Phyllanthus superbus</i>	... Very plentiful.
Nasi-Nasi	... <i>Buccharia sapida</i>	... Common in Malacca.
	... <i>Aperosa lepidostachya</i>	... do.
	... <i>Aperosa</i> sp.	...
	... <i>Vitex pubescens</i>	... Very common.
	... <i>Meliosma lanceolata</i>	... do.
	... <i>Cupania fuscidula</i>	... do.
	... <i>Antidesma pubescens</i>	... do.
Pulut	... <i>Barringtonia racimosa</i>	... Rather rare, cultivated.
Mahang Utan	... <i>Rottleria montana</i>	... Very plentiful.
Makapas	... <i>Xanthophyllum obscurum</i>	... Somewhat rare fruit eaten by
Sënâ	... <i>Xanthophyllum vitellinum</i>	... do. [Chinese.]
Mâta Këli	... <i>Gynotriches axillaris</i>	... Very plentiful.
Merbau Pâsar	... <i>Sindora Siamensis</i>	... Rare.
Blalang	... <i>Pithecolobium angulatum</i>	... Very plentiful.
Mampat	... <i>Hypericaceæ</i> , sp.	... do.
Mërbau Pâsir	... <i>Gironniera celtidifolia</i>	... do.
Simpon	... <i>Kurrimia paniculata</i>	... do.
Katâpang	... <i>Terminalia catappa</i>	... Rare fruit much esteemed by
Mësâwa	... <i>Symplocos pedicellata</i>	... Very common. [natives.]
Mongol	... <i>Gordonia Singaperiana</i>	... Common.
Trentang	... <i>Castanospermum auriculatum</i>	... do. on Bukit Timah.
Mërambong	... <i>Nauclea cadamba</i>	... Rare.
	... <i>Commersonia platyhylla</i>	... Very common near chief town.
Satebal	... <i>Phyllanthus surperba</i>	... do. do. everywhere.
Rando Kapok	... <i>Eriodendron anfractuosum</i>	... Common.
Merapal	... <i>Mæsa</i> sp.	...
Berangan Utan	... <i>Cratoxylon</i> sp.	... Common on hilly ground.
Meranti Utan	... <i>Aromadendron elegans</i>	... Very rare.
Jëlei	... <i>Elaeocarpus</i> sp.	... Several kinds very common.
Gëtah Percha	... <i>Dichopsis gutta</i>	... Very rare.
Bërangan Bâbi	... <i>Quercus</i> sps.	... Very common.

	Bignonia sp.	... Common, leaves eaten.
Médang	... Tetranthera Roxburghii	... Common.
Kayu Darah	... Myristica fatua	... do.
	... " sesquipedale	... Rare.
Bûta	... Euphorbiaceæ sp.	... Common.
Sapetei	... Albizzia sp.	... Rare.
Sâga Laut	... Adenantha bicolor	... Rather rare.
Médang Jâti	... Pithecolobium confertum	... Very rare.
	Dysoxylon binectariferum	... Rare.
Kâyu Arang	... Maba ebenus. Diospyros fruticosus	Common.
	Alstonia macrophylla	... do.
	... " scholaris	... do.
	Pittosporum ferrugineum	... do.
Pênaga Purga	... Adinandra dumosa	... do.
Mahang	... Macaranga hypoleuca	... do.
	Macaranga sp.	... do.

IV.—List of Trees growing in Swampy ground.

Local Name.	Systematic Name.		
Kayu Laut	.....	House posts	... Common as small trees.
Bântangor Batu	Calophyllum	Ship's masts	... Not common.
	lum &	&	
Bântangor	... C. spectabile	... General purposes	... do.
Rambeï	... Pierardia dulcis	... Fruit edible	... Common in a cultivated state only.
Têmûsu	... Fagraea peregrina	... A valuable resinous wood, very durable under-ground.	do. do.
Manggis	... Garcinia mangostana.	The well-known Mangosteen.	do. do.
	Garcinia of sorts	...	
Manis	... Cinnamomum sp.	...	Common.
Kâsîh	... Symplocos sp.	...	do.
	Podocarpus poly-stachya	...	Not common.
Smârum	... Mimusops Indica	... Large tree timber useful for constructive purposes.	do.
Pênaga Purga	.. Adinandra dumosa	... ..	Common.
	Thespesia populnea	... Wood hard & durable, used for cart-wheel, &c.	Common near the sea.
	Elaeocarpus stipularis.	.....	Rather common.
Tampinis	... Sclotia sideroxylon	... Extremely durable, used for beams, piles, &c.	Very rare.
Médang Jâti	... Pithecolobium confertum.	Timber for constructive purposes.	Rare.
Jambu	... Rhodannia trinervia..	.....	Common as small trees.
	Eugenia jambolana	... Wood hard, heavy; bark slightly-astringent.	Common as small trees
	E. acuminatissimum	...	do.
	E. jambosa	...	do.
	E. molucciana	... Valuable timbers.	do.
	E. aquea	...	do.
Kayu Kêlat	... E. zeylanica	... Fruit eaten by Chinese only. Wood said to be durable.	Rather rare.
	Xanthophyllum obscurum.	ob-	

	Xanthophyllum vitellinum.		Rare.
Rumania	... Bouea microphylla	} Yields edible fruits ...	Common in a cultivated state.
	B. macrophylla		do.
Binjei	... Mangifera caesia	... Cultivated for its fruit	
Pulei	... Alstonia scholaris var.	} Yields a Gutta; wood soft & white.	Common.
Gëtah Jelutong	Dyera costulata.		Rare.
	Sterculia foetida	... Wood light.	Exudes gum. Rare.
	Sterculia, sp.	...	.....
Jâwi-jâwi	... Ficus nitida	...	Common.
Buah Pâla	... Myristica fatua	...	Not common.
Do.	M. furfuracea	...	do.
Do.	M. sesquipedale	...	Rare.
Cajeputi or Kâyû Pûteh.	Melaleuca leucodendron.	Yields a valuable oil.	Common in Malacca.
Nam-Nam	... Cynometra cauliflora.	Yields a fruit.	Timber of ordinary quality.

NOTE.—It is to be observed that some trees grow both in marshy and hilly ground. These appear on both lists.

V.—List of Trees found in Salt Water Marshes.

Local Name.	Systematic Name.	
Api-Api	... Lumnitzera coccinea	... Exclusively used for firewood.
Bâkau	... Bruguiera sp.	... do.
do.	Rhizophora mucronata	... do.
Lënggâdei	...	do.
Mërbâtu	...	do. and charcoal.
Merpuan	...	do. do.
Nyëreh Bunga	...	House-building, &c.
Bâru	... Rhizophora conjugata	... Bark used for caulking seams of boats.
	Heritiera littoralis	... Wood tough and durable.

VI.—List of Trees chiefly used as Fuel.

Local Name.	Systematic Name.	
Bâkau	... Bruguiera and Rhizophora.	} Common as small trees in the swamps along the coast.
Lënggâdei	...	
Mërbâtu	...	
Chëndërei	...	
Api-Api	... Lumnitzera coccinea. do alba.	
Cajeputi or Kâyû Pûteh	Melaleuca leucodendron	...

VII.—List of valuable Trees, very few of which still remain in Singapore.

Local Name.	Systematic Name.
Tampinis	... Slætia sideroxydon
Kayu Kulim	... Scorodocarpus Borneensis
Meranti	... Hopea Meranti and Dipterocarpeæ generally.
Tëmûsu	... Fagræa peregrina

Smarum	... Mimusops Indica	...
Medang Serei	... Litsæa lancifolia	...
Klêdang	... Artocarpus sp.	...
Gëtah Jelutong	... Dyera costulata	...
Pënâga	... Calophyllum inophyllum	...
Bëntangor	... Calophyllum spectabile	...
Pâsal	... Artocarpus Ehinatus	...
Kïmyan puteh	... Mabba buxifolia	...
Kayu këlät	... Eugenia Zeylanica	...
Pulei	... Alstonia scholaris var.	...
Klêdang	... Diospyros sp.	...
Jambu-jambu	... Inocarpus edulis	...
Serâya	... Shorea and Hopea	...

VIII.—*List of valuable Indigenous Trees believed to be extinct in the Forests of the Straits Settlements.*

Local Name.	Systematic Name.	
Bâlau	...	I know of no wood so durable as this under all circumstances and that can be used for more general purposes.
Kranji	... Leguminosæ	... Wood close-grained, heavy and durable.
„ hîtam	...	
„ dârah	...	
Kweng or Minyak Jan-tan.	Dipterocarpus sp.	... Yields the kruing oil of commerce, One or two trees observed.
Mëdang lebar daun	...	House posts, &c.
Kayu Laut	...	Used in making masts and spars for vessels, paddles, &c.
Dûrian bûrong	... Durio oxleyanus	...
Kayu chichan	...	
Nangka Pîpit	...	
Bëlian Wangi	...	As beams for house building boat planking, &c.
Mëdang Kunyet	...	
Daru Daru or Dëdâru	Sideroxylon lanceolatum var.	For building purposes; One tree seen.
Chëmpëdak ayer	...	For boat building.
Kayu Kâpor	... Dryobalanopsis camphora	... Do. constructive purposes.
Pëtâling	... Strombosia Javanica	... Wood close-grained of a light colour; used for general purposes.
Rëngas	... Gluta velutina	...
Nîpis Kulit	...	
Merambong	...	
Rambeï Daun	... Dichopsis Gutta	... Yields gutta-percha.
Tëmbësû	...	Used by natives for rafters.

IX.—*List of undergrowth in Singapore.*

Local Name.	Systematic Name.	
Rëmpëdal Ayam	... Holoragis distica	...
	Leea sambucina	... Very common.
Mahang Utan	... Mallotus paniculatus	... do.
	Ardisia paniculata	... do.
	Ardisia solanacea	... do.

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Bixa	...	Bixa orelliana	...	Naturalised.
		Callicarpum longifolium	...	
		Cassia auriculata	...	
		Olea maritima	...	
		Rhodomyrtus tomentosus	...	Common in woods near the sea.
		Uvaria hirsuta	...	
		Uvaria purpurea	...	} Rather rare.
		Uvaria reticulata	...	
		Aglaia odorata	...	
	Nasi-Nasi	...	Sponia Amboinense	...	Very common.
		Ixora congesta	...	do.
		Ixora Griffithii	...	do.
		Gardenia campanulata	...	do.
		Psychotria sp.	...	do.
Julong-Julong	...	Gartneria obesa	...	do.
		Scaveola Koenigii	...	Common in marshy ground.
		Curculigo Sumatrana	...	do. everywhere.
		Pavetta indica	...	
		Thevetia nerifolia	...	Naturalised.
		Dracæna Cantleyii	...	Rather rare.
		Dracæna angustifolia	...	Common in open parts.
		Dianella ensifolia	...	} Common in swamps.
		Callicarpum macrophyllum	...	
		Costus speciosus	...	} Common everywhere.
		Sponia virgata	...	
		Marumia muscosa	...	
		Clerodendron sp.	...	
		Crotolaria striata	...	
		Urania sinuata	...	
		Melastoma malabathricum	...	} In more open places.
		Indigofera sp.	...	
		Tephrosia candida	...	
		Clerodendron velutinum	...	
		Mimosa sepiaria	...	
	Pandanus sp.	...		
	Nipa fruticans	...		
	Freycinetia angustifolia	...		

X.—*List of the more remarkable of the Fern tribe, Singapore.*

Alsophila cymosa.
 Alsophila latibrosa.
 Dicksonia Barmetz.
 Gleichenia dichotoma.
 Gleichenia flagellaris.
 Blechnum orientale.
 Dipteris Horsfieldii.
 Marattia, Lomaria, Angiopteris, &c.

XI.—*List of the more remarkable of the Palm tribe, Straits Settlements.*

Local Name.	Systematic Name.	
Lontar	... Borassus flabelliformis	... The Palmyra palm, not plentiful.
Nibong	... Areca nebung	... Common, near the seashore on west coast.
Klâpa	... Cocos nucifera	... Several curious varieties observed.

	Arenga obtusifolia	...	
	do. saccharifera	...	Sugar palm.
Sâgu	... Sagus lœvis	...	Sago palm, common in marshy ground only.
	do. Rumphii	...	
Daun Daun	... Orania macrocladus	...	
	Caryota urens	...	Toddy palm.
	do. Cummingii	...	Rare.
	do. obtusa	...	do.
	do. sobolifera	...	do.
	Pinanga maculata	...	do.
	Ptychosperma Singaporensis	...	Common.
	do. coccinea	...	Rather rare.
	... Zalacca edulis	...	Common.
	Calamus sp.	...	do.
Malam wâren	... Cyrtostachys Rendah	...	Getting scarce. The most ornamental of all the palms seen.

XII.—List of the chief Creepers, Singapore.

Local Name.	Systematic Name.	
	Entada scandens	... Very plentiful.
Akar	... Fibraea tinctoria	... Root yields a dye, very common.
	... Strobilostema marmorata	... Rare.
	... Strobilostema elegans	... Very common.
Akar Ubi Utan	Vitis Hookeri	... do.
	* Vitis semisagittifolia	... do.
Gêtah Gitan	... Willoughbeia firma	... Common.
Gêtah Hitam	... Willoughbeia Martabanica	... do.
Akar Ara	... Willoughbeia flavescens	... do.
	Vanilla albida (?)	... Rather rare.
	Pothos sps.	... Common.
	* Modecca obtusa	... do.
Rôtan	... Calamus sps.	... do.
	* Cocculus sps.	... do.
	* Passiflora foetida	... do.
	* Passiflora molucciana	... do.
	Melodorum sps.	...
	Hiptage madablota	...
	... * Lygodium scandens	... Everywhere abundant.
	Bignonia Ungua	... do.
	* Tristelletia australasica	... Common in Sérangân district only.
	* Cocculus glaucescens	... Common, fruit eaten, very refreshing.
	Grewia umbellata	... Not common.
	* Hexacentris mysorensis	... Common.
	* Derris elliptica	... do. used for intoxicating fish.
	* Derris thursiflora	... Not very plentiful.
Pîna-Pîna	... Smilax sp.	... do.
	* Convolvulus reptans	... do.
	Hoya pratense	... do.
	Hoya imperialis	... do.
	Hoya lacunosa	... do.
	Hoya carnosâ	... do.
	Strychnos colubrina	... Everywhere abundant.
Gambir	... Uncaria gambir	... do.
	Uncaria ferruginea	... Rather rare.
Kait-Kait	... Uncaria sp.	...
Rêsâm	... * Gleichenia flagellaris	... Common.
	Rhynosperrnum fragrans	... do.

XIII.—*List of Parasites, Singapore.*

Loranthus chrysanthus.
 Do. sphærocarpus.
 Do. tetragonus.
 Do. lepidotus.
 Viscum compressum.
 Do. ramosissimum.
 Ficus, several species.

About 20 more species are said to occur of the first named, among which are Loranthus formosus and Loxanthera speciosa.

XIV.—*List of spontaneous growth on Waste lands, Singapore.*

Cinnamomum platyphylla.
 Rottlera montana.
 Ficus sp.
 Eugenia, several sp.
 Mæsa do.
 Adinandra dumosa.
 Myristica furfuracea.
 Fagræa peregrina.

And as undergrowth the following.

Clerodendron velutinum.
 Melastoma malabathrica.
 Mimosa sepiaria.
 Solanum, several species.

XV.—*List of spontaneous growth on Waste lands, Malacca.*

Rottlera montana.
 Eugenia zeylanica.
 Simplocos lucida.
 Ficus Sps.
 Rhodamnia trinervia.
 Macaranga hypoleuca.
 Do. Sp.
 Artocarpus echinatus.
 Ixonanthes icosandra.
 Alstonia scholaris var.
 Aralia Sp.

And as undergrowth the following.

Melastoma malabathrica.
 Lantana mutabilis.
 Solanum species.

XVI.—List of Exotic Trees, Singapore.

Native Name.	Systematic Name.	Native Country.	
Jâti	... Tectona grandis	... India	... This has grown to a large size in the Colony. Young plants look well.
	Dammara robusta	... Australia	... Very fair progress.
Rain tree	... Inga saman	... S. America	... Grows well.
	Inga dulcis	... India	... Do.
Sênâ	... Pterocarpus indicus	... Do.	... Said to grow in the Peninsula.
Flamboyant	... Poinciana Regia	... Madagascar	... Grows well.
	Casuarina sumatrana	Sumatra	... Do.
Mahogany	... Swietenia Mahogani	... W. Indies	... Very rapid growth, should be planted extensively.
Gum tree	... Eucalyptus piperita E. rostrata	... Australia	... Make fair progress.
Tecoma	... Tecoma leucoxydon	... India	... Looks promising.
Green heart	... Nectandra Rodicœi	... Demerara	... Only lately planted.
Gêtah sundek	... Ficus sp.	... Perak	... }
Para rubber	... Hevea brasiliensis	... America	... } The growth made promises well.
Panama do.	... Castilloa elastica	... Do.	... }
Ceara scrap do.	... Manihot Glaziovi Adenantha p... niana.	... Do. ... Italia	... }
Queensland nut	... Macadami bifolia	Australia	... Grows slowly. Not long introduced.
Nutmeg	... Myristica moschata	... Moluccas	... Cultivated.
Brazil nut	... Bertholletia excelsa	... Brazil	... Grows well. Lately introduced.
Satin wood	... Swietenia chloroxylon	India	... Very fair growth.
Pongam	... Pongamia glabra	... Do.	... Grows well said to be indigenous in Penang.

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APPENDIX B.



I.—*List of valuable Indian Timber Trees recommended for planting in the Straits Settlements.*

Names.	
Chickrassia tabularis	
Pongamia glabra	... Considered native in Penang.
Heritiera macrophylla	
Mesua Coromandelina	
Putranjiva Roxburghii	
Tectona grandis	... Introduced, doing well.
Bassia latifolia	Do.
Bassia longifolia	
Terminalia chebula	
Terminalia arguna	
Terminalia tomentosa	
Albizzia Lebbek	... Introduced, growth satisfactorily.
Albizzia stipulata	
Albizzia amara	
Xylia dolabriformis	... Said to be found in the forests of the Settlements, but I have not met with it.
Hardwickia binata	
Anogeissus acuminata	
Pterocarpus marsupium	
Pterocarpus santalinus	
Dalbergia latifolia	
Dalbergia sissoo	
Soymida febrifuga	
Michelia champaca	
Nauclea cadamba	... Introduced, grows well.
Nauclea parvifolia	Do. do.
Stereospermum chelonoides	... Do. do.
Adenanthera pavoniana	Do. do.
Podocarpus latifolius	Do. do.
Cedrela serrata	
Ougeinia dalbergioides	

II.—*List of Burmese Trees.*

Name.	
Pinus longifolia	
Fraxinus floribunda	
Cedrela Toona	
Afzelia bijuga	... Said to occur in the forests of the Settlements.
Gmelina arborea.	... Introduced.
Schilecheria trijuga	Do.

III.—*List of Valuable Australian Trees.*

Name.	REMARKS.
Castanospermum Australe	... Introduced and doing well.
Casuarina equisetifolia	... Do. do.
Dammara robusta	... Do. do.
Eugenia eucalyptoides	...
Eucalyptus calophylla	... Do. do.

Names.	REMARKS.
Eucalyptus rostrata	...
„ amygdalina	...
„ piperata	...
„ marginata	...
„ corymbosa	...
Pinus australis	...
„ edulis	...
Grevillea robusta	... Introduced.

IV.—*List of African and Mascarene Trees.*

Names.	REMARKS.
Vatica africana	...
V. seychellarum	...
Barringtonia speciosa	...
Diospyros bicolor	...
Imbricaria maxima	...
Stadtmanmia sideroxylon	... Introduced and doing well.
Elæodendron orientale	...
Canarium colophania	...
Sideroxylon grandiflorum	...
Foetida mauritiana	...
Diospyros mauritiana	...
Oldfilaia africana	...
Noronhia Broomiana	...

V.—*List of American trees.*

Swietenia Mahagoni	... Introduced and doing well.
Nectandra Rodiaei	... Do.

VI.—*List of Trees suitable for Road-side planting.*

Ficus religiosa
Pterocarpus indicus
Sterospermum chelonoides
Do. suaveolens
Eugenia densiflora
Lagerstroemia reginae
Ficus nitida
Do. terebrata
Elæodendron Roxburghii
Poinciana regia
Tecoma leucoxylon
Sindora indica
Do. siamensis.
Kurrimia paniculata
Albizzia malacciana
Aromiadendron elegans
Rhus sp—a large tree found in Singapore
Vatica grandiflora
Eugenia—several sps.

APPENDIX C.

List of Birds observed to feed on Forest Fruits.

Large Fruit Pigeon	Carpophasia sylvatica.
Imperial Fruit Pigeon	Carpophasia Cœnea.
Lesser do. do.	Osmobeiron olax.
Java Sparrow	Loxia Ovygiorra.
Bul Bul	Ixos analis.
Tree-fare	Calorris chalybæus.

Bats.

I must not forget the Bat tribe. These nocturnal birds or winged-rats are most destructive to fruits, and are very numerous in the Straits, living more abundantly on the Johor side, whence clouds of them may be seen in the evening proceeding towards Singapore.

Pigs.

The Hog tribe, too, do incalculable mischief. There is, perhaps, no country in the world, in which, looking at the size of the place, so many of these animals are to be found as in this Colony. Every little jungle swarms with them. They eat everything, but show a decided preference for acorns, which fall in great plenty from the numerous varieties of Oaks (Querous) with which the forests abound. The Malays name these nuts "*Barangan Bâbi*," or pigs' nuts.

Deer.

Local Name.	Zoological Name.	
Rusa	... Rusa Tunjuc	... Common Java Deer.
Sambur	... Sambulo rufus	... Of large size.
Kangil or Plandok	... Moschus Javanicus	... The Napu Musk Deer.

The two first named do much harm to young trees at the season when they shed their horns, to get rid of which they rub them against stout saplings and destroy the bark, but deer are not sufficiently numerous on the island to be reckoned among forest exterminators.

Monkeys.

Local Name.	Zoological Name.	
Brök	... Cynocephalus	... Large Grey Monkey.
Monyet	... Macacus Cynomologos	... Small do. do.
Lotong	... Macacus	... Do. Black do.

Squirrels.

Local Name.	Zoological Name.
Small Brown Squirrel	... Tamias Lysteri.
Large two-coloured do.	... Sinrus bicolor.
Do. Yellow do.	... (?)

APPENDIX D.

Comparative Annual Abstract of Rainfall for the years 1869 to 1881—SINGAPORE.

MONTHS.	MEAN REGISTERED RAINFALL.														REMARKS.
	1869	1870	1871	1872	1873	1874	1875	1876	1877	1878	Mean of 10 years.	1879	1880	1881	
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
January	3.93	18.25	11.05	2.37	7.16	3.88	2.91	3.97	2.89	13.57	7.00	18.17	5.17	13.35	Rainfall was registered at
February	3.23	7.80	7.69	7.72	9.57	2.34	7.02	1.84	5.74	7.29	6.02	9.16	9.36	2.00	During the year 1869 1 Station.
March	3.37	3.15	12.95	3.43	9.74	3.20	16.92	4.60	5.01	7	6.45	9.80	8.46	9.03	do. 1870 1 do.
April	9.23	8.81	4.85	4.15	10.54	6.54	6.47	7.23	1.37	8.0	6.72	6.60	11.12	5.20	do. 1871 4 S'tions.
May	9.19	5.01	3.96	5.12	5.50	5.78	4.09	7.86	4.05	11.59	6.21	10.85	8.88	9.39	do. 1872 5 do.
June	6.81	11.51	4.59	4.89	4.81	6.37	9.53	10.58	11.47	4.07	7.46	7.07	6.81	4.03	do. 1873 5 do.
July	5.43	5.11	12.42	6.43	3.55	6.32	4.26	4.46	5.70	6.33	6.00	5.53	9.83	6.34	do. 1874 6 do.
August	12.31	11.36	6.69	7.12	6.08	10.58	8.36	9.32	4.00	19.33	9.52	8.94	9.75	5.77	do. 1875 8 do.
September	3.13	12.62	8.97	10.79	3.00	11.02	8.24	7.19	2.74	5.01	7.27	5.54	7.19	5.51	do. 1876 7 do.
October	5.11	9.99	12.36	5.74	7.93	7.09	8.29	10.67	2.09	7.38	7.67	14.96	9.95	10.54	do. 1877 7 do.
November	8.24	11.50	11.36	11.54	12.56	16.37	11.37	12.06	5.24	8.47	10.87	8.37	15.81	9.47	do. 1878 7 do.
December	20.66	18.13	12.56	6.00	5.16	7.56	6.50	10.13	8.07	9.91	10.47	10.14	8.56	13.32	
TOTAL	90.63	123.24	109.45	75.30	85.60	87.05	93.96	89.91	58.37	103.16	91.66	116.13	110.89	93.95	
	5.61	6.25	4.20	3.10	4.40	4.15	4.25	5.16	5.20	5.40					
Greatest Rainfall in 24 hours.	31st Augt.	26th Dec.	8th Jan.	12th Sept.	21st May	28th Nov.	26th Oct.	26th May	16th June.	27th Augt.					

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09/02

Annual Abstract of Meteorological Observations for the year 1876—SINGAPORE.

MONTHS.	BAROMETRICAL READINGS CORRECTED AND REDUCED TO 32° F.					THERMOMETERS.								HYGROMETRICAL RESULTS.			SELF-REGISTERING THERMOMETER.						REMARKS.
	9 A.M.	3 P.M.	9 P.M.	Diurnal range.	Means.	9 A.M.		3 P.M.		9 P.M.		Means.		Mean temperature of dew point.	Mean elastic force of vapour.	Mean degree of humidity saturation and = 100.	Maximum in Sun's rays (in vacuo.)	Minimum on grass.	Maximum in shade.	Minimum in shade.	Diurnal range.	Approximate temperature.	
						Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.										
	Inches.	Inches.	Inches.	Inches.	Inches.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	Inches	° F.	° F.	° F.	° F.	° F.	° F.	° F.	
January...	29.930	29.826	29.928	.110	29.895	80.2	75.7	82.4	76.2	75.3	73.8	79.3	75.2	74.4	0.796	79.8	147.7	63.4	85.3	71.6	13.7	78.4	
February..	.939	.834	.925	.106	.899	80.6	75.8	84.2	76.9	76.2	74.2	83.3	76.6	72.4	.796	76.8	150.	66.3	87.7	71.	16.7	79.8	
March ...	.937	.816	.911	.122	.888	82.2	77.2	84.4	78.1	76.7	75.4	81.1	76.9	74.	.840	79.2	150.	68.1	87.6	72.6	15.	80.1
April ...	.883	.773	.865	.111	.840	83.6	78.4	85.	78.9	77.9	76.8	82.2	79.	75.2	.874	79.2	150.	70.9	88.	74.2	13.8	81.1
May ...	.909	.804	.893	.109	.869	83.9	79.3	86.1	79.8	79.2	77.5	83.1	79.9	76.1	.900	79.2	154.	72.	88.4	75.	13.4	81.7
June ...	.913	.822	.908	.098	.881	81.9	77.7	84.8	77.9	79.1	76.9	81.9	75.5	74.5	.854	78.9	144.	71.3	86.6	73.8	12.8	80.2
July ....	.919	.839	.913	.085	.890	82.4	78.	84.7	78.8	80.	77.3	82.	78.	75.	.868	78.4	145.	72.2	86.6	75.3	11.3	80.9
August ...	.911	.829	.917	.093	.886	82.4	77.6	82.5	77.1	78.6	76.2	81.2	77.	74.2	.846	79.2	148.	71.6	86.	74.6	11.4	80.3
September	.937	.836	.928	.107	.900	81.5	77.3	84.6	78.2	78.6	76.5	81.6	77.3	74.4	.851	79.1	151.	69.9	86.5	73.4	13.1	79.9	
October ...	.934	.839	.942	.109	.908	81.3	77.	83.8	77.4	77.5	75.9	80.9	76.8	74.	.840	80.	149.9	70.	86.2	73.2	13.	79.7
November.	.923	.829	.900	.097	.851	80.1	76.8	82.9	77.5	76.7	75.5	80.1	76.6	74.2	.846	82.6	148.7	71.1	85.2	73.2	12.	79.2	
December.	.947	.859	.923	.089	.910	80.	75.7	81.1	75.9	75.6	74.3	78.9	75.3	72.8	.807	81.	148.	69.8	84.9	71.7	13.2	78.3	
MEAN ...	29.924	29.825	29.913	0.103	29.845	81.7	77.2	83.9	77.7	77.6	75.8	81.1	76.9	74.1	0.843	79.4	148.8	70.2	86.6	73.3	13.3	79.9	

Highest reading of Barometer during the year ... 30.029 inches. | Highest Temperature observed 91°
 Lowest do. do. 29.711 do. | Lowest do. do. 66°
 Greatest Rainfall in 24 hours516 do.

19/08

Annual Abstract of Meteorological Observations for the year 1881, Lat. 2.°10, Long. 102.°14—SINGAPORE.

MONTHS.	BAROMETRICAL READINGS CORRECTED AND REDUCED TO 32° F.					HYGROMETER.								SELF-REGISTERING THERMOMETER.							MEAN DIRECTION OF THE WIND.	
	9 A.M.	3 P.M.	9 P.M.	Diurnal range.	Means.	9 A.M.		3 P.M.		9 P.M.		Means.		Maximum in sun's rays (in vacuo).	Maximum in sun's rays (exposed).	Minimum on grass.	Maximum in shade.	Maximum in shade.	Diurnal range.	Approximate temperature.		Rainfall in 24 hours.
						Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.									
	In.	In.	In.	In.	In.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	In.	
January	29.981	29.909	30.080	0.171	29.990	79.4	76.6	76.	76.	78.8	76.6	77.4	76.4	15	...	68.4	82.0	72.	10.	77.	4.02	North.
February	.846	30.052	30.010	.206	.966	81.4	70.2	84.4	80.4	80.	74.4	82.2	75.	143.4	...	70.6	85.2	73.8	11.4	79.5	2.29	N. N. East.
March	.885	29.845	29.869	.116	.833	81.6	77.2	83.4	73.6	81.	79.2	82.	78.4	146.	...	70.6	85.4	71.2	14.2	78.4	2.54	S. East.
April	.913	.963	.853	.110	.909	84.2	80.	85.8	81.	82.8	78.	84.2	79.4	152.	...	69.4	87.2	75.8	10.4	81.6	3.26	Southerly.
May	.920	.743	.755	.177	.806	86.4	80.	85.8	81.8	82.4	78.8	84.8	80.2	152.	...	61.	85.2	75.8	9.4	80.	8.43	Do.
June	.979	.730	.745	.249	.818	84.	78.	86.	80.8	83.	79.8	84.2	79.6	151.	...	64.	85.	78.	7.	81.2	7.91	S. West.
July	.749	.742	.750	.018	.744	83.	78.6	86.	80.8	83.	82.	84.	80.4	157.	...	79.	88.	75.	13.	81.2	5.18	Do.
August	.786	.759	.742	.044	.762	83.2	80.	85.4	81.4	82.6	77.8	83.8	79.8	157.	...	68.	88.4	75.5	13.	82.	8.06	N. N. West.
September	.992	.789	.857	.203	.879	81.	79.4	83.8	81.	79.8	79.	81.6	79.8	157.	...	74.	86.	79.	7.	82.2	18.25	Do.
October	.860	.769	.859	.091	.829	80.6	78.2	83.	80.	79.8	78.	81.2	78.8	156.	...	71.	81.	74.	11.	72.2	17.94	N. East.
November	.872	.808	.882	.094	.854	79.8	79.	81.6	79.	78.	77.	79.8	78.6	156.	...	75.	85.	74.	11.	79.	11.68	Do.
December	.933	.748	.938	.005	.973	80.	71.	82.	76.8	79.	77.	80.	75.0	150.	...	71.	81.	71.6	9.4	71.	13.67	Do.
MEANS	29.897	29.988	29.866	0.124	29.905	82.	77.4	83.6	79.8	80.2	78.2	82.8	77.6	151.2	...	70.2	84.9	82.9	10.6	78.8	...	

Highest reading of Barometer during the year	30.080	Highest Temperature observed	88.°4	Total... 103.23
Lowest ditto	29.742	Lowest ditto	71.°2	

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Table shewing the number of Rainy days according to the Register noted below.

MONTHS.	REGISTERED AT THE CRIMINAL PRISON, SINGAPORE.												AVERAGE.
	1869	1870	1871	1872	1873	1874	1875	1876	1877	1878	1879	1880	
January ...	12	24	19	6	18	16	9	11	4	21	24	15	15
February ...	12	21	21	20	18	10	13	7	10	13	14	13	14
March ...	8	14	22	11	18	15	22	9	9	5	15	16	14
April ...	16	17	8	13	18	12	16	11	7	13	13	15	13
May ...	16	10	14	12	14	13	16	10	10	17	15	13	13
June ...	11	17	13	16	13	10	14	17	12	8	8	12	12
July ...	13	11	19	17	11	16	9	7	13	12	10	13	13
August ...	18	17	20	14	13	15	14	11	6	16	13	15	14
September ...	12	18	20	17	11	14	12	14	2	7	11	18	13
October ...	15	17	20	19	22	12	14	16	8	11	18	14	16
November ...	21	25	20	23	23	22	18	12	17	16	19	20	20
December ...	26	18	16	18	20	17	15	15	16	18	16	18	18
TOTAL ...	180	209	212	186	199	172	172	146	109	161	75	179	175

Smallest number in any year, 109 days in 1877.
 Greatest do. 212 „ 1871.

Table shewing the number of Rainy days from 1864 to 1880, as recorded by A. Knight, Esq., at Mount Pleasant, Thompson Road, Singapore.

MONTHS.	1864	1865	1866	1867	1868	1869	1870	1871	1872	1873	1874	1875	1876	1877	1878	1879	1880	AVERAGE.
Jany.	19	14	21	15	15	15	25	24	4	16	19	11	14	7	22	28	21	17
Feb.	2	12	17	19	9	12	25	21	17	19	15	14	7	20	18	17	14	15
March	12	9	14	8	13	15	17	26	11	19	20	24	18	14	6	25	18	16
April	11	22	17	22	22	22	18	15	16	20	21	21	15	5	22	18	16	18
May	13	15	19	12	16	24	12	14	13	14	18	17	17	15	22	20	20	17
June	13	15	9	15	11	14	20	18	20	13	16	13	17	13	20	15	18	15
July	16	16	17	19	24	13	9	20	19	13	20	9	12	10	15	20	13	16
Aug.	16	22	18	11	15	20	19	20	20	15	19	15	14	9	21	21	18	17
Sept.	17	13	11	18	14	15	24	21	13	7	16	13	16	7	13	13	20	15
Oct.	24	20	18	25	17	15	15	18	27	18	18	23	22	8	14	27	15	19
Nov.	25	19	22	24	26	26	27	23	27	22	25	24	23	15	18	19	24	23
Dec.	24	24	11	21	26	29	21	18	19	23	23	19	25	21	24	21	20	21
TOTAL	192	201	194	209	208	220	232	238	211	199	227	203	200	144	215	244	217	209

Smallest number in any year, 144 days in 1877.
 Greatest do. 244 „ 1879.

Annual Abstract of Meteorological Observations for the year 1881—PENANG.

MONTHS.	BAROMETRICAL READINGS CORRECTED AND REDUCED TO 32° F.				HYGROMETERS.								SELF-REGISTERING THERMOMETERS.						REMARKS			
	9	3	9	Means.	9 A. M.		3 P. M.		9 P. M.		Means.		Maximum in Sun's rays.	Minimum on grass.	Maximum in Shade.	Maximum in Shade.	Diurnal Range.	Approximate Temperature.		Rainfall during the month.		
	A. M.	P. M.	P. M.		Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.										
January	30.032	29.987	30.030	30.016	81.1	78.1	86.2	79.2	79.4	77.5	82.2	78.2	156.2	65.8	89.5	73.1	16.4	81.3	1.22			
February	30.032	29.970	30.030	30.010	83.1	79.6	86.9	80.6	80.9	79.0	83.6	79.7	158.8	65.8	92.9	75.0	17.9	83.9	2.09			
March	29.994	29.900	30.035	29.976	83.7	80.1	87.0	82.2	81.1	79.0	83.9	80.0	159.6	63.5	92.7	75.1	17.6	83.9	5.44			
April	30.011	29.934	30.032	29.992	84.0	80.7	87.4	82.8	80.5	78.5	83.9	80.6	159.9	65.5	91.4	78.1	13.3	84.7	8.97			
May	29.978	29.948	29.980	29.968	82.7	80.3	86.2	83.6	79.2	77.3	82.7	80.4	152.0	...	90.7	79.6	11.1	85.1	9.03			
June	29.974	29.934	29.994	29.967	84.3	82.0	86.4	83.8	80.7	78.3	83.8	81.3	147.9	...	89.5	77.0	12.5	83.2	4.85			
July	29.968	29.914	30.025	29.969	83.0	80.0	85.7	80.8	80.8	78.5	83.1	79.7	148.1	...	89.1	75.4	13.7	82.2	9.63			
August	29.957	29.895	29.970	29.940	83.0	80.8	85.8	83.3	80.0	77.9	82.9	80.6	155.8	...	89.2	75.1	14.1	82.1	5.44			
September	29.965	29.931	30.014	29.970	83.0	80.6	84.6	82.2	80.5	77.9	82.7	80.2	146.6	...	87.3	75.3	12.0	81.3	14.57			
October	30.003	29.928	30.024	29.985	82.3	79.7	84.4	81.8	80.5	77.2	82.4	79.5	144.8	...	87.1	74.4	12.7	80.7	21.54			
November	29.901	29.887	30.000	29.929	83.6	81.2	86.3	82.9	80.8	78.0	83.5	80.7	154.1	...	89.1	74.4	14.7	81.7	9.36			
December	29.941	29.903	30.014	29.952	83.7	80.9	85.7	82.6	80.3	77.3	83.2	80.2	147.2	...	89.3	74.1	15.2	81.7	9.46			
MEANS			30.012		83.1	80.3	86.0	82.1	80.3	78.0	83.1	80.1	152.3	65.1	89.8	75.5	14.2	82.6				
																		TOTAL	...	101.60		

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Comparative Annual Abstract of Meteorological Observations for the years 1869, 1870, 1871, 1872, 1873, 1874 and 1875—SINGAPORE.
Lat. 1° 17' N.—Long. 103° 51' E.

MONTHS.	BAROMETRICAL READINGS CORRECTED AND REDUCED TO 32° F.							MEAN READINGS.																											
								MAXIMUM THERMOMETER IN THE SHADE.							MINIMUM THERMOMETER IN THE SHADE.							DAILY RANGE.													
	1869	1870	1871	1872	1873	1874	1875	1869	1870	1871	1872	1873	1874	1875	1869	1870	1871	1872	1873	1874	1875	1869	1870	1871	1872	1873	1874	1875							
In.	In.	In.	In.	In.	In.	In.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.							
January	29.922	29.779	...	29.869	29.831	29.934	29.889	84.8	84.1	84.3	86.1	85.6	84.2	85.7	72.4	71.9	71.4	71.7	71.3	71.3	71.3	12.4	12.2	12.9	14.4	14.3	12.9	14.4							
February ... ..	.912	.814	...	.850	.845	.904	.893	88.3	83.9	86.0	84.5	85.2	86.2	85.7	73.9	72.5	72.6	71.7	71.6	70.6	70.1	14.4	11.4	13.4	12.8	13.6	15.6	15.6				
March ... ..	.867	.802	...	.853	.832	.847	.902	89.2	87.1	85.6	87.3	87.1	88.0	85.8	74.6	73.0	72.6	72.0	72.3	71.4	72.0	14.6	14.1	13.0	15.3	14.8	16.6	13.8				
April ... ..	.862	.777	...	.799	.806	.864	.852	87.3	87.9	88.5	87.6	87.1	89.9	87.9	75.6	74.6	74.0	74.3	72.8	72.5	73.6	11.7	13.3	14.5	13.3	14.3	17.4	13.6				
May ... ..	.804	.778	...	.816	.786	.843	.846	88.0	87.8	88.6	88.6	88.7	87.3	85.5	75.9	74.6	74.5	74.6	74.4	74.0	72.3	12.1	13.2	14.1	14.0	14.3	13.8	14.2				
June ... ..	.806	.796	...	.796	.807	.848	.866	87.1	85.8	87.0	87.1	88.3	86.0	86.0	76.8	74.1	74.3	74.9	75.7	75.0	72.8	10.3	11.7	12.7	12.2	12.6	12.5	13.2				
July ... ..	.818	.803	29.842	.818	.820	.850	.871	86.9	86.9	84.5	86.5	86.9	85.9	86.4	76.1	74.3	73.1	74.4	76.1	73.1	73.3	10.8	12.6	11.4	12.1	10.8	12.8	13.1						
August ... ..	.828	.759	.836	.818	.828	.879	.891	84.7	85.7	85.8	85.6	86.1	85.3	86.2	74.4	74.0	74.0	74.7	75.5	73.6	73.5	10.3	11.7	11.8	10.9	10.6	11.7	12.7						
September ... ..	.846	.824	.833	.834	.847	.879	.903	87.4	85.8	85.4	86.4	87.8	85.5	87.2	74.8	73.7	73.7	73.0	75.6	73.2	73.5	12.6	12.1	11.7	13.4	12.2	12.3	13.7						
October ... ..	.833	.826	.824	.824	.133	.882	.882	87.0	86.4	85.8	86.9	86.2	85.7	86.4	74.6	73.1	73.8	73.4	74.8	73.0	73.1	12.4	13.3	12.0	13.5	11.4	12.7	13.3						
November ... ..	.836	.830	.820	.789	.864	.905	.914	84.5	86.2	85.2	86.5	84.8	84.9	86.1	73.2	73.6	73.1	73.3	74.1	73.0	72.7	11.3	12.6	12.1	13.2	10.7	11.9	13.4						
December ... ..	.816	.841	.860	.810	.850	.916	.896	84.6	83.8	84.6	85.5	85.1	84.6	83.6	73.3	72.1	72.0	72.5	72.9	71.3	71.7	11.3	11.7	12.6	13.0	12.2	13.3	11.9						
MEANS	29.846	29.802	29.836	29.824	29.829	29.879	29.884	86.6	85.9	85.9	86.5	86.6	86.3	86.0	74.6	73.5	73.2	73.4	74.0	72.7	72.5	12.0	12.4	12.7	13.1	12.6	13.6	13.5							

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27/08

Comparative Annual Abstract of Meteorological Observations for the years 1869, 1870, 1871, 1872, 1873, 1874 and 1875—SINGAPORE.
Lat. 1° 17' N.—Long. 103° 51' E.—Concluded.

MONTHS.	MEAN READINGS.							RAINFALL.						
	APPROXIMATE TEMPERATURE.							MEAN RAINFALL.						
	1869	1870	1871	1872	1873	1874	1875	1869	1870	1871	1872	1873	1874	1875
	°F.	°F.	°F.	°F.	°F.	°F.	°F.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
January ...	78.6	78.0	77.8	78.9	78.4	77.7	78.5	3.93	18.25	11.05	2.37	3.88	2.91	
February ...	81.1	78.2	79.3	78.1	78.4	78.4	77.9	8.23	7.80	7.69	7.72	9.57	7.02	
March ...	81.9	80.0	79.1	79.6	79.7	79.7	78.9	3.37	3.15	12.95	3.43	9.74	16.92	
April ...	81.4	81.2	81.2	80.9	79.9	81.2	80.4	9.23	8.81	4.85	4.15	10.54	6.47	
May ...	81.9	81.2	81.5	81.6	81.5	80.6	79.4	9.19	5.01	3.96	5.12	5.50	4.09	
June ...	81.9	79.9	80.6	81.0	82.0	81.2	79.4	6.81	11.51	4.59	4.89	4.81	9.53	
July ...	81.5	80.6	78.8	80.4	81.5	79.5	79.8	5.42	5.11	12.42	6.43	3.55	4.26	
August ...	79.5	79.8	79.9	80.1	80.8	79.4	79.8	12.31	11.36	6.69	7.12	6.08	8.36	
September ...	88.1	79.7	79.5	79.7	81.7	79.3	80.3	3.13	12.62	8.97	10.79	3.00	8.24	
October ...	80.8	79.7	79.8	80.1	80.5	79.3	79.7	5.11	9.99	12.36	5.74	7.93	8.29	
November ...	78.8	79.9	79.1	79.9	79.4	78.9	79.4	8.24	11.50	11.36	11.54	12.56	11.37	
Décember ...	78.9	77.9	78.3	79.0	79.0	78.0	77.6	20.66	18.13	12.56	6.00	5.16	6.50	
MEANS ...	80.6	79.7	79.5	79.9	80.3	79.5	79.3	7.55	10.27	9.12	6.27	7.13	7.83	
								TOTAL...	90.63	123.24	109.45	75.30	85.60	93.96

Year	Highest reading of Barometer—in.	Lowest reading of Barometer—in.	Highest Temperature.	Lowest Temperature.	Greatest Rainfall in 24 hours—in.
1869	30.017	29.664	92°	69°	5.61 on the 31st Augt.
1870	29.983	29.611	93°	69°	6.25 on the 26th Dec.
1871	29.973	29.684	91°5	69°	4.20 on the 8th Jany.
1872	29.985	29.645	92°	67°	3.10 on the 12th Sept.
1873	29.991	29.629	92°5	68°5	4.08 on the 21st May.
1874	30.065	29.700	91°5	65°	4°15 on the 26th Nov.
1875	30.010	29.706	90°5	66°	4.25 on the 26th Oct.

APPENDIX E.

Report by the Colonial Engineer on the Timber Forests in the Malayan Peninsula.

COLONIAL ENGINEER'S OFFICE,

Singapore, 21st June, 1879.

SIR,—In obedience to the instructions of Government communicated in your letter, Colonial Secretary, ³⁶¹⁰/₇₉, of the 16th May last, I have now the honor to transmit a Return (marked A) of the principal forest trees, indigenous to the Straits Settlements and Native States of the Malayan Peninsula.

The preparation of this Return has unavoidably taken some time, owing to the limited amount of data at my disposal, but with the assistance of Mr. Bayliss and Officers of the Works Department, and Captain Douglas, H. B. M.'s Resident at Selangor, and others, together with a reference to Colonel Low's dissertation, and the result of experiments made by this Department in the various woods in the Settlement, some valuable information has been got together in the Return, though it is as yet, I am aware, far from being as complete as could be desired. The botanical names of the trees have been for the most part entered by Mr. Murton, Superintendent of the Botanical Gardens.

When the densely wooded forests of the Peninsula are opened up, and this is now taking place by the advent of planters from Ceylon, we shall then doubtless become acquainted with much valuable timber which, like the 'Jelutong,' will be found useful for exportation to India, the Mauritius, and other places less favored.

On the further points regarding which the Right Hon'ble the Secretary of State has requested information, I have deemed it better to throw the whole into a series of answers to the questions put, which will be found in Return B.

I have, &c.,

J. F. A. McNAIR, Major, R. A.,
Colonial Engineer and Surveyor-General,
Straits Settlements.

To The Hon'ble

The Colonial Secretary.

Copy of Colonial Engineer's Minute on Survey, ⁴⁰⁵⁵/₇₈, dated 27th August, 1878.

His Excellency refers to the question of our rainfall, and the relation that it bears to the retention or otherwise of our forest land. This is a point of so much general interest that I may be pardoned if I suggest that if it be taken up by the Principal Civil Medical Officer, who now possesses some very valuable meteorological records, which can be further supplemented from data at the disposal of the Municipal Commissioners.

Briefly, one would say that we depend for our supply almost entirely from the ocean, and a preponderance of winds across it at a certain temperature gives us an additional allowance as at present; we get little or nothing from re-evaporation.

The distribution of rain depends a good deal on position, height, direction of mountain ranges and the like, and if there happens to be great condensation at a particular point, then the winds come to it from every quarter.

In looking at some tables taken thirty years ago, I find that our average rainfall has not in any way diminished, though the land has been largely denuded of forest.

There is, however, one method by which we may sustain a loss by permitting the indiscriminate felling of our jungle trees on hill tops, I allude to that by evaporation; and it is perhaps to this that His Excellency more refers. Doubtless if the land is laid bare to the full power of a tropical sun, evaporation will go on at an enormous rate, and this would be an appreciable factor in a climate such as ours. In this view it might seem to His Excellency advisable to reserve the hill of Bukit Timah, and a considerable distance round its base as a "Crown" reserve absolutely.

J. F. A. McNAIR.

A.

Native Name.	Botanical Name.	Uses.	Soil in which they thrive.	Height	Girih.	Whether of rapid growth.	Weight per cubic foot.	Value per cubic foot.	Abundant or otherwise.	REMARKS.
Damar Laut	Not known.	Beams for house building.	Hilly ground, light clayey soil.	80 to 100 ft.	6 to 12 ft.	Slow ...	70 lbs. ...	35 to 50 cents.	Scarce in Singapore and Malacca, but is brought into Penang from the Native States in fair quantity.	Damar Laut is a very resinous close-grained, heavy and durable wood much used in Penang for building purposes; next to Tampinis is the best wood in the Straits Settlements for beams.
Temsu ...	<i>Fagraea peregrina.</i>	Piles of bridges and bridge building generally, sometimes used for tapioca barrels.	Marshy, or light soil on low ground with clay.	80 to 100 ft.	4 to 10 ft.	Very slow.	75 lbs. ...	35 to 50 cents.	Very scarce in Singapore and Penang, but at Malacca it is more readily obtained.	Temsu is a very resinous wood, very durable, but not much used, it has a strong acid smell. Breaking weight of a specimen 2' x 1' x 1", 4 cwts. 28 lbs.
Tampinis ...	<i>Artocarpus</i> sp.	Beams for house building and piles.	Hills, and light clayey soil.	100 to 120 ft.	5 to 10 ft.	Slow ...	67 lbs. ...	40 to 60 cents.	Very scarce now in Singapore and Penang, but is obtained at Malacca.	Hard and durable, is of a light reddish colour becomes very dark with age, used for bridges and Telegraph posts, or for any use where constant exposure to weather is necessary; is liable to warp and twist in seasoning, sinks in water. Breaking weight of a specimen 2' x 1' x 1', 6 cwts. 56 lbs.
Meranti ...	<i>Hopea Cernua</i> & <i>H. Meranti.</i>	House building, and boat building purposes as planks.	On the plains and in light soils and on river banks.	100 to 200 ft.	6 to 10 ft.	Rapid ...	38 lbs. ...	25 to 40 cents.	Getting scarce ...	Very useful for house building, planks 3 feet broad can be obtained; it is also good for boat building, floats in water, yields a gum.

Chengei ...	Not known.	Ship and boat building.	Sandy grounds	100 to 200 ft.	18 to 25 ft. circumference.	Rather slow.	70 lbs.	30 to 56 cts.	Scarce ...	Very useful for ship and boat building stands the salt water well, fracture rather short.
Medang Lê-bar-daun.	Do.	House building, chiefly for floor-boards.	Plains, sandy and light soil.	100 to 180 ft.	10 to 20 ft.	Rapid ...	40 lbs.	30 to 50 cts.	Getting scarce ...	Fracture fibrous, white colour, large spars may be obtained. Breaking weight of a specimen 2' x 1" x 1", 4 cwts. 60 lbs.
Glam Tikus	Do.	House building...	On the plains, light and sandy soil.	80 to 100 ft.	7 to 10 ft.	Middling	Not ascertained.	Not ascertained.	Not very plentiful..	This is a middle sized tree, colour brownish yellow, its red bark is much used for tanning, fishing netts, fracture, strong and fibrous. The wood is not prized, liable to dry rot. Breaking weight of a specimen 2' x 1" x 1", 6 cwts. 7 lbs.
Dungûn ...	Do.	In stockades the planks are used as a defence against musketry by the Malays.	Banks of rivers and near the sea-shore.	100 to 200 ft.	10 to 20 ft.	Rather slow.	Do.	Do.	Plentiful, but none in the market.	Colour dark-brown. timber crooked and tough, not very liable to dry rot. Breaking weight of a specimen 2' 1" x 1", 6 cwts. 28 lbs.
Kayu Laut...	Do.	Used for house posts.	Grows in brackish water.	80 to 150 ft.	7 to 15 ft.	Slow ...	Do.	Do.	Do.	Colour yellowish, lasts five or six years when exposed. Breaking weight of a specimen 2' x 1" x 1", 3 cwts.
Api-Api ...	Do.	Very good firewood.	Marshy grounds.	50 to 80 ft.	3 to 9 ft.	Rapid ...	Do.	Do.	Plentiful, but seldom brought to market.	Is very good for firewood, grows to a good size, colour white. Breaking weight of a specimen 2' x 1" x 1", 3 cwts.
Bruas ...	Bruguiera sp.	Used for house building, by natives for making oars.	Marshy ground.	30 to 50 ft.	2 to 5 ft.	Slow ...	Not ascertained.	Not ascertained.	Moderately plentiful.	Moderately sized tree, the wood sinks in water. Breaking weight of a specimen 2' by 1" by 1", 6 cwts. 22 lbs.

Durian Durian bu- rong.	Duno Zibe- thinus D. Oxleya- nus.	Excellent masts and spars for vessels.	On the plains and light and sandy soils.	80 to 120 ft.	4 to 8 ft.	Do.	Do.	Do.	Very scarce	The spars and masts of this wood are excellent. Breaking weight of a specimen 2' by 1" by 1", 3 cwts. 21 lbs.
Re ng a s (Red wood)	Gluta velu- tina.	For furniture...	Clayey soil ...	80 to 100 ft.	Do.	Do.	Do.	Do.	Plentiful	Prettily veined, and takes a good polish.
Petaling ...	Strombosia	House building, for rafters and flooring joists.	Plains and un- dulating land in light soil.	Do.	6 feet.	Rather slow.	56 lbs.	Not known	In Malacca there is a fair supply.	A good sized tree, the wood is close-grained, of a light red or brown colour. Breaking weight of a specimen 2' by 1" by 1", 4 cwts. 28 lbs.
Kilim or Ku- lim.	Scorodocar- pus bor- neensis (Becc.)	Piles and beams in bridge building.	Hilly ground, clayey soil.	Lofty tree	10 to 12 ft.	Slow ...	67 lbs.	30 to 50 cts.	A fair supply	This wood has a strong smell of garlic, and is called by the Natives from India "Lahsun." Breaking weight of a specimen 2' by 1" by 1", 3 cwts. 56 lbs.
Rusak ...	Not known	Making paddles and oars and carrying sticks by the Chinese.	Do.	Middling sized tree.	4 to 5 ft.	Rather slow in coming to matu- rity.	Sinks in water.	Not known	Not very plentiful	The tree is red; for about $\frac{2}{3}$ rds. of its diameter is very tough.
Kayu Chi- chak.	Not known	Making paddles by the natives.	...	...	...	...	...	...	Not much known, is said to be very durable	
Kayu Pe- naga.	Calophyl- lum sp.	Ship building, house and bridge build- ing.	On the sea- shore in sandy places.	Lofty tree	6 to 7 ft.	Slow ...	72 lbs.	30 to 40 cts.	A fair supply in Malacca only at present.	Penaga is a very useful tree, it yields durable timber for ship and boat building, an infu- sion of its leaves is used, for inflammation of the eyes on the Malabar Coast, where it is called the Alexandrian laurel. In Bengal it is called "Poorlange; yields a resin.

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Limpong or Lampong.	Not known	Used for planks.	S w a m p y ground.	Do.	Do.	Quick ...	Not ascertain- ed.	Not ascer- tained.	Not very plentiful	Not much used as it is not durable.
Giam ...	Inocarpus edulis.	Boat and ship building.	S w a m p y ground and on the sea- shore.	Do.	6 to 8 ft.	Not very rapid.	Very heavy, sinks in wa- ter like iron.	50 cents ...	Fair supply in Penang.	It is very hard and dura- ble wood, very difficult to work, it is objected to by carpenters on this account, it stands salt water well, and resists both in water and out for a very long time. Used for sheathing piles, yields a resin.
Kayu Ru- or Aru.	Casuarina littorea; Cassia sp. is given for this by an old wood- man (Malay.)	Not much used for any pur- poses.	High ground, clayey soil, prefers a sandy soil.	Lofty ...	5 to 6 ft.	Rapid ...	Light wood. ts in wa-	Not known	Scarce ...	This is a species of fir, it is a graceful tree, some- what tapering, wood is hard but not much used, very liable to attack by white ants, yields a resin.
Tumus or Tumbus.	Not known	Used by the Malays for raf- ters.	Grows in man- grove jungle on the sea- shore or salt water creeks.	50 to 80 ft.	10 to 28 inches.	Do. ...	Not ascerta- ed.	Not ascer- tained.	Not very plentiful	Does not stand exposure. Breaking weight of a specimen 2' by 1" by 1", 5 cwts.
Medang Kun- jib.	Sapotacea...	Boat planking...	Plains and light soil.	80 to 100 ft.	3 to 5 ft.	Pretty ra- pid.	Not ascertain- ed.	Not ascer- tained.	Not very plentiful...	Fibrous fracture, seldom brought to market. Breaking weight of a specimen 2' by 1" by 1", 6 cwts. 84 lbs.
Bintangor...	Calophyllum Inophyl- lum.	Masts and spars of vessels, housebuilding, scaffolding, poles and vari- ous purposes.	Low grounds, clayey soil.	80 feet and upwards.	2 to 4 ft.	Rapid ...	Do.	Do.	Plentiful ...	At present there is a fair supply of this timber, but it is rapidly grow- ing scarce on account of the great demand. There are several spe- cies, but the only last- ing one is that known as Bintangor Batu, it is a very durable wood. Breaking weight of specimen 2' by 1" by 1", 5 cwts.

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Nunka Pipit.	Not known.	Used by the Natives for house building.	On the plains and light and sandy soil.	50 feet ...	20 to 30 inches.	Rather slow.	Do.	Do.	Not very plentiful...	This is perhaps the lightest of the durable woods, its habitat is on high lands. It is difficult to saw. It is the sparrow jack, sinks in water, yields a gum. Breaking weight of a specimen 2' by 1" by 1", 2 cwts. 56 lbs.
Kranji Laut	Do.	Piles, beams for bridges and house building generally.	Hilly ground.	Lofty tree.	10 to 14 ft.	Slow ...	77 lbs. ...	40 to 64 cts.	Plentiful ...	This is a very hard and durable wood, but it is very difficult to work, sinks in water. A specimen 3" by 1½" by 1½", broke with 930 lbs.
Merbau ... Do. Hitam Do. Darah Do. Rengkong.	Not known	General purposes, house building, boat and ship building, furniture, gun carriage.	High ground, light clayey soil.	Lofty tree, say 140 feet.	15 to 20 ft.	Slow ...	67 lbs. ...	40 to 60 cts.	Getting scarce, especially large old timber.	Somewhat similar in appearance to old English oak, a very superior wood, polishes well, and is very durable. Used for furniture and cabinet work. The average breaking weight of a specimen 3' by 1½" by 1½", was 578 lbs.
Kladang ...	Artocarpus sq. This and Kladang confused most probably.	Used in boat building.	Clayey soil...	Lofty tree	...	Moderately rapid.	ascertained.	Not ascertained.	Not very plentiful.	Dark colour, something like Honduras Mahogany, takes a good polish, it is excellent for house fitting, buoyant in water.
Nibong ...	Areca Nibong, Mart	House posts, rafters, lath, &c., and as floors to Native huts.	Marshy ground	Lofty but not very large.	1 to 2 ft.	Do.	Do.	Do.	Plentiful ...	Is a species of Palm, the wood is valuable, it is very hard and fibrous in its facture, durable.
Ibuah ...	Orania, macrocladus.	...	High ground	Do.	Do.	...	Much superior to the preceding.

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Makomzi ...	Not known	Moderate sized tree.	...	Rather slow.	Do.	Do.	Very scarce	...	Is a good durable wood but never used.
Kemuning...	Murraya exotica.	Kris handles ...	Rocky ...	20 to 30 ft.	2 to 3 ft.	Very slow	60 lbs.	...	Rather scarce	...	Handsome grained wood takes a fine polish.
Angsana ...	Pterocarpus indicus.	Superior furniture.	Clayey and sandy soil.	100 feet ...	24 feet ...	Rapid ...	Not ascertained.	Not ascertained.	Abundant	...	...
Bâlau or Ambâlau.	Not known	Sleepers beams and files.	Do.	60 feet ...	10 feet ...	Slow ...	Do.	Do.	Scarce	...	...
Bahan Wanji.	Do.	Beams for house building.	Do.	100 feet ...	30 feet ...	Do.	...	Not known	Abundant	...	Very strong and durable.
Daru or Daru-Daru.	Not known	Beams for house building.	Clayey and sandy soil.	80 feet ...	12 feet ...	Slow ...	61 lbs.	Not known	Abundant	...	This is useful timber for building purposes and is abundant in the market of the Straits Settlements. It is very resinous and suits better when not exposed.
Glam ...	Melaleuca leucadendron.	Firewood and fishing stakes, bark used for caulking boats	Clayey soil ...	60 feet ...	9 feet ...	Rapid ...	Not ascertained.	Not ascertained.	Do.	...	...
Klat ...	...	Firewood ...	Do.	70 feet ...	12 feet ...	Do.	66 lbs.	Not known	Do.	...	Used in Singapore for planks, but inferior in quality.
lédang ...	Diospyros fruticosus.	Shipbuilding and used chiefly by Chinese for coffins.	Do.	80 feet ...	14 feet ...	Do.	43 lbs.	Do.	Do.	...	...
Bakau ...	Buguiera sp.	Piles for formation of bridges, houses or embankments.	Salt water swamps on the seashore.	Not very large tree.	6 to 9 inch diameter.	Do.	Sinks in water.	Do.	Do.	...	This is also called "Mangrove" and is used in large quantities as fuel for steamers and burning bricks, and the bark is used in tanning.

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Kayu Jati (Teak) ...	Tectona grandis.	...	Clayey soil	Now to a very large tree.	Now to a very large size.
Chempedar Ayer.	Artocarpus varians Miq.	It is used in making boats.	On the banks of rivers and in marshes.	Lofty tree...	Moderate- ly rapid.	...	Wood 25 to 30 cts. to cubic foot.	Not known	Fair supply	...
Nipis Kulit	Not known	Used in house building for posts and raf- ters and for handles to oars and tools.	Plains sandy soil.	50 feet ...	6 feet ...	Rather slow.	Not known ...	20 to 30 cts.	Fair supply to Ma- lacca.	...
Tampang ...	Artocarpus rigidus.	Good for house posts.	Marshy ground	Lofty tree...	Do.	Slow ...	Do.	Do.	Scarce ...	...
Pulei ...	Leguminosæ	Used for planks only.	High land ...	Do.	10 feet ...	Moderate- ly rapid.	...	20 to 30 cts.	Fair supply	...
Jelutong ...	Alyxia sp.	Used much by undertaker, large planks can be obtain- ed, it is also used for mak- ing clogs.	Marshy ground	Do.	...	Rapid ...	Do.	Do.	Do.	...

This tree is not indige-
nous to the Straits Set-
tlements, though found
in Burmah and Siam; it
was introduced into the
Straits Settlements, by
David Brown, Esq., many
years ago; it thrives
well, and some trees of
respectable dimensions
were cut down, but no
pains have been taken
to extend its cultivation.

Is a yellowish wood.
floats in water, bark is
flexible and strong, and
is used for walls of
native houses, grana-
ries, &c., yields a gum.
Breaking weight of a
specimen 2' by 1" by
1", 3 cwts. 14 lbs.
Bark is very thin and
vertically straited
hard, fawn colour,
sinks in water, yields a
resin. Breaking
weight of a specimen
2' by 1" by 1", 5 cwts.
42 lbs.

Next to Temsu for dura-
bility, yields a gum.

White wood, buoyant,
not very durable, yield
a resin.

Do.

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20/100

Lengâdei ...	Not known	Excellent fire-wood.	On the plains and sandy soil.	Do.	Not ascertain- ed.	Not ascer- tained.	Getting scarce ...	Breaking weight of a specimen 2' by 1" by 1", 2 cwts.
Leban ...	Do.	Ship-Kemstones, carriage wheels.	Clayey soil ...	30 feet	6 feet ...	Do.	57 lbs. ...	Not known	Abundant	...
Merbâtu ...	Do.	Fishing stakes, piles, and makes the best fuel for steam- ers and best charcoal for a blacksmith's forge.	Do.	50 feet	14 feet ...	Slow ...	Not ascertain- ed.	Not ascer- tained.	Do.	...
Merpuan ...	Not known	Fishing stakes, piles, and makes the best fuel for steam- ers and best charcoal for a blacksmith's forge.	Clayey soil ...	50 feet	14 feet ...	Slow ...	Not ascertain- ed.	Not ascer- tained.	Abundant	...
Miniak Jan- tan.	Diptero- carpus.	...	Do.	150 feet	15 feet ...	Do.	Do.	Do.	Do.	The wood oil of commerce is tapped from this tree.
Meranbong	Not known	Fencing ...	Do.	80 feet	6 feet ...	Do.	47 lbs. ...	Not known	Scarce ...	...
Rasah ...	Do.	House building	Do.	Do.	10 feet ...	Do.	70 lbs. ...	Do.	Do.	...
Red Man- grove.	Do.	Cart-wheels and other purposes.	Do.	70 feet	6 feet ...	Rapid ...	Not ascertain- ed.	Not ascer- tained.	Do.	...
R a m b e i Dam.	Bruguiera sp.	House building for natives.	Do.	150 feet	10 feet ...	Do.	Do.	Do.	Do.	Yields a gum.

B.

Questions.

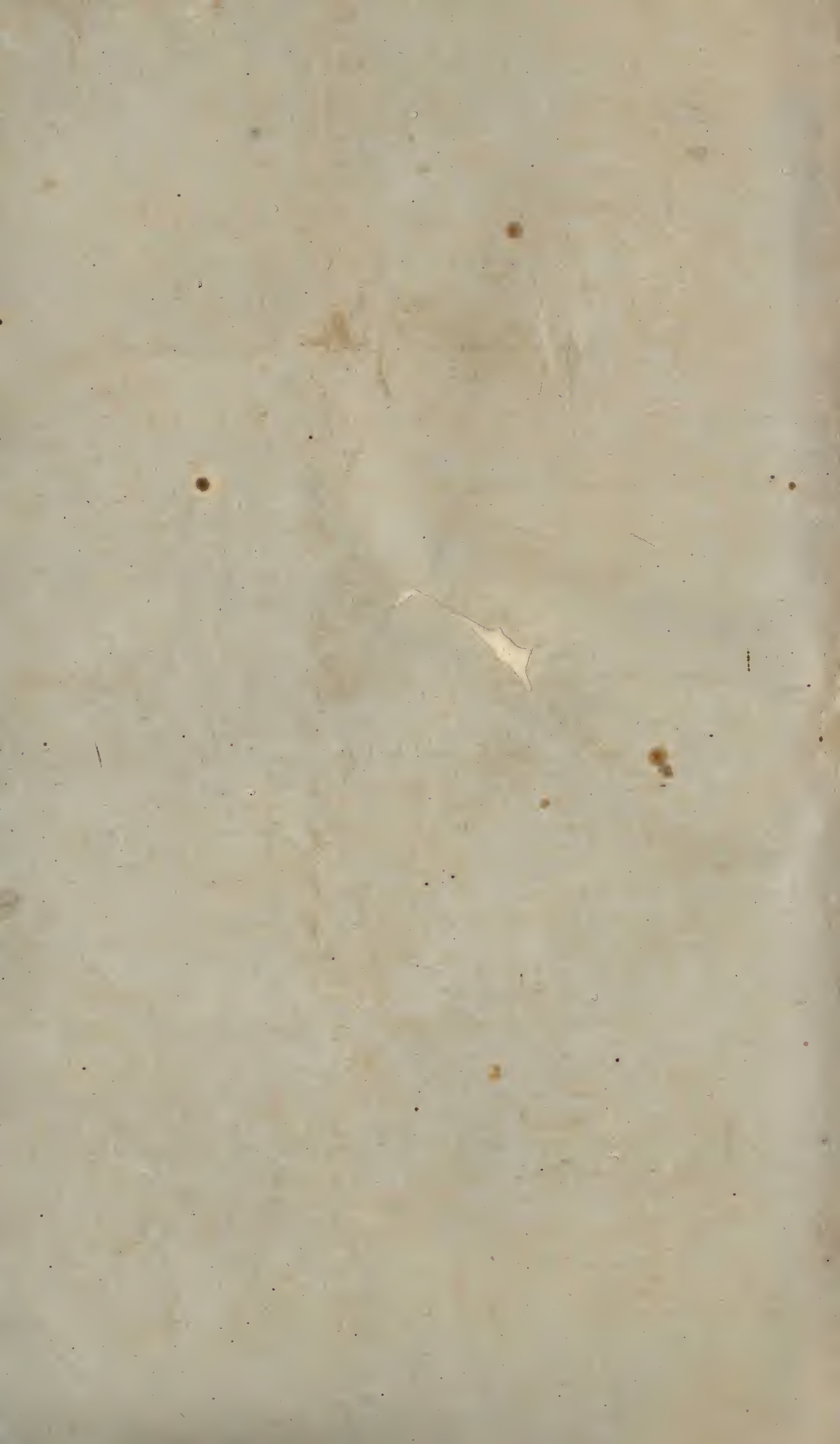
- I. What are the kinds of timber trees produced in the country, and to what uses, are they generally applied? (State the botanical name where known.)
- II. Are the forests or lands producing the trees owned by the Government or by private persons?
- III. What is the approximate extent of timber-producing forests or lands at the present time?
- IV. Is this area increasing or diminishing?
- V. If diminishing, from what cause?
- VI. Are any steps taken for the prevention of waste or for re-planting any area which has been cleared?
- VII. What is the quantity of timber which might fairly be cut every year without permanent injury to the forests?
- VIII. What is the quantity actually cut every year?
- IX. What is the proportion for home consumption and for export?
- X. What have been the annual exports of each kind of timber during the last ten years; stating the proportions to each country, and the value of such exports?
- XI. What are the reasons for, or causes of, the increase or diminution of quantity or value in the exports?
- XII. (If it be so), what are they causes of the small exportation in comparison with the capability of production?
- XIII. Have any observations been made or conclusions arrived at as to the climatic influence of forests or the effect of their clearance on the rainfall, floods, &c.?
- XIV. Forward any reports made by departments or societies, or any Acts of Legislature bearing on the subject.

Replies:

- I. *Vide* Return A.
- II. Owned by the Government chiefly.
- III.

	Acres.
In Singapore	22,000
In Penang & P. Wellesley.	130,000
In Malacca	45,000
- IV. Diminishing.
- V. From the sale of land and extension of cultivation and too often from illicit felling, and from charcoal burning.
- VI. The Government has one Forest Ranger at Singapore and two at Penang, and frequently men are brought before the Police and punished for felling trees on Government land, but no steps are taken to re-plant any area with such trees which has been cleared. The Eucalyptus and Acacia of Australia are being tried at Singapore on a small scale.
- VII. The Government can spare no more in either of the Settlements. At Singapore a reserve is kept round the principal hill for climatic purposes, and at Penang, Province Wellesley and Malacca there are also belts reserved for the same purpose, but it is feared that trees are often felled by Chinese, for want of a larger staff for supervision.
- VIII. It is impossible to say.
- IX. None for export; mangrove is used for firewood, of which there is an abundant supply, but all timbers for building purposes are imported into the Settlements. Mangrove bark is exported to a limited extent.
- X. No exports during the last ten years.
- XI. Do.
- XII. Do.
- XIII. It is found at Singapore that although the Crown lands have been greatly denuded of trees, there has been no marked diminution in the rainfall. I attach a minute, sent in by me to Government last year, when the subject was under consideration.
- XIV. There are no Acts of the Legislature bearing on this subject, but there can be no doubt that it would be desirable that there should be attached to the Land Department, a small Forestry Department, for the purpose of preserving our reserves, and restoring our forest by the establishment of nurseries for young trees.

APPENDIX F.



STRAITS SETTLEMENTS.

Paper laid before the Legislative Council by Command of His Excellency the Officer Administering the Government.

THURSDAY, 23RD APRIL, 1885.

Annual Report on the Forest Department, Straits Settlements, for the year 1884.

—:0:—

IN the organization and working of the Forest Department during the year, the recommendations contained in my preliminary report (see paragraph 112) on the Forests of the Straits Settlements have been closely adhered to.

2.—Following the plan of that report, details are here given of the work accomplished and the expenditure incurred in each Settlement. The work has been entirely separate from that carried out in connection with the Botanic Gardens during the year.

3.—It having pleased His Excellency Governor Sir F. A. WELD, to accord me the honour of organizing the Forest Department throughout the Colony, the following executive officers have been appointed and, although some of these are still new to their work, the Department may now be said to be established and will yearly become more efficient and useful.

(1st.)—Superintendent, N. CANTLEY, Singapore.

Staff.

(2nd.)—Assistant Superintendent, C. CURTIS, Penang.

This officer assumed his duties towards the end of July, and has been placed in charge of the Penang and Province Wellesley forests.

(3rd.)—Overseer 1st grade, V. JACKSON, Malacca. Assumed his duties on the 1st January.

(4th.)—Overseer 2nd grade, D. C. YOUNG. Was appointed in July to be Overseer in Singapore

(5th.)—Overseer 3rd grade, PETER NENKEY. In charge of the Penang experimental nurseries.

4.—The Assistant Superintendent in Penang and Overseers in Malacca and Singapore have each a separate staff of subordinate officers for the supervision of forest watchmen and coolies engaged in forest work.

5.—The number of labourers employed during the year has varied greatly, ranging between two and six hundred, according to the nature of the work in hand.

6.—The forest watchmen are a body separate from the ordinary employés. They wear uniform, and their chief duties are to protect the forest reserves and keep open the boundary paths. They work under special regulations which have been drawn up for their guidance.

SINGAPORE.

7.—In Singapore there are eight reserves, the two largest being the Jurong and Bukit Mandi reserves; the total area to be reserved is about 8,000 acres (or about one-twentieth of the total area of the island). About sixteen miles of boundary line have been demarcated, and about 12 miles planted with fast-growing trees.

Selection of forest reserves.

8.—In selecting these reserves, every effort has been made to obtain as much forest and forest growth within their boundaries as possible, but, as trees generally occur in small patches widely scattered over the island, it has been impossible to avoid the inclusion of a large extent of waste land.

9.—Among the Singapore reserves I have classed the Bakau or Mangrove jungle, which extends along most of the coast line of the island. The preservation of this jungle, which includes wood useful for many purposes, is a very important matter. Its great length renders it difficult of protection and, so far, I have had to content myself with merely pointing out to the Land Department what extent of it might be leased for cultivation.

A paper on the sanitary disadvantages arising from the destruction of mangrove jungle has been already laid before Government, and the subject is worthy of further careful enquiry.

Erection of
quarters.

10.—Quarters for the accommodation of the Overseer have been erected at Bukit Timah, within the reserve, and near the same position the central station of the forest watchmen has been constructed.

Two houses have been put up at each of the Jurong and Bukit Mandi reserves, one for the forest watchmen and one for the coolies employed in the work of demarcation. Two houses have also been erected for the coolies at each of the nurseries at Bukit Timah and the Military reserve.

Demarcation
of reserves.

11.—The demarcation of the Bukit Timah reserve was one of the first works that occupied my attention. The line cleared around this reserve is 6 miles in length and 16 feet in width and has been planted along its outer edge with fast-growing trees, 14 feet apart, over its whole length. The width of this line will prevent a jungle fire, under ordinary circumstances, from crossing into the reserve and injuring the young plantations and natural growth.

12.—The Jurong reserve has been demarcated with an eight-foot path over a distance of three miles and has also been planted with trees.

13.—The boundary of the Bukit Mandi reserve has been opened over a distance of about seven miles, three miles of which have been planted with trees.

The cutting of the boundary line of this reserve presented much difficulty, owing to the irregularity of the surface and the heavy covering of jungle.

Formation of
nurseries.

14.—A nursery for the propagation of trees has been opened at Bukit Timah, and comprises an area of about 3 acres. There is also one at the Military reserve for propagation and experimental purposes, about 4 acres in extent. The number of young trees propagated in these two nurseries may be roughly set down at about 300,000; this number was supplemented by about 60,000 from the forest nursery opened in the Botanic Gardens in 1883, but since closed, owing to its being inconveniently distant from the seat of operations.

About 148,000 plants, of the number given above, were planted out within the year. It was not advisable to plant out the rest, as they had not gained sufficient strength to enable them to cope with obstructive vegetation in the open.

Planting of
waste lands.

15.—It being desirable to perfect the Bukit Timah reserve as early as possible, about 50 acres of the waste land within its boundary have been planted with young trees at about 2,000 to the acre. Twenty acres of the Military reserve have also been planted in the same way, and about eight acres of the latter have been gone over and the plants cleared of weeds and grass.

Introduced
trees.

16.—The kinds of trees planted on these waste lands are chiefly as under:—

Teak.—*Teclona grandis*, has grown well only on the low lands in the better kinds of soil.

African Gum Copal.—*Hymenia verrucosa*, has thriven well.

American Rain Tree.—*Inga saman*, makes very rapid growth.

Mahogany.—*Swietenia mahogani*, } thrive exceedingly well.

Brazilian Iron Wood, *Casalpinia ferrea*, }

Illipi.—*Bassia longifolia*, looks promising.

Australian Dammar.—*Dammara robusta*, grows moderately well.
 Albizzia.—*Albizzia stipulosa* and *A. moluccana*, grows very rapidly.
 Indian long-leaved Pine.—*Pinus longifolia*, plants small as yet.
 Toon.—*Cedrela Toona*,
 Pride of India.—*Lagerstræmia regina*, } grow fairly well.
 Cassia florida, grows with remarkable vigour.
 Sissoo.—*Dalbergia Sissoo*, grows slowly and appears unsuited to the climate.
 Inga dulcis, grows slowly.

Bintangor.—*Calophyllum inophyllum*, grows well. Native Trees
 Serayah.—*Hopea cernua*,
 Wood oil tree.—*Dipterocarpus Sps.*,
 Mirabu.—*Afzelia palembanica*,
 Petaling.—*Strombosia javanica*,
 Kulim.—*Scorodocarpus bornensis*,
 Meranti.—*Hopea meranti*,
 Malacca Iron Wood.—*Kumpassia malaccana*,
 Kêlat.—*Eugenia zeylanica*,
 Eugenia Sps.,
 Těmpinis.—*Sloetia sideroxylon*,
 Kayu Arang.—*Diospyros discolor* } grow slowly.
 Incense Tree.—*Elæodendron Sps.*,
 Kayu Ru.—*Casuarina equisetæfolia*, } very rapid growth.

17.—The rate of growth of the various trees planted is carefully recorded, but none are as yet sufficiently advanced to admit of a decided opinion being formed as to their probable future behaviour. I refer more particularly to introduced trees; as to the success of native trees I am in a degree certain, but it will be most useful to preserve statistics of the rate of their growth in order that it may be clearly ascertained which will grow most satisfactorily on exposed lands. All nursery operations and planting will be guided by the experience so gained.

18.—The collecting of Herbarium specimens, in order to afford material for scientific investigation from other points of view, has not been forgotten. Herbarium specimens.

MALACCA.

19.—In Malacca, quarters for the forest watchmen have been erected in the following reserves:—Bukit Bruang, Ayer Panas, Jûs, and Sungei Udang. The houses erected are of a more permanent character than those in Singapore, being substantial wooden buildings raised on pillars. Erection of quarters.

20.—A nursery of about 3 acres in extent has been made at Bukit Bruang, and one at Ayer Panas of about one acre. Through these nurseries about 270,000 plants have passed during the year. In the vicinity coolies have collected about 340 lb of seed of various trees which, together with the greater number of the plants, were sent to Singapore. A good many plants have been planted out in and near the nurseries with a view to observing their rate of growth. Formation of nurseries.

21.—Forest reserves in Malacca require but little planting. They are, for the most part, well stocked with natural growth, and plants and seeds of the better kinds being comparatively abundant, the opportunity was taken of supplying the other Settlements which are less fortunate in this respect. A much larger supply of seed than that obtained can, however, be utilized with great advantage, as seeds are always preferable to plants when it is necessary to transport nursery stock from a distance. Forest reserves.

22.—In order to make Bukit Bruang reserve as efficient as possible, it was thought desirable to add to it the forest lands adjoining its eastern boundary. These lands contain a very large proportion of young trees of Těmpinis and other good timbers and are held by an Arab, without, it is believed, any real title to them. Bukit Bruang reserve.

I would earnestly urge on the Government the necessity for action in this matter, with a view to extending the reserve so as to take in these lands. Further delay may see them entirely destroyed.

23.—With a view to obtaining a more practicable western boundary for the reserve, it was decided to purchase some abandoned lands which had become overgrown with secondary growth and brushwood. A line was consequently run by survey outside those portions which were believed to be purchaseable at fair prices, but as soon as the Government were seen to be in earnest about securing the lands, the native owners raised the prices and it was found impossible to agree to the purchase of more than one holding of about 7 acres within the year. Some of the proprietors will no doubt come to terms later on, but the delay caused was vexatious, as nearly \$2,000 lapsed to the Treasury. I may here be permitted to observe that it would be advantageous in the future to set aside annually a certain lump sum of money to be expended in the purchase of lands required by the Forest Department and for compensation to cultivators.

Herbarium specimens.

24.—The collecting of Herbarium specimens of the plants of Malacca and of the adjoining Protected Native States was taken in hand, and about a thousand were sent to Singapore before the close of the year. The Overseer has taken advantage of his visits to the reserves to collect as much botanical information as his various other duties permitted.

PENANG.

25.—Next to Singapore, the work accomplished in Penang has been the most extensive of the year, notwithstanding the drawback that one-half of the year elapsed before the arrival of a qualified assistant from England. Mr. CURTIS reported himself towards the end of July, and has pushed on the work with great energy.

The work accomplished consisted of the demarcation of the hill forest reserves; the formation of a Forest tree nursery, an experimental nursery, and the clearing and laying out of grounds at the Waterfall for planting colonial products.

Demarcation of the hill reserves.

26.—The largest reserve made covers the highest hill range in the island with an altitude varying from 2,550 to 2,713 feet, respectively. This was considered the most important and consequently it was the first taken in hand.

From one-third to one-half of the elevation of this range has been included, due regard being paid to the nature of the soil, angle of the slope and amount of cultivation. The outline of the reserves as demarcated is very irregular, owing to cultivation having attained a higher altitude than was consistent with the general welfare. That no restriction should have been placed on the ascent of cultivation is to be deplored. To avoid including these encroachments it was necessary to raise the outline of the reserve higher at certain points than would have been necessary had there been no such obstacles, and by way of compensating to some extent for this loss the line was proportionately lowered in places where no cultivation existed and where the angle of the hill side was such as to render cultivation impracticable. This has been done at the expense of much cutting and hard climbing, and the few clearings unavoidably included within the reserve are of no great value. A list of these and their approximate areas has been drawn up, and they have been valued with a view to arrangements being made for taking them over.

27.—The demarcation line has been cut nine feet wide, of which five feet have been cleared of tree stumps, etc., and the upper side of the slope dug away to make a passable inspection path. The total length of the line thus opened, from the commencement of operations to the close of the year, is about 30 miles. The line embraces the whole of the main hill range of the island from western Ayer Hitam to Batu Feringgi, and this circle is now completed with the exception of a small portion between Half-way house on Government hill and Bukit Timah, the opening of which has been deferred pending the settlement, by purchase or otherwise, of the lands over the watershed of the Penang river upon which George-town is principally dependent for its water supply.

Quarters.

28.—As the work of demarcation proceeded, it was found more economical to rent houses from Chinese for the accommodation of the coolies than to erect new quarters for them.

Substantial quarters for the forest watchmen have, however, been erected at Telok Bahang, Bukit Timah, and Government hill reserves at approved points, and it is hoped that when the watchmen get properly to work, destruction of forest above the reserve line will be entirely prevented.

29.—The preparation of a piece of land to serve as a forest tree and experimental nursery was begun early in September on Government hill. In selecting the site, care was taken to secure the greatest elevation combined with a constant supply of water. An area of about six acres has been selected and cleared of jungle close to the road leading to the Government Bungalow at an elevation of 2,000 feet. A stream runs through the nursery which affords a supply of water that is believed never to fail even in the driest season. It has been found necessary to terrace the greater portion of this nursery, owing to the slope of the hill side being too steep for cultivation in its natural form. Formation of nursery.

30.—Temporary sheds have been erected for coolies employed in the nursery and, although there is generally more or less fever on new clearings, the coolies have been exceptionally free from it in this place. A span roof plant house with a movable chick roof has been put up for plant protection and propagation purposes.

31.—The collecting of native plants was commenced in December, and a good many, useful for exchange, ornamentation, etc., have been got together. Collecting of native plants and seeds.

Such seeds as could be obtained in Penang have been collected, and among them a small supply of home grown Teak seed from trees growing near Telok Bahang where they appear to be doing remarkably well.

32.—But little could be done during the year to forestry in Province Wellesley, owing to the pressure of work on the Penang side of the Straits. Province Wellesley.

33.—The formation of a nursery for the planting of colonial products at the Waterfall in Penang was also a work of the Forest Department during the year. Penang Waterfall nursery.

Part of the Municipal land at the Waterfall was taken over by Government for the purpose of forming a nursery, but the work was not actively commenced till late in the year, when a large band of men were put on to clear an area of about ten acres: rather more than half of this space has been dug over twice to a depth of about two feet and the lalang roots and stones removed. The remaining portion, not being of a nature suitable for cultivation, has been sloped or levelled as the case required and a great part of it turfed. Holes have been prepared for the reception of plants, and a few flower beds have been made along the main walk with a view to combining the ornamental with the useful. The old path which passed through the land and which followed the course of the river has been altered, re-modelled, and metalled. It will prove a good, durable carriage road.

A new road striking off from the reservoir and skirting the outer boundary of the nursery was commenced and had considerably advanced towards completion before the close of the year.

The necessary paths for the convenience of working parties and visitors have been laid out and the edges turfed. Actual planting was only prevented by the setting in of dry weather before the nursery was sufficiently advanced to admit of planting being done.

34.—Summarizing the work of the Forest Department in the three Settlements during the past year, I would point out that the forest reserves dealt with to a more or less extent are fifteen in number; that forty-six miles of boundary line have been opened at an average cost of \$83 per mile including the planting up of twelve miles with fast-growing trees; that the area of land laid out in nurseries is over twenty acres; and that some 390,000 plants have been propagated in these nurseries at an average cost of \$1 per 100. Summary.

35.—Seventy-three acres of waste land were planted with about 148,000 plants at an average cost of \$12 per acre or per 2,000 plants. The stock in the nurseries at the close of the year numbered about 200,000 plants. It will be noticed that the area of waste land planted with trees is comparatively small, but what was of most importance, viz., the demarcation of reserves, to prevent further encroachment had to be first undertaken. This done, attention could with more security be turned to planting operations and other work within the reserve boundaries.

36.—Over 1,160 lbs of seeds have been got together from various quarters and utilized for the benefit of the reserves. About 1,600 Herbarium specimens of plants affording material for scientific investigation, have been procured at an average cost of \$10 per 100; which, when the difficult nature of the country and places requiring to be visited is taken into account, must be considered reasonable.

37.—The buildings erected include quarters for the overseers, stations for the forest watchmen, coolies' houses and plant sheds: in all 27 in number.

39.—A small Library of books on forestry has been formed for the benefit of the Forest Staff. A list of books received during the year is appended.

40.—In conclusion, I would add that, irrespective of periodical tours through the Settlements generally, a good deal of my time has been taken up in travelling over the island of Singapore on special forest duty, such as reporting on forest lands applied for by Chinese cultivators, it being now the rule that all forest lands applied for should be reported on by the Forest Department in the first instance.

These inspections entailed much heavy travelling and exposure, as in every case miles had to be walked on foot to reach the spot requiring inspection.

41.—I may also mention that the amount of correspondence which the addition of the Forest Department has thrown upon the Garden's office has about quadrupled the business of previous years.

N. CANTLEY.

Singapore, 13th April, 1885.

Revenue and Expenditure of the Forest Department, Straits Settlements, 1884.

REVENUE.

Government Grant, Singapore,	\$ 7,000
Do., Penang,	7,000
Do., Malacca,	6,000
	<hr/>
	\$ 20,000
	<hr/>

EXPENDITURE.

	Singapore.	Penang.	Malacca.
Salaries, ...	\$654.52	\$731.72	\$837.90
Demarcation of reserves, ...	1,712.86	1,676.70	...
Formation of nurseries, ...	1,508.12	1,799.90	869.24
Planting waste lands, ...	600.00	...	...
Hill Bungalow grounds, Bukit Timah, ...	300.00	...	...
Herbarium specimens, ...	51.00	...	52.73
Erection of quarters, ...	993.23	608.31	631.00
Uniform, tools, and implements, ...	233.10	589.07	163.00
Manure and cartage, ...	214.82	...	80.00
Transport, ...	343.10	417.83	623.53
Miscellaneous, ...	366.24	95.57	99.30
Rent, ...	...	113.50	130.00
Boundary stones, ...	...	500.00	...
Survey fees, ...	...	264.00	494.28
Foreign seeds and plants purchased, ...	...	200.00	...
Purchase of land, ...	...	...	100.00
	<hr/>	<hr/>	<hr/>
	6,976.99	6,996.60	4,080.98
Balance in hand, ...	23.10	3.40	1,919.02
	<hr/>	<hr/>	<hr/>
	7,000.00	7,000.00	6,000.00

Nursery garden for planting Colonial Products, Penang.

Government Grant,— \$ 2,500.

Expenditure, 1884,	{	Salaries, Cooly hire, &c.	\$ 1,993.63
		Tools and materials,	250.75
		Manure and cartage,	190.00
		Rent of Cooly houses,	40.00
		Petty expenses,	20.50
			<hr/>
			2,494.88
		Balance in hand,	5.12
			<hr/>
			\$ 2,500.00
			<hr/>

Statement of Seeds procured for the Department during the year.

Date.	Name.	Quantity	From whom received.
<i>From Foreign Sources.</i>		lbs. oz.	
2.2	Casuarina equisetœfolia, ...	1	Forest Dept., India.
22.5	Lagerstrœmia reginæ, } ...	25	Do., Rangoon.
30.5	Do., do. ...	25	Do., do.
10.6	Tectona grandis, ...	50	Do., do.
7.7.	Swietenia mahogani, ...	365	Do., do.
24.7.	Do. do., ...	10	Botanic Garden, Jamaica.
28.7.	Terminalia Sps., ...	50	Do., Trinidad.
7.8.	Dipterocarpustuberculatus, ...	100	Forest Dept. India N.W.P.
10.9.	Bassia longifolia, ...	60	Do., N. C. Poona.
19.9.	Do. do., ...	26	Do., Coimbatore.
14.10.	Aguillaria agallocha, ...	26	Do., do.
17.10.	Bignonia chelonoides, ...	20	Do., Assam.
24.12.	Chickrassia tabularis, ...	5	Do., Rangoon..
		60	Do., Chanda.
<i>From Home Sources.</i>			
	Calophyllum inophyllum, ...	340	Collected in Malacca.
	Hopea cernua, ...		
	Dipterocarpus Sps., ...		
	Azelia palembanica, ...		
	Strombosia javanica, ...		
	Scorodocarpus bornensis, ...		
	Hopea meranti, ...		
	Kumpassia malaccana, ...		
	Eugenia zeylanica, ...		
	Eugenia Sps., ...		
	Sloetia sideroxylon, ...		
	Diospyros discolor, ...		
	Elœodendron Sps., ...		
	Mixed species, ...		
		1,163	

List of Books at present forming the Library of the Forest Department.

- American Journal of Forestry (F. B. HOUGH.)
Notes on Forestry (C. F. AMERY.)
Timber Merchant and Builder's Vade Mecum (BOUSFIELD.)
Origin, Progress, Prevention, and Cure of Dry Rot in Timber (BRITTON.)
Forest and Moisture (J. CROMBIE BROWN.)
Pine Plantations on the Sand-wastes of France (J. C. BROWN.)
Introduction to the Study of Modern Forest Economy (BROWN.)
French Forest Ordinance of 1669 (J. C. BROWN.)
Reboisement in France (J. C. BROWN.)
Trees of America (BROWN.)
Science for Forests (A. J. BURROWS.)
The Planting and Profitable Cultivation of Underwood.
Tree-pruning, (A. DES CARS.)
Tree Lifter (G. GREENWOOD.)
Timber and Timber Trees (G. LASLETT.)
Strength of Timber (WILLIAM LEA.)
The Organisation and Valuation of Forests on the Continental System. (L. MACGREGOR.)
Report on the Forest Resources of Western Australia (MULLER.)
Manual of Injurious Insects (E. A. ORMERO.)
Guide to Methods of Insect Life.
Saw Mills their Arrangement and Management (BALE.)
Indian Forest Reports.
Forest Department Code.

No. 31.

STRAITS SETTLEMENTS.

REPORT

ON THE

BOTANIC GARDENS,

SINGAPORE.

FOR THE YEAR

1885,

WITH AN APPENDIX CONTAINING NOTES ON ECONOMIC PLANTS,

BY

N. CANTLEY,

SUPERINTENDENT OF THE BOTANIC GARDENS.

LAID BEFORE THE LEGISLATIVE COUNCIL BY COMMAND OF HIS EXCELLENCY THE GOVERNOR.



SINGAPORE.

PRINTED AT THE GOVERNMENT PRINTING OFFICE.

1886.

ORD. ARTOCARPEÆ.

Sákán (Bread-fruit), *Artocarpus incisa* :—Fruit used by the Malays as a vegetable. The tree, however, seldom produces fruit in perfection in the Straits, the greater number falling prematurely.

Nángká *Artocarpus integrifolius* :— }
Champedak, *Artocarpus polyphema* :— } Young fruit used as a vegetable by the Malays.

ORD. PAPAYACEÆ.

Bětěk or *Buah Papaya*, *Carica papaya* :—Extensively cultivated and used as a vegetable. Plentiful in the bazaars.

ORD. FILICES.

Paku Rúan, *Ceratopteris thalictroides* :—Common in ditches. Used chiefly by Klings and Malays.

Anisogonium esculentum :—A fern not uncommon in ditches. Is a very good vegetable, used by the Malays, who also use the young shoots of the following ferns :—

Paku Akar, *Stenochlaena palustris* :— }
Paku Uban, *Blechnum orientale* :— } All fairly plentiful in a wild state.
Samber, *Thamnopteris nidus* :— }

ORD. GRAMINEÆ.

Rěbong, *Gynotochloa aspera* (?) :—A bamboo the young shoots of which are extensively used among the Chinese as a vegetable and for preserves.

Jaggong, (Maize) :—Is grown to some extent and used green as a vegetable.

ORD. PALMEÆ.

Pinang, *Klapa*, *Areca* and *Cocos* :—Heart or growing point used as salad. Supply very limited.

2. From the foregoing it will be seen that there are about eighty kinds of vegetables at present more or less in cultivation in the Colony. Of that number, but few are exclusively Chinese, but a good deal of the seed from which they are grown comes from China. The cultivation is, however, much at fault, there being a tendency to produce quantity instead of quality, and some control over present system of cultivation seems necessary.

3. The following 45 kinds of vegetables of species cultivated in England have been tried, in Penang, at 1,000 feet elevation, and in Singapore at about 150 feet, with results as follows :—

II.—VEGETABLES GROWN FOR TRIAL.

<i>Giant Asparagus</i> , in Penang grew freely, but not to a large size.	
<i>Broad Windsor Beans</i> , ...	{ Flowered in Singapore and Penang, but failed to set fruit.
<i>Scarlet Runners</i> , ...	Failed quite everywhere.
<i>Egyptian Turnip, rooted Beet</i> , ...	Did well in Penang.
<i>Delt's Flower Garden Beet</i> , ...	Grew fairly well in Singapore, not tried in Penang.
<i>Broccoli</i> , ...	} Grew leaves only in the open ground, makes better centre when grown in pots. Penang and Singapore experiments gave same results.
<i>Brussels Sprouts</i> , ...	
<i>Cabbage, Large White Erfurt</i> , ...	
<i>Cabbage, Early Blood Red</i> , ...	
<i>Cabbage, Savoy</i> , ...	
<i>Carrots—Early short Horn</i> , ...	} Grew well both in Penang and Singapore, but of inferior flavour in Singapore.
<i>Carrot, Earliest French forcing</i> , ...	
<i>Cress, Curled</i> , ...	} All grew well in Penang and Singapore. Succeeded better in Penang.
<i>Cress, American</i> , ...	
<i>Cress, Indian</i> , ...	
<i>Telegraph Cucumber</i> , ...	Grew fairly well in Penang. Failed in Singapore.
<i>Sundringham Celery</i> , ...	Grew fairly in Penang.
<i>Cos defiant Celery</i> , ...	} Grew to leaves only in Singapore.
<i>Williams' Matchless Celery</i> , ...	
<i>Major Clark's Red Celery</i> , ...	
<i>Dandelion</i> , ...	Grew well in Penang and Singapore.
<i>Musselburgh Leek</i> , ...	Grew well in Penang.
<i>Kole Rabi</i> , ...	Do. do. and Singapore.

<i>Lettuce, Cabbage, ...</i>	... }	Succeeded perfectly in Penang and fairly well in Singapore.
<i>Lettuce, Tom Thumb,</i>	... }	
<i>Carter's Giant White Cos,</i>	... }	
<i>Carter's Giant Brown,</i>	... }	
<i>Melon, ...</i>	...	Failed everywhere.
<i>Mustard, ...</i>	...	Grew freely everywhere.
<i>Onion, The Queen,</i>	...	Grew well in Penang.
<i>The Student Parsnip,</i>	...	Grew well in Penang.
<i>Parsley, ...</i>	...	Everywhere a success.
<i>Peas, Ring-leader, ...</i>	...	Grew fairly well in Penang.
<i>Peas, Best of all, ...</i>	...	Failed in Singapore.
<i>Potatoes, Early Ash-leaf,</i>	...	Grew to a fair size, but rather watery in quality.
<i>Raddish, ...</i>	...	All kinds grew well.
<i>Horse Raddish,</i>	...	Grew well.
<i>Rhubarb, ...</i>	...	Grew well for a time in Penang. Failed in Singapore.
<i>Sea Kale, ...</i>	...	Failed everywhere.
<i>Turnip, Early French,</i>	...	Grew well in Penang; not tried in Singapore.
<i>Turnip, American Strap-leaf,</i>	...	Grew well in Singapore; not tried in Penang.
<i>Tomatoes, ...</i>	...	All kinds grew well, especially the small variety.
<i>Jerusalem Artichoke,</i>	...	Failed in Singapore.
<i>Globe Do., ...</i>	...	Failed in Singapore, but produced a few flowers in Penang.

POT HERBS.

<i>Sage, ...</i>	... }	All grew well in Penang and Singapore. Sage and Thyme best in Penang.
<i>Thyme, ...</i>	... }	
<i>Sweet Marjorum, ...</i>	... }	
<i>Spear Mint, ...</i>	... }	
<i>Pepper Mint, ...</i>	... }	
<i>Sweet Basil, ...</i>	... }	

4. It will be admitted that these results carry with them a large amount of success, and all that seems required to keep up a supply is the issuing of a standing order to a seedsman to send a regular supply of seeds of such as have succeeded and the appointment, for a year or two, of an intelligent person well acquainted with vegetable cultivation to superintend the distribution of seeds and regulate bazaar supply.

He should keep a register of all growers for sale, and submit, for the information of Government, periodical reports on the progress of new vegetables, and encourage cultivators by liberal assistance.

5. By this means private enterprise would be stimulated and the object desired obtained without causing the injury to cultivators which the establishment of a Government vegetable garden for bazaar supply would entail upon them.

III.—OTHER ECONOMIC PLANTS.

6. *Coca-leaf*.—The seed of coca was much in demand during the early part of the year, but the value of the leaf has now fallen so low that it would hardly pay to cultivate it in the Straits.

7. *Cubeb*s.—There is at present but little cubeb pepper in cultivation in the Straits. Some plants lately received from Dr. TREUB have been placed in the Experimental Nursery for trial. Samples of a large consignment from India of prepared cubeb pepper were received at the Garden from a Singapore merchant for botanical determination. The samples turned out to be only one-third cubeb, the remainder *Piper nigrum*, or some allied specimens. Cubeb can always be distinguished from *Piper nigrum* by the berries having little stalks.

9. *Black Pepper*.—The rise in the price of black and white pepper has stimulated the cultivation of the plant both in the colony and elsewhere. Several demands from other colonies have been made for the Singapore variety, which is acknowledged to be of superior quality.

10. I made a special visit to the Achinese plantations in Province Wellesley, where the plant is cultivated differently from the mode practised by the Chinese, but the difference only proved to be what may be summed up in the word neglect, and bore no comparison to the better and higher cultivation as practised by the Chinese.

The adoption of living supports by the Achinese (*Dadup*) is a point I would recommend, however, as in every way more natural and economical than dead wood as used by the Chinese.

11. *Tea*.—The cultivation of tea is likely to prove a success in the Straits if handled with forethought and care. The chief drawback is the tendency the soil has to rent and fissure, even during a short period of drought, but this could be remedied by making special compost and planting in large holes.

12. *Cardamums*.—Further experiments with Cardamums show that the atmosphere in Singapore and Penang is apparently too dry for the proper cultivation of the plant, but it would no doubt succeed admirably in some parts of the Native States.

13. *Gambier*.—Observations have shewn that the gambier plant may be cultivated for forty or fifty years on the same land without the land becoming exhausted, if properly cultivated. This is the opposite to the general opinion. I measured the stems of some plants of the age mentioned and found them about 18 inches in circumference close to the ground and still bearing large quantities of leaves.

14. *Croton Oil*.—The Croton Oil plant produces seed freely in Singapore, and could no doubt be grown with advantage. I would strongly recommend it to planters for trial.

15. *Cassia Auriculata*.—This is an East Indian bark which grows very freely in the Straits. The bark contains a valuable tanning principle, which would no doubt pay in cultivation.

16. *Cocoa*.—The new varieties of Chocolate grow well, and the plant is now established in the Straits, but white ants, leaf insects, mildew, &c., play such havoc as almost to prohibit its cultivation in some districts.

17. *Nutmegs and Cloves*.—The protracted drought in Penang tried the Nutmegs and Cloves plantation very much, many young plants died, but the drought was of exceptional severity and has not discouraged planting.

18. *Hemp*.—Some plants of Mauritius Hemp, planted for experiment among rough lalang, have coped successfully with that troublesome grass, and although they have grown less rapidly, they have by means of their wide-spreading leaves, prevented the grass from covering them over and cutting off their supply of light.

19. *Rubber and Gutta Percha*.—The Foreign Rubber trees mentioned in previous reports continue to grow well, but in a country where the best rubbers grow wild, it is somewhat superfluous to refer to foreign species, the ultimate success of which may be doubtful. What is more required is the careful conservation and cultivation of native kinds, the growth and produce of which in our soil is not a matter of question. I believe a purely Gutta Taban forest, worked as they do timber forests in Germany, on say, a 30 years rotation would yield a good return in profit, that is to say, a certain area, however large, to be reaped (cut down if necessary) annually, and a corresponding area planted with young trees.

20. *Vanilla*.—The cultivation of Vanilla is being tried in the colony. There are some native varieties which fruit freely, especially in Penang, but I doubt the suitability of our climate for the cultivation of *V. planifolia*, the kind most prized.

21. *Mangosteen and other Fruits*.—The Mangosteen, which has hitherto been considered to fruit nowhere out of Malaya, is now reported almost simultaneously as bearing fruit in Jamaica, Ceylon, and India, and must be near bearing in the Mauritius and Seychelle Islands.

The cultivation of fruit pays well in the Straits, and orchards might be greatly extended with advantage.

22. *New Economics*.—Introductions during the year include *Mimusops globosa*, a famous West Indian Rubber tree; Chinese ginger; Chinese rice-paper plant; Yoroba Indigo, Canonboll tree of West Indies, and West Indian fruits and medicinal plants the growth and properties of which will be detailed in next year's report.

N. CANTLEY,

Superintendent

STRAITS SETTLEMENTS.

R E P O R T

ON THE

FOREST DEPARTMENT,

FOR THE YEAR

• 1885.

L A I D B E F O R E T H E L E G I S L A T I V E C O U N C I L B Y C O M M A N D O F H I S E X C E L L E N C Y
T H E O F F I C E R A D M I N I S T E R I N G T H E G O V E R N M E N T.



SINGAPORE:

PRINTED AT THE GOVERNMENT PRINTING OFFICE, STRAITS SETTLEMENTS.

1885.

20/70

STRAITS SETTLEMENTS.

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ON THE

FOREST DEPARTMENT,

FOR THE YEAR

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ANNUAL REPORT ON THE FOREST DEPARTMENT, STRAITS
SETTLEMENTS, FOR THE YEAR 1885.

SINGAPORE.

Demarcation of Reserves.

THE demarcation of reserves has been one of the chief works of the year. The following have been marked off where necessary by an eight-foot boundary path, viz. :—Chan Chu Kang, Sembawang, Pandan, and Mandai reserves. These contain together an area of about 4,383 acres.

2. The length of boundary lines opened amounts to about thirteen miles, five miles of which have been planted with fast-growing trees; rivers and public roads have been adopted for ten miles of boundary, which has kept down cost of demarcation and maintenance. Reserves in various districts other than the above have been marked off on the maps and noted by the Land Office; these contain an area of about 4,914 acres.

Leases within Reserves.

3. Within the boundaries of the reserves are several small holdings as yet unpurchased, these may amount together to an area of 1,500 acres, and will be demarcated under the new Land Ordinance without cost to Government.

Protection.

4. For protective purposes, a staff of ten watchmen has been employed throughout the year, and has protected an area of 5,553 acres, being an average charge of 555 acres per man. They have also kept in order 16 miles of 8-foot boundary line opened last year, which has been the means of preventing fire entering the reserves as well as forming a boundary to them. The watchmen made four arrests and obtained three convictions, chiefly for illicit wood-cutting.

Maps shewing the reserve boundaries have been supplied by the Survey Department, on a scale of 16 chains to the inch, which materially assisted the work of the year.

Fires and Damage.

5. The only case of fire which occurred during the year took place on the military reserve, where about two acres of young plantation were partly destroyed. The fire originated through carelessness on the part of workmen who had quarters within the reserve.

The heavy rains which took place in the middle of December flooded some 20 acres of the flat land of this reserve and killed about 3,000 plants. There have been no other casualties to record.

Erection of Quarters.

6. Sheds for the accommodation of coolies employed in demarcation work have been erected at Pandan and at Chan Chu Kang, and a substantial wood house for the overseer of the experimental nursery at Tanglin.

Nurseries.

7. About seven acres have been added to the area of the nurseries, viz.:— a new nursery of about 2 acres at Jurong, one of 1 acre at Bukit Mandai, and 4 acres added to the experimental nursery at Tanglin. The number of plants propagated during the year amounted to about 150,000, of which about 110,000 were sent to the reserves, and 40,000 distributed to various Government institutions, the Public Works Department taking the greater number. Seed to the amount of 386 lb has been used in the nurseries, being 300 lb of various native tree-seeds and 86 lb of kinds received from India.

8. In the Tanglin nursery, the following, not specially mentioned previously, form part of a large assortment planted during the year, viz.:—Dindie (said to be the best timber tree of British Columbia); Araucarias; Eucalyptus of sorts (E. Sideroxylon, E. Piperata, and E. Calophyllus have done remarkably well); Teak; Indian long-leaved pine; Cassia bark tree; Sissoo; Nutmegs and Cloves; long-leaved Acacia from Australia; Casuarina stricta; American, African and Native Rubbers; new varieties of Chocolate; Brazilian, African and Queensland edible nuts; native and foreign fruit trees; native Sago palms; Mauritius Hemp plant; Cardamums, &c.

Planting Waste Lands.

9. The area planted during the year in the reserves is about 55 acres, with about 2,000 plants to the acre—forty-seven acres of the waste lands in Bukit Timah reserve and eight acres of the military reserve. The trees planted in the former consisted chiefly of the best native kinds; and principally foreign trees in the latter. The progress made by the plants planted is very satisfactory in most cases.

10. From observation of the growth of the plantations made last year, the following among native trees have grown with most vigour, viz.:—Serayah, Meranti, Kemunyan, Bintangor, Kēlat, Klēdang, Tembusu, Kayu arang, Merabu, Chempadak, Petaling, Kayu minyak, and Eugenias of sorts. Among foreign kinds, the following grow with great vigour on suitable soils, viz.:—Teak, Dipterocarpus tuberculosa, Inga saman, Schleicheria trijuga, Cedrela, Toona, Eucalyptus of sorts, Stereospermum chelonoides, Albizzia Moluccana and Albizzia stipulata, Cassia florida, Hymenoclea verrucosa, and Mahogany.

Weeding.

11. All the plantations made during the year, and also those made last year, have been gone over twice, and the plants cleared of weeds and grass, except on a portion of the military reserve, which was left untouched for observation as to how the plants would cope with the lalang and other obstructive vegetation. On examination, the following were found to have grown up through the grass, and seem beyond danger of suffocation, viz.:—Bintangor, Kēlat, Klēdang, Chempadak, Tembusu, Kumpas, several Eugenias, Albizzia Moluccana, Cassia florida and Cedrela odorata. The last three mentioned are exotics.

12. The undermentioned were left behind in the race for light and completely covered over by the grass in most cases, viz.:—Lagerstroemia reginæ, Mahogany, Dindie, Albizzia lebbeck, Bassia longifolia, Teak (when planted in elevated situations), Adenantha pavonina, and Inga dulcis. These observations shew that native trees are best adapted for the re-wooding of the waste lands of the Settlement, and that, if closely planted, or sown *in situ*, require but little assistance in the way of weeding under ordinary circumstances.

Assistance to other Departments.

13. A quantity of small timber has been supplied from the reserves for the renewal and repairing of bridges on country roads. In September orders were received to assist the Colonial Engineer with certain works at the new fortifications. The work then put in hand has continued up to date and has occupied much time.

Herbarium.

14. Some hundreds of herbarium specimens have been collected during the year, and are being reduced gradually to their various genera and species as time admits.

Changes in Staff.

15. The salary attached to the post of Overseer of Forest has been placed on an increasing scale of from \$600 to \$840 per annum, at which rate an intelligent officer was

obtained towards the close of the year. The previous Overseer resigned on account of insufficient salary. The duties attached to the post are arduous and trying to a European constitution in this climate.

MALACCA.

Demarcation of Reserves.

16. In Malacca, as in the other Settlements, demarcation constituted the chief work of the year. The total area demarcated was about 10,000 acres and includes the following reserves:—Sungei Udang, Merlimau, part of Bukit Bruang, and part of Bukit Panchor. The length of 8-foot boundary opened was 22 miles. The area surveyed, 8,865 acres, of which 3,300 acres were surveyed specially by the department.

The total area taken up amounted to about 42,000 acres, of which 32,000 remain undemarcated.

17. The additions made to the old reserves have been as follows:—Merlimau, 4,000 acres; Sungei Udang, 1,300 acres; Ayer Panas, 1,675 acres; Bukit Bruang, 23 acres (the latter purchased at a cost of about \$11 per acre); Bukit Panchor, 2,880 acres. Total additional area, 8,203 acres. The Bukit Panchor reserve is, however, more of a new reserve than an addition to the old one, of which 420 acres only were retained. In the modification of this reserve, the Bukit Panchor hill-chain has been included within the boundary. Nearly all the additions made to the reserves are fairly well wooded and none require to be stocked artificially by planting.

Erection of Quarters.

18. Quarters for watchmen have been erected during the year at Briso, Merlimau, and Bukit Panchor reserves, and consist of three substantial wooden buildings raised on piles.

Protection.

19. Seven watchmen have been employed during the latter half of the year, and have occupied quarters at Sungei Udang, Merlimau, and Bukit Bruang. They have had charge of about 1,870 acres each on an average, and have kept the boundary paths in order. They made fifteen arrests for illicit wood-cutting within the reserves, and obtained ten convictions.

Nurseries.

20. The nursery made last year at Bukit Bruang has been maintained for experimental purposes, in which the following plants have been tried, viz.:—*Bassia longifolia* (which yields good timber and an excellent oil); *Cedrela odorata*; *Pinus longifolia*; Rubber trees of sorts; Mahogany; Teak; Logwood; Mauritius Hemp; China Grass; Coffee, and several others. The *Cedrela*, *Bassia* and Mahogany have grown best. Mauritius Hemp has grown well, and some Chinese are about to take up its cultivation.

21. About 20,000 young trees have been raised in the nursery during the year, chiefly *Tampinis*, but as these are little wanted in Malacca, they are being transported to the other Settlements where a supply is needed. The Ayer Panas nursery, opened last year, was closed during the year, owing to the cost of transport and difficulty attending its proper supervision, it being at too great a distance from the site of all other operations of a kindred nature.

22. Mr. JACKSON, the Overseer, resigned at the close of the year, and as no one possessing the necessary qualifications could be found in the Colony, application has been made to the Home Government for an officer to fill the post.

Specimens for Exhibition.

23. Specimens of the indigenous timbers, to the number of 86, and 100 kinds of fibres, prepared mostly from Malacca plants, have been forwarded to the Colonial and Indian Exhibition, London.

Herbarium specimens, to the number of 1,840, and 300 lb of seeds of the most valuable timber-trees have been collected and forwarded to Singapore.

PENANG.

Demarcation of Reserves.

24. In Penang, the demarcation of the hill reserves has been urgently pushed on and nearly completed within the year. The reserves demarcated are four in number, viz.:—Bukit Batu, Bukit Lasmana, Highlands, and Muka Head. The area of these reserves has not yet been fully determined, but the Revenue Survey now at work will

be able to supply the information at an early date. I think, however, that 6,000 acres may be taken as representing approximately the total demarcated area up to date.

25. The reserves cover and protect the crests of the principal hill-chains and have been established, wherever practicable, throughout the island. The reserves contain, for the most part, trees or shrub, and require but little, if any, planting.

26. Twenty-three miles of boundary line have been opened during the year, the rugged nature of the hill-sides offering many obstacles to progress as the work proceeded. The breadth and nature of the line cut is the same as detailed in my report of last year. Little further demarcation can be done in Penang, the chief work which now remains is the placing in position of boundary-marks, for which purpose stones have been already procured and properly lettered.

Watershed of Town Rivers.

27. The proposal to re-wood the watershed of the river which supplies the town with drinking water was abandoned after much survey and labour, it is said, through want of funds. A paper came under my notice during the year in which Dr. HAMPSHIRE called attention some eight years ago to the pollution of the river by Chinese squatters on the watershed, and it is to be regretted that, after so much labour, a remedy could not be found for the evil, which now extends over nearly the whole catchment area of the river, whereas when Dr. HAMPSHIRE wrote the clearings made were very few. It is earnestly to be hoped, however, that so important a subject will not be left in abeyance any longer than the financial position of the Settlement may render absolutely necessary.

Protection.

28. Notices in Chinese, Tamil, and Malay have been posted on the boundary lines informing people of the nature of the reserves and forbidding trespass. Three watchmen have been at work throughout the year, located in quarters erected for them on the hills last year. They have succeeded in preventing any serious encroachment on the reserves, as well as having kept the boundaries opened last year in proper order. They made four arrests, and obtained two convictions.

Nurseries.

29. The Bungalow-Garden on Government Hill was placed under the control of the Forest Department in March, and has been utilised for the accommodation of plants which require a low temperature. The addition of this garden gives the Department as complete a range for experiment as can be obtained within the Colony, and the course proposed is to place plants on their first arrival from temperate countries into the hill top nursery, and, by taking them down through the other nurseries, gradually acclimatize them for cultivation on the lower plains.

30. Four hundred and fifty kinds of seeds, and a great variety of plants, have been introduced during the year; included among the latter were peaches, figs, olives, oranges, apples, pears, apricot, cherries, &c. The growth of nearly all has exceeded expectation. A large assortment of vegetables, both native and foreign, have been tried and grown to great perfection in the intermediate hill nursery; some of which were sent to Singapore and arrived in perfect condition. *Vide* Botanic Gardens Report for 1886.

Waterfall Nursery.

31. The economic plants introduced into the Waterfall Nursery have mostly grown well. The following are measurements of a few planted only twelve months ago, viz.:—Ceara rubber (*Manihot glaziovii*) 15 to 20 feet; Para rubber (*Hevea Braziliensis*) 7 to 9 feet; Teak (*Tectona grandis*) 5 to 10 feet. Teak grows better in Penang than in any of the other Settlements, which the comparative absence of laterite in the soil accounts for.

32. The principal work of the year in this nursery consisted in planting, construction of bridges, roads, lawns, and the planting of shrubberies, &c. It has been much visited by the public for recreation. The site contains many natural beauties hardly equalled elsewhere, and with a little further expenditure could be made very picturesque and attractive. Requisitions for trees for roadside and other planting have been met by this nursery, and some 11,500 plants have been supplied.

Specimens for Colonial and Indian Exhibition.

33. Forty-three samples of timber and forty-seven of fruits have been prepared for the Colonial and Indian Exhibition after considerable labour, and forwarded to London.

Mr. CURTIS, the Assistant Superintendent, who has worked with great energy and enthusiasm, collected on his various rounds one thousand eight hundred herbarium specimens of the flora of the Island. So far as these have been determined, the order Dipterocarpeæ appears much more largely represented in Penang than has hitherto been known. The order yields excellent timber, oils, resins, &c. The specimens of timber prepared for the Exhibition have also shewn that a larger percentage of valuable timber exists in the Island reserves than has hitherto been credited, and although these exist at present mostly as small trees, they constitute an element of growing value which will benefit the Island at no distant future.

PROVINCE WELLESLEY.

Selection of Reserves.

34. The active forest operations in Penang has hitherto prevented much being done in Province Wellesley. A beginning was, however, made during the year, and 72 acres of land reserved in the interior of the country, four acres of which reserve have been planted with about 8,000 trees from Penang nurseries. Two have been dressed into nursery order for the reception of seeds, &c. A large collection of sugar-cane and dadup cuttings have been planted in this nursery for local supply.

I would here point out that, although forestry proper is kept in view, and worked up to as the primary object of the Forest Department, it nevertheless assists, by means of its nurseries, the agriculture of the Colony generally, of which forestry is but a branch.

Special Forest Tours.

35. Three special tours in search of plants and information were undertaken during the year. In January, I visited Pêrak, accompanied by Mr. CURTIS, and after inspecting the various Government gardens, we ascended Gunong Bubu, and made a large collection of plants, both as dried and living specimens. In November, I visited, with Mr. CURTIS, the Achinese pepper plantations at Arakudah near the boundary of Kêdah; and in December, Mr. CURTIS made a short trip to Lower Pêrak, and brought back a large collection of plants required for various purposes.

Summary.

36. In conclusion, I would briefly summarize the more important works of the year in the three Settlements, viz. :—Area demarcated, 17,455 acres. Surveyed, 8,865 acres. Length of boundary opened, 61 miles, at a cost of about \$62 per mile, and five miles planted with fast-growing trees. Length of boundary kept up of previous year's demarcation, 46 miles. Area protected, 22,753 acres, being about an average of 1,202 per watchman employed. Buildings erected, 7, being 4 permanent and 3 temporary. Area planted, 59 acres; weeded, 64 acres. Weeding and planting taken together cost about \$13 per acre. Number of plants propagated, 180,000, at an average cost of \$9 per 1,000. Number of specimens for Colonial and Indian Exhibition, 271. Number of Herbarium specimens collected, 4,389. Seeds collected, 300 lb. Received from India, 86 lbs. Number of prosecutions for illicit tree-cutting, 23. Number of convictions obtained, 15. Area added to nurseries, 9 acres.

37. The annexed Comparative Statement shews the progress of the principal works since the commencement of the Department in 1884, exclusive of erection of quarters and purchase of lands.

38. A Statement shewing the Revenue and Expenditure of the year is also annexed.

N. CANTLEY,
Superintendent.

20/82

Comparative Statement shewing the principal works carried out since the commencement of the Forest Department in 1884.

YEAR.	SINGAPORE.							MALACCA.						PENANG.					PROVINCE WELLESLEY.									
	Contemplated.	Demarcated.	Boundary opened.	Surveyed.	Waste Lands planted.	Nurseries made.	Protected.	Contemplated.	Demarcated.	Boundary opened.	Surveyed.	Waste Lands planted.	Nurseries made.	Protected.	Contemplated.	Demarcated.	Surveyed.	Boundary opened.	Waste Lands planted.	Nurseries made.	Protected.	Contemplated.	Demarcated.	Boundary opened.	Surveyed.	Waste Lands planted.	Nurseries made.	Protected.
	Acres.	Acres.	Miles.	Miles.	Acres.	Acres.	Acres.	Acres.	Acres.	Miles.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Miles.	Acres.	Acres.	Acres.	Acres.	Acres.	Miles.	Acres.	Acres.	Acres.	Acres.
1884,	14,000	1,463	16	...	50	7	1,453	42,000	...	...	2,000	...	4	...	6,000	3,000	...	30	...	16	3,000	20,000	...	...	...	...	...	...
1885, ... ..	...	4,383	13	...	55	7	7,299	...	10,000	22	8,865	...	...	13,000	...	3,000	...	23	...	...	6,000	...	72	3	...	4	272	
Total,	14,000	5,846	29	...	105	14	7,299	42,000	10,000	22	10,865	...	4	13,000	6,000	6,000	...	53	...	16	6,000	20,000	72	3	...	4	272	

Settlements Generally, for both Years.

Total Contemplated, ...	...	...	82,000 Acres
Do., Demarcated, ...	...	...	21,918 ,,
Do., Planted, ...	...	...	109 ,,
Do., Under Protection, ...	...	...	26,371 ,,
Do., Eight-foot Boundary-line opened, ...	...	...	107 Miles.

REVENUE AND EXPENDITURE OF THE FOREST DEPARTMENT,
STRAITS SETTLEMENTS, 1885.

R E V E N U E .

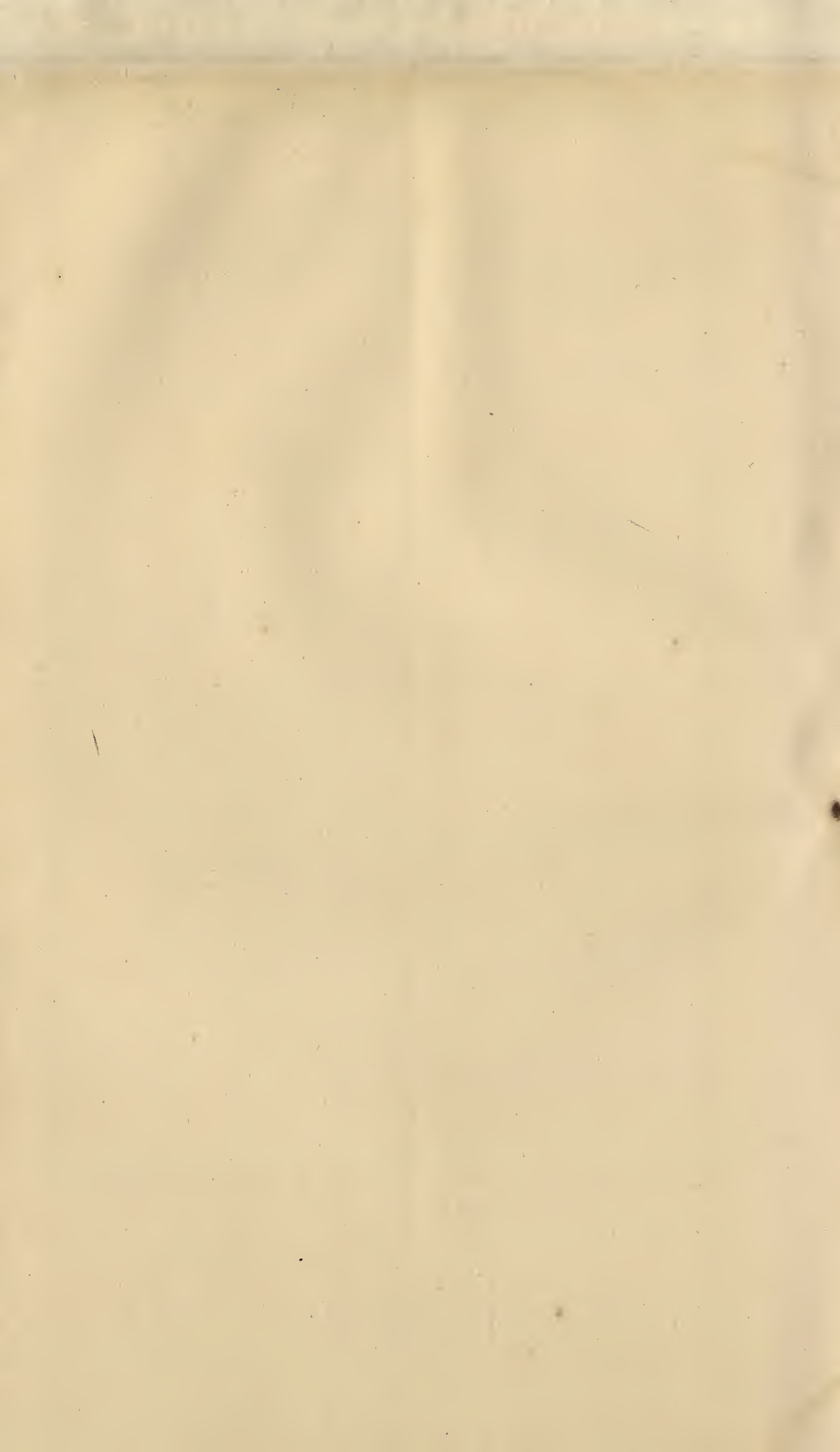
			\$
Government Grant, Singapore, ...	...	...	7,000
Do. Penang, ...	...	...	7,200
Do. Malacca, ...	...	...	5,800
			\$20,000

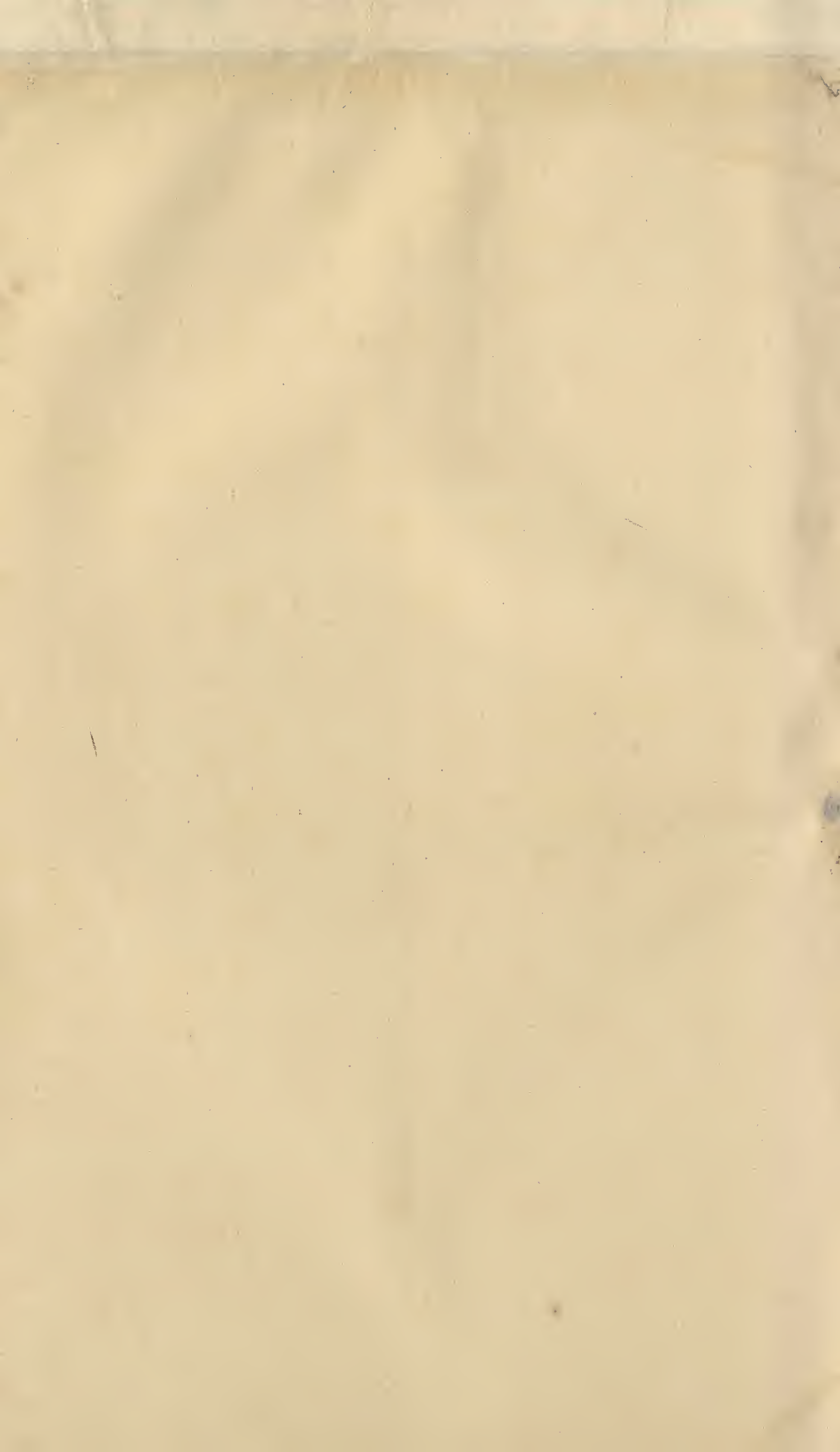
E X P E N D I T U R E .

	SINGAPORE	PENANG.	MALACCA.	
	\$ c.	\$ c.	\$	c.
Salaries, ...	1,534.64	2,601.26	1,391.00	
Demarcation of Reserves, ...	1,610.83	1,261.61	758.80	
Planting Waste Lands and Weeding, ...	1,057.79	522.60		
Formation and Up-keep of Nurseries, ...	974.00	746.34	405.81	
Erection of Quarters, ...	225.00		637.00	
Purchase of Land, ...			260.00	
Survey Fees, ...			511.31	
Road-making, ...			299.10	
Manure and Cartage, ...	143.25	53.20		
Foreign Seeds and Plants purchased, ...		131.76	36.10	
Herbarium Specimens and collecting Seeds, ...	200.00			
Transport, ...	477.03	432.00	424.71	
Rent, ...		420.00	120.00	
Personal Field Allowance, ...		530.14	591.51	
Uniforms, Tools and Implements, ...	313.03	255.66	11.30	
Miscellaneous and Petty Expenses, ...	464.41	245.00	353.36	
Balance,...	0.02	0.43		
Total,...	\$7,000.00	\$7,200.00	\$5,800.00	\$20,000

Nursery Garden for Colonial Products, Penang.

Government Grant, ...	...	...	\$2,000.00
EXPENDITURE, ...	{	Overseer, ...	215.00
		Coolies ...	1,467.69
		Tools and Materials, ...	98.52
		Manure and Cartage, ...	80.80
		Miscellaneous, ...	137.99
<i>Total, ...</i>			\$ 2,000.00





ANNUAL PROGRESS REPORT OF THE ASSISTANT SUPERINTENDENT OF FORESTS, PENANG, FOR THE YEAR 1885.

I. —FORESTS.

THE demarcation of reserves, commenced in 1884, was continued during the past year, and, so far as the island of Penang is concerned, is now almost completed.

2. The number of reserves demarcated during the year are four, viz., Bukit Batu Feringhi, Bukit Laksamana, the Highlands; and that portion of the island to the north-west of a line drawn from the sea coast near Teluk Bahang, to the sea near Pantei Acheh on the opposite side.

3. These reserves are, for the most part, covered with small timber or scrub, and contain very little bare land requiring planting.

4. The length of line opened during the year is twenty-three miles, which, together with that previously done, makes a total of fifty-three miles.

5. It having been decided that nothing can be done towards purchasing the bare land over the watershed, for the purpose of re-afforestation, the line from Bukit Timah to the Cooly-lines half way up Government Hill has been carried above the cleared land to the back of Bukit Padre, thus completing the circle of the main range which was left unfinished in 1884, pending the settlement of this question then before the Government.

6. A small staff of Forest watchmen have been at work since March, and are stationed at Penara Bukit, Teluk Bahang, and half way up Government Hill. This staff will require strengthening as the area to be guarded has been considerably extended since they were first engaged.

7. Notices in Chinese, Tamil, and Malay, have been posted along the boundary lines, informing cultivators and others that licenses to cut timber, &c., issued by the Land Office, are of no avail within the reserved area, and have led to the boundary being generally respected.

PROVINCE WELLESLEY.

8. Hitherto the limited means at our disposal prevented operations being carried across the strait, the demarcation of hill ranges in Penang being of the first importance, but during the past year a commencement has been made in Province Wellesley.

A plot of land of seventy-two acres has been taken over, about two acres of which has been cleared to serve as a Forest-tree nursery.

9. A demand for *Dedap* having arisen among the Achinese planters near the boundary, to enable them to extend the cultivation of pepper, seven thousand plants have been planted on a portion of this land, and another portion planted with teak, merbau, &c., for trial.

10. In November, Mr. CANTLEY being in Penang on inspection duty, I accompanied him to Ara Kuda, to examine the pepper plantations that have been made there, and owing to the heavy rains we had to wade through water from three to five feet deep for over half a mile both in going and returning, and the rivers were crossed with great difficulty.

11. At the time of our visit, the crop was looking very promising, and the planters spoke cheerfully of their prospects, but only a small quantity has yet been exported, as most of the plantations are comparatively new.

12. Six hundred (600) samples of the Flora of Penang have been collected in triplicate, and sets forwarded to the Botanic Gardens, Singapore, and the Royal Gardens, Kew; and an examination of these proves that many new and undescribed plants are still to be found in this island.

13. A cabinet has been purchased, in which the specimens kept for reference in Penang are arranged in their proper order, and it is hoped that the Government will eventually provide a suitable place in which these, and other objects of Forest produce and Natural History, may be placed and made available for the whole community.

14. Much labour has been entailed in connection with the collection and preparation of articles for the Indo-Colonial Exhibition, including samples of timbers in transverse sections and wild and cultivated fruits in glass bottles, as detailed in Annexure *A*.

15. Two journeys have been undertaken during the year for the purpose of collecting plants and seeds and obtaining information as to the vegetable products of the Native States.

On the first occasion, I accompanied Mr. CANTLEY to Pêrak, where we ascended Gunong Bubu, and Gunong Pondok, near Kuala Kangsa and Maxwell's Hill near Thaipeng. Many interesting plants were collected during this trip, which are growing well in the Experimental Nursery on Penang Hill.

16. The second trip was made in November, when I proceeded to Têluk Anson and up the Sungkei river for the purpose of collecting orchids, &c., which were needed to exchange for foreign plants and seeds.

I intended during this trip to have visited the Slim range of hills, but owing to my leave of absence from Penang being very limited, I found it impossible to carry out that intention.

With the kind assistance of Mr. DENISON, Superintendent of Lower Pêrak, I succeeded in obtaining the plants required, and brought back a fine collection in good condition.

II.—GARDENS AND NURSERIES.

17. Planting in the Experimental Nurseries would have been commenced in January had the weather been favourable, but, owing to the unusually prolonged drought, nothing could be done to this until April.

18. As soon as the rains commenced, the necessity of covering the slopes to prevent the banks washing away was made manifest; and as bringing turf from the foot of the hill is a very expensive undertaking, a coarse grass was collected along the edge of the jungle which has grown well and answers the purpose admirably.

19. A great number of plants and seeds have been introduced during the year, and much valuable information gained as to the kinds most likely to succeed in this climate.

These include fruit trees and economic plants from Australia, India and China; and a great variety of trees and shrubs from other parts, a list of which is appended. Annexure *B*.

HILL NURSERY.

20. Among fruit trees that have grown well and promise to succeed here, may be mentioned peaches, figs, olives and oranges. Many other European fruits have exceeded our anticipations in this Nursery, but a sufficient time has not elapsed to form an opinion of the ultimate result.

21. The selection and improvement of the best native fruits has been kept in view, and many kinds are planted in the Nursery.

22. A collection of vegetable seeds was received from England in February, and a portion at once sown, but, owing to the unfavourable state of the weather, did not prove a great success.

A second sowing, made a few weeks later, proved that, in favourable seasons, many European vegetables can be grown here with but little trouble.

A list of the kinds that have grown best is shown in Appendix *C*.

23. The general result, points to the conclusion that quick-growing kinds, such as are sown in England for a first crop, are best suited for this climate, and very late kinds the least so.

Carrots, parsnips, beet, tomatoes, spinach, endive, lettuce and radish grow freely.

24. The great drawback to maintaining a constant and regular supply is the great difficulty of preserving, for any length of time, the vitality of seeds, but this could be overcome by giving a standing order for small quantities to be sent out from England three or four times a year.

25. In March, the Government Bungalow grounds on the hill top, at an altitude of 2,500 feet, were placed under the Forest Department, and made available for extended experimental work.

It is found that some plants do better in exposed than sheltered positions, and advantage has been taken of the hill-top to arrange the collection accordingly.

26. The flower beds on the upper terrace in front of the corridor have been replanted, and attention paid to the collection of plants in pots.

WATERFALL GARDEN.

27. The formation of a garden at the waterfall, commenced in October, 1884, has been pushed on during the past year, the work consisting principally in the completion of roads and bridges, and in turfing and planting the ground already cleared.

28. As in the case of the Experimental Nursery, the drought prevented planting operations being commenced until April, and in the meantime the roads were got in good order, and holes prepared for the reception of trees.

29. With the first rains, planting commenced in earnest, and to the end of the year three thousand trees, shrubs, &c., of various kinds, had been put out in ground specially prepared.

30. A collection of economic plants have been planted in a portion of land adjoining the nursery, and include many plants of commercial

value; such as Cinnamon, Camphor, Kola Nut, Liberian Coffee, and American and African Rubbers.

31. The rate of growth of trees planted in April is so far satisfactory, as the following measurements, taken in December, will shew:—

Ceara rubber (*Manihot Glaziovii*) 15 to 20 feet high.

Para rubber (*Hena Brasiliensis*) 7 to 9 feet high.

Teak (*Tectonia grandis*) 5 to 10 feet high

Mahogany (*Swietenia mahagoni*) 5 to 6 feet high.

Bintangore (*Calophyllum inophyllum*) 6 to 7 feet high.

Liberian Coffee (*Coffee Liberica*) 2 to 2½ feet high.

32. The Municipal Commissioners, realising the benefit to the community of this garden, which has already become a favourite place of public resort, voted the sum of \$200 towards improvements near the entrance—a work that had been deferred for want of money on the Government grant.

33. With this assistance, the ground on the river side of the entrance has been put in order, and the whole turfed and planted with flowering plants, palms, &c. The road has also been considerably raised and put in good order.

34. Temporary seats were used for a time, but towards the end of the year eight good garden seats were placed in the grounds and are much appreciated by visitors.

35. The collection of plants in pots have been largely increased during the year, but no permanent plant-house has yet been erected, the collection being protected by temporary structures.

36. The propagation of trees and shrubs for roadside and public buildings has been carried on here, and three thousand five hundred 3,500 plants sent out, in addition to those used for planting the grounds within the garden. Several thousands are still available.

37. Much remains to be done in order to complete this garden, and, until the south side of the river is cleared and laid out somewhat on the same lines as the present scene of operations, the work cannot be considered in any way finished.

38. The removal of the old gate-house, and the erection of a substantial gateway in line with the main road from town, is much needed, the present entrance being entirely out of keeping with the interior.

I have, &c.,

C. CURTIS,

Assistant Superintendent,

Forest Department.

RECEIPTS AND EXPENDITURE OF THE FOREST
DEPARTMENT, PENANG, 1885.

<i>Receipts.</i>		<i>Expenditure.</i>
I.—FORESTS.		
Government Grant,	\$7,000.00	Assistant Superintendent, \$1,500.00
Transferred from Malacca		Overseers, 504.00
Forest Vote, ...	200.00	Forest Watchmen, ... 340.36
		Carpenter, 73.40
		Messenger and Plant Col- lector, 183.50
		Coolies demarcating Re- serves, 1,261.61
		Coolies clearing and plant- ing, P. W., 522.60
		Coolies, Experimental Nursery, 746.34
		Tools and Material, ... 161.66
		Plants Seeds, etc., ... 131.76
		Manure, 53.20
		Uniforms, 94.00
		Miscellaneous, ... 245.00
		<i>Allowances.</i>
		Superintendent, Travel- ling and Personal, ... 365.40
		Assistant Superintendent, Travelling and Personal, 164.74
		Assistant Superintendent, Pony Allowance, ... 432.00
		Assistant Superintendent, House Rent, 420.00
		Balance, .. 0.43
	<u>\$7,200.00</u>	<u>\$7,200.00</u>

II.—GARDENS.

Government Grant, ...	\$2,000.00	Overseer, \$215.00
		Coolies, 1,467.69
		Tools and Material, ... 98.52
		Manure and Cartage, ... 80.80
		Miscellaneous, ... 137.99
	<u>\$2,000.00</u>	<u>\$2,000.00</u>

ANNEXURE A.

List of Articles prepared for the Colonial and Indian Exhibition, 1886.

LOCAL NAME.	BOTANIC NAME.	REMARKS.
<i>I.—Timbers.</i>		
Damar laut, No. 1,	... Shorea sp. ✓	... The best timber in the Straits.
}, daun besar,	... " "	...
Rengkong,	... Anisopteris Curtisii, Dyer.	... New sp.
Tankang,	... Hopea mengaranan, Mig.	...
Meranti sutra,	... Shorea sp.	...
,, tai,	... ,, Curtisii, Dyer.	... New sp.
,, merah,	... ,, sp.	} In common use for many purposes being very easy to work.
,,	... ,, parvifolia, Dyer.	
Tampaya mas, Serâya	... ,, sp. ? ... ,, serecia, Dyer.	
Pinang baik,	... Vatica, sp. ?	} Almost as good as dam- marlaut; largely used for house-building.
Chengi, Beangan,	... Dipterocarpaceæ. ... Castanopsis Suma- trana.	
,, babie,	... Quercus umbonata, Hance.	... Common on the hills.
,, "	... Quercus oidocarpa, Korth.	
,, "	... Quercus, sp.	
,, "	... Quercus, sp.	
Rêngas,	... Melanorrhœa Cur- tisii, Oliver.	... New sp.
Moopoo,	... Swintonia spicifera, Hk. f.	
Klêdang,	... Artocarpus sp.	
Tarrap,	... ,, Blumei.	
Kranjie,	... Dialum Maingayii, Baker.	
Kayu kelat,	... Eugenia Zeylanica, Wight.	
Krean batu,	... Eugenia sp.	
Bëntangor batu,	... Calophyllum pul- cherrimum,	... Used for masts, spars, &c.
Monkoyan,	... Rhodamnia triner- va, Bl.	
Matopus,	... Mesua ferrea, L.	... Iron wood.
Damar hitam,	... Dipterocarpaceæ.	
Mirbean,	... Sindora Wallichii, Benth.	
Kompas,	... Koompassia Malac- censis, Maingay.	
Tampînis,	... Sloetia sideroxylon.	... Much sought after on ac- count of its durability.

List of Articles prepared for the Colonial and Indian Exhibition, 1886.—Contd.

I.—Timbers.—Contd.

LOCAL NAME.	BOTANIC NAME.	REMARKS.
Jelutong,	... <i>Dyera costulata</i> ,	Very light wood.
Mongkondook,	... <i>Macaranga</i> sp.	
Kayu-rue-bukit,	... <i>Dacrydium elatum</i> , Wall.	
Damar,	... <i>Dammara orientalis</i> , <i>Schima crenata</i> , Korth.	
Tëmûsu,	... <i>Fagraea Wallichiana</i> , Benth.	... Excellent for posts.
Palawan,	... <i>Tristania Maingayii</i> ?	
Dedap,	... <i>Erythrina indica</i> , Lamk.	
Rumania,	... <i>Bouea microphylla</i> , <i>Englehardtia Wallichiana</i> , L.	
Angesana,	... <i>Pterocarpus indica</i> , Lank.	Good tree for road-side planting.
Chëndërie,	... <i>Grewia paniculata</i> , Rox.	
Merawan,	...	
Bâkau,	... <i>Rhizophora</i> sp.	
Nyëreh,	... " sp.	
Api-Api,	... <i>Lumnitzera coccinea</i> .	

II.—Wild and Cultivated Fruits, &c.

Alia,	...	... <i>Yingiber officinale</i> . Ginger.
Amrah,	...	... <i>Spondias dulcis</i> Cultivated.
Bëangan,	...	... <i>Castanopsis Sumatрана</i> Eaten roasted.
Buah Tanjong,	...	... <i>Mimusops Elengi</i> .
Buah Pala,	...	... <i>Myristica fragrans</i> . Cultivated nutmeg.
„ hutan,	...	... „ sp. 1. ... Wild nutmeg.
„ „	...	... „ sp. 2. ... „
Bingie,	...	... <i>Mangifera cæsia</i> Used for curries, &c.
Buah Sou,	...	...
Chemekey,	...	... Seeds of <i>Citrillus vulgaris</i> Eaten.
Cacao,	...	... <i>Theobroma cacao</i> .
Duko,	...	... <i>Lansium domesticum</i> .
Durian,	...	... <i>Durio Zebthinus</i> Favourite fruit of the Malays.
Jamboo Mawar,	...	... <i>Eugenia jambos</i> Rose apple.
Jermie,	...	... <i>Sicca disticha</i> .
Kranji,	...	... <i>Dialum Maingayii</i> . Large tree.
Krean,	...	... <i>Eugenia thumra</i>

List of Articles Prepared for the Colonial and Indian Exhibition, 1886.—Contd.

II.—Wild and Cultivated Fruits &c.—Contd.

LOCAL NAME.	BOTANIC NAME.	REMARKS.
Klédang, ...	... Artocarpus sp.	
Kadongdong,	... Spondias sp.	
Karmunting,	... Rhodomyrtus to- mentosa.	
Kandis, ...	... Garcinia sp. } ... Wild mangosteen.	
Langsa, ...	... Lansium domesti- cum.	
Mata Ayam,	... Mangifera Indica.	
Mamplam, ...	... Cynometra cauliflo- ra.	
Nam-Nam, ...	... Garcinia mangos- tana.	
Manggis, ...	... Maranta arundi- naria.	
Nangkelang,	... " " "	
Ubie Arrowroot,	... Nephelium muta- bile.	
Pulasan, ...	... Areca catechu. } Fresh gathered and prepar- ed for chewing.	
Pénang hidop,	... " " }	
„ Kachape,	... Nephelium lappa- ceum.	
Rhambotan,	... Pierardia dulcis.	
Rambei, ...	... Flacourtia cata- phracta.	
Rokum, ...	... Xrospermum No- ronhianum?	
Rapdah, ...	... Bouea microphylla.	
Rumania, ...	... Zalacca edulis.	
Salak, ...	... Chavica betel. ... Used with betel-nut.	
Sirih, ...	... Sandoricum Indi- cum.	
Sentiol, ...	... Artocarpus rigidus.	
Tamponey, ...	... " Blumii.	
Tarrap, ...	... Hedycarpus Mala- yanum. ... Jungle fruit.	
Tampoie, ...	... Flacourtia inermis.	
Tomi-Tomi,	... Artocarpus sp.	
Tampang. ...	... Calosanthes Indica. Disoxylon sp. Eugenia sp. Parinarium asperu- lum. Fibraurea tinctoria. Vitis sp.	
	... Smilax glabra.	
Nieor or Klapa,	... Cocos nucifera.	
Durian hutan,	... Durio sp. ... Wild durian.	
„	... Durio Malaccensis,	
Gula Gereh,	... " " ... Palm Sugar.	
Kachang Jawa,	... Arachis hypogæa, Ground-nut.	

Annexure B.

List of Plants and Seeds introduced by the Forest Department, Penang, 1885.

BOTANIC NAME.	REMARKS.
Abutilon Boule-de-neige, ...	Growing well.
Acacia pendula, ...	Do.
„ simplex, ...	„
„ decurrens, ...	„
„ odoratissima, ...	„
„ cyanophylla, ...	„
Acalypha marginata, ...	„
„ tricolor, ...	„
Acanthus mollis, ...	„
„ sp., ...	„
Achras Australis, ...	„
„ Sapota, ...	Sapodilla Plum
Adiantum capillus veneris, ...	„
„ Farleyense, ...	„
Amaryllis reticulata, ...	„
„ hybrids, ...	Many kinds.
Ægle marmelos, ...	„
Aglaia, odorata, ...	„
Aganis marginata, ...	„
Aleurites triloba, ...	Kumerie. Yields an oil.
Albizzia Lebbek, ...	Grows well.
Amygdalus communis, ...	Almond. Growing well.
Alyxia ruscifolia, ...	„
Alsophila excelsa, ...	„
Alchornia ilicifolia, ...	„
Amaranthus Henderii, ...	„
„ Prince of Wales, ...	„
Amherstia nobilis, ...	„
Amygdalus Persica, ...	The Peach. Very promising.
Angophora intermedea, ...	„
„ lanceolata, ...	„
Anigosanthus Manglesii	„
Atirrhinum, ...	Growing and flowering freely.
Anemone Japonica, ...	„
Anthurium crystallinum, ...	„
„ Harrisii, ...	„
„ candidum, ...	„
Aquilegia, ...	„
Aralia Sieboldii, ...	„
„ reticulata, ...	„
„ Guilfoylei, ...	„
Artimesia Chinensis, ...	„
Arbutus unedo, ...	Strawberry tree.
Areca Bancrui, ...	„
Aucuba Japonica, ...	„
Auricula (Primula auricula),	} Growing well.
Agaphantus, umbellatus,	
„ albus, ...	
„ folio var.,	„
Achimenes, ...	„

List of Plants and Seeds introduced by the Forest Department, Penang, 1885.—Contd.

BOTANIC NAME.	REMARKS.
Auricularia Cunninghamii,	} Growing well.
„ Cookii, ...	
„ excelsa, ...	
„ Bidwellii, ...	
Bauhinia acuminata,
„ purpurea,
„ sp. Mauritius,
Bambusa arundinaria,
Baloghia lucida
Barleria cœrulea,
„ „ alba,
Banksia grandis,
Balsam challenger, ..	Varieties.
Begonia; many sps. and varieties,
Beaufortia decussata,
Bignonia chelinoides,
„ sp.
Biota orientalis,
Bougainvillea argentea,
Brachysema lanceolata,
„ subcordata,
Browallia elata,
Brucea Sumatrana,
Brassaia actinophylla,
„ actinodendron,
„ cinera,
Brownea antiginensis,
Bussaria spinosa,
Buddleia Lindleyana,
Buxus sempervirens, ...	Box tree.
Caryota urens,
Callistemon liniaris sobolifera,
„ brachyandrus,
„ lanceolata,
„ rigidus,
„ regulosus,
„ speciosus,
„ salignus,
Casuarina distyle,
„ Cunninghamii,
„ glauca,
„ torulosa,
Carumbium populifolium,
Cassia erinophila,
„ fistula,
„ glauca,
Candollia sp.
Calla Æthiopica, ...	Lily of the Nile.
Capsicum, Prince of Wales,
Carnation, ...	Grows well.
Canna, varieties,
Camellia, ...	Has flowered.

List of Plants and Seeds introduced by the Forest Department, Penang, 1885.—Contd.

BOTANIC NAME.	REMARKS.
Calanthe vistola, ...	...
Caladium sp., ...	...
Carex sp., ...	...
Castanospermum Australis, ...	Moreton Bay Chestnut.
Capparis Mitchellii, ...	{ ...
Coesalpinia nuga, ...	{ ...
" vernalis, ...	{ ...
Carissa carandus, ...	Fruit edible.
Caryophyllus aromaticus, ...	Clove. New stock from Java.
Celosia pyramidalis, ...	...
Celosia Huttonii, ...	...
Cerasus vulgaris, ...	Cherry. Growing well.
Celtis sinensis, ...	...
Centrosolina bullata, ...	...
Ceratopetalum opetalum, ...	...
Chirita sp., ...	...
Chloranthus inconspicuus, ...	...
Chrysanthemum carinatum, ...	...
" large flowered, ...	...
Chorizema cordatum, ...	...
" ilicifolium, ...	...
Citrus Australis, ...	} Orange. Many good varieties received from Australia.
" aurantium, ...	
Cissus discolor, ...	...
Clematis flammula, ...	...
" aristata, ...	...
Clusia rosea, ...	...
Clianthus punicens, ...	...
Clerodendron tomentosum, ...	...
Cola acuminata, ...	Kola-nut.
Corypha Australis, ...	...
Coleus, ...	...
Cockscomb, ...	...
Cobea scandens, ...	...
Cookia punctata, ...	Wampee.
Cordyline sp., ...	...
Corylus avellana, ...	Filbert.
Crowea augustifolia, ...	...
Crossandra undulœfolia, ...	...
Cuphea eminens, ...	...
Cydonia vulgaris, ...	The Quince.
Cryptocarpa Australis, ...	...
Cryptomeria Japonica, ...	...
Cyclamen persicum, ...	...
Cyrtostachys rendah, ...	...
Dahlia, varieties, ...	Single and double in variety.
Dandelion, ...	Grows well.
Delphinium, varieties, ...	Larkspur.
Digitalis, ...	Fox-glove. Growing well.
Diospyros Kaukii, ...	"Pisang Kakie;" from China.
Diffenbachia, ...	...
Disoxylon Fraserii, ...	...

List of Plants and Seeds introduced by the Forest Department, Penang, 1885.—Contd.

BOTANIC NAME.	REMARKS.
Diprothemium Maritianum, ...	Fruit edible.
Dianthus Chinensis, ...	Growing well.
Doryanthes Palmerii, ...	
„ excelsa, ...	
Dracaena goldiana, ...	
„ many varieties, ...	
Dyandra floribunda, ...	
Drymonia sp., ...	
Duranta Ellisii, ...	
Elœacarpus serratus, ...	Growing well.
Erythrina Cristagalli, ...	
Erythroxyton coca, ...	Coca. Growing well.
Eranthemum tricolor, ...	
„ pulchellum, ...	
„ hypocratifforme, ...	
Eriobotrya Japonica, ...	The Loquat. Growing well.
Eupatorium aypannah, ...	
Engenia Brasiliensis, ...	Grows well, has fruited.
„ Ventanatii, ...	
„ parvifolia, ...	
„ Australis, ...	
Eucalyptus, 26 species, ...	Several kinds growing freely.
Eucharis candida, ...	
„ Sanderii, ...	
Faradaya Papuana, ...	
Fittonia rubro-nervia, ...	
Ficus Porcellii, ...	
„ Australis, ...	
„ macrophylla, ...	
„ carica, ...	The Fig. Very promising.
Frenela rhomboidea, ...	
„ Macleayana, ...	
„ robusta, ...	
Gardenia Thumbergii, ...	
„ florida, ...	
„ globosa, ...	
Garcinia Livingstonii, ...	African mangosteen.
Geranium, ...	
Geitonoplesium cymosum, ...	
Grevellia robusta, ...	
Gladiolus, ...	Flowered well.
Gloxinia, varieties, ...	
Gymnogramma Japonica, ...	
Grewia Asiatica, ...	
Hardenbergia monophylla, ...	
Hakea. 12 species, ...	
Hobrothannus elegans, ...	
Heliotropium, ...	
Hippeastrum sp., ...	
Hibiscus splendens, ...	
„ heterophyllus, ...	
„ mutabilis, ...	

List of Plants and Seeds introduced by the Forest Department, Penang, 1885.—Contd.

BOTANIC NAME.	REMARKS.
<i>Humea elegans</i> ,
<i>Hypericum Chinensis</i> ,
<i>Hydrangea Japonica</i> ,
<i>Hymenoporum flavum</i> ,
<i>Ilex Paraguayensis</i> , ...	Paraguay Teo.
<i>Impatiens Sultani</i> ,
Indian Pink,
<i>Indigofera coccinea</i> ,
<i>Ipomaea variegata</i> ,
„ <i>tuberculata</i> ,
<i>Jasminum gracillimum</i> ,
„ <i>sp. nov.</i> ...	Collected in Pêrak.
<i>Jacquemontia violacea</i> ,
<i>Jatropha sp.</i> ,
<i>Justicia guttata</i> ,
„ <i>sp.</i> ,
<i>Kadsura Chinensis</i> ,
<i>Kempferia regeliana</i> ,
„ <i>rubicunda</i> ,
<i>Kentia Belmoriana</i> ,
„ <i>Forsteriana</i> ,
„ <i>Canterburyana</i> ,
<i>Lavendula spica</i> , ...	Lavender. Grows well.
<i>Laurus camphora</i> , ...	Camphor-wood.
<i>Landolphia Kirkii</i> ...	African Rubber. Growing well.
<i>Tagunaria Patersonii</i> ,
„ <i>ptospermum scoparium</i> ,
„ <i>lavegatum</i> ,
„ <i>flavescens</i> ,
<i>Lilium longiflorum</i> ,
„ <i>tigrenum</i> ,
„ <i>lancifolium</i> ,
„ <i>auratum</i> ,
„ <i>martagon</i> ,
„ <i>Scovtzianum</i> ,
<i>Livistona sinensis</i> ,
<i>Linum grandiflorum</i> ,
<i>Ligustrum sp.</i> ,
<i>Lobelia speciosa</i> , ...	} Growing well.
„ <i>cardinalis</i> , ...	
<i>Amaranthus Melancholicus</i> ,
<i>Lupinus</i> ,
<i>Macadamia ternifolia</i> ,
<i>Maranta</i> , several varieties,
<i>Maxmilliana regia</i> ,
<i>Melaleuca cricifolia</i> ,
„ <i>acuminata</i> ,
„ <i>genistifolia</i> ,
„ <i>hypericifolia</i> ,
„ <i>linarifolia</i> ,
„ <i>Griessiana</i> ,
„ <i>decussata</i> ,

List of Plants and Seeds introduced by the Forset Department, Penang, 1885.—Contd.

BOTANIC NAME.	REMARKS.
Melaleuca densa, ...	...
„ stypeloides, ...	...
„ liucadendron, ...	...
Mentha Japonica, ...	...
Michelia fuscata, ...	...
„ champaca, ...	...
Meyenia Vogeliana, ...	...
Mimulus hybrids, ...	...
Mignonette, ...	...
Moorea Robinsoniana, ...	...
Monstera deliciosa, ...	... Growing well.
Mormodica charantiee, ...	...
Morus niger, ...	... Mulberry, var. Australia.
Musa textilis, ...	... Manilla Hemp.
Myoporum Cunninghamii, ...	...
Myosotis densiflora, ...	...
Narcissus poeticus, ...	...
Nephelium leiocarpum, ...	...
Nerina Fothergillii, ...	...
Olea Europea, ...	... Olive. Very promising.
Ouvirandra fenestralis, ...	... Lattice-leaf plant.
Oxylobium collistachya, ...	...
Oxalis sensitiva, ...	...
Panax sp., ...	...
„ cochleatum, ...	...
Patersonia sp., ...	...
Papaver umbrosum, ...	... Poppy.
Pavetta Indica, ...	...
Passiflora pectinata, ...	... Passion-flower.
Pandanus Fosterii, ...	...
Petrophila pulchella, ...	...
Pentstemon, many varieties, ...	... Growing and flowering freely.
Petraea volubilis, ...	...
Phyllanthus sp., ...	...
Phormium tenax, ...	... New Zealand Flax.
Phlox Drummondii, ...	... Does well.
Philodendron Carderii, ...	...
„ gloriosum, ...	...
„ lasciniata, ...	...
Phalaenopsis violacea, ...	...
„ Sumatrana, ...	...
„ grandiflora, ...	...
„ amabilis, ...	...
Pholidota Chinensis, ...	...
Phoenix reclinata, ...	...
„ dactylifera, ...	... Date Palm.
Pinus sinensis, ...	...
„ longifolia, ...	... Growing freely.
„ insignis, ...	...
Pimelia spectabilis, ...	...
Pisonia inermis, ...	...
Pittosporum revolutum, ...	...

List of Plants and Seeds introduced by the Forest Department, Penang, 1885.—Contd.

BOTANIC NAME.	REMARKS.
Pittosporum undulatum, ...	
„ rhombifolium, ...	
„ erioloma, ...	
Picotée, ...	
Pimenta vulgaris, ...	Allspice. Growing well.
Pomaderris ligustrum, ...	
Pothos aurea, ...	
Podocarpus latifolius, ...	
„ totarii, ...	
Pourania volubilis, ...	
Primula Japonica, ...	
„ denticulata, ...	
Prunus Armeniaca, ...	Apricot } Planted late in the year. Plum }
„ domestica, ...	
Protea nullifera, ...	
Ptychosperma Alexandreae, ...	
Pyrus malus, ...	Apple. Has made good growth.
„ communis, ...	Peas. Moderate growth.
Quassia amra, ...	
Rannuculus, varieties, ...	
Ratonia tenax, ...	
Randia macrophylla, ...	
Rhus succudanea, ...	
Rhododendron championi, ...	
Rhodolia championi, ...	
Rhyncospermum jasminoides, ...	
Ricinus, ...	
Rivinia humilis, ...	
Rondoletia speciosa, ...	
Rubus Chinensis, ...	
„ idœus, ...	Raspberry.
Sagus rufia, ...	Rofia Palm.
Salix Babylonica, ...	
Salvia pitcherii, ...	} Growing well.
„ splendens, ...	
„ patens, ...	
„ argentea, ...	
Scolopia Chinensis, ...	Flowered freely.
Scolopia Brownii, ...	
Schizanthus, ...	
Scutellaria coccinea, ...	
Sedum sp., ...	
„ Alfredii, ...	
Seaforthia elegans ...	
Senecio sp., ...	
Sollya heterophylla, ...	
Solanum capsicastricum, ...	
„ hybrids, ...	
„ arboreum, ...	Growing rapidly.
Solandra grandiflora, ...	
Spondias pliozyne, ...	
„ mangifera, ...	

List of Plants and Seeds introduced by the Forest Department, Penang, 1885.—Contd.

BOTANIC NAME.	REMARKS.
Spiraea Japonica,
„ palmata,
Spathodea companulata, ...	Growing rapidly.
Sponia velutina,
Sterculia acerifolia,
„ lurida,
„ diversifolia,
„ heterophylla,
„ coccinea,
Stephanotis floribunda,
Stevensonia grandifolia,
Stenocarpus sinuatus,
Stillingia sebifera,
Styrax odoratissima,
Swietenia mahogani, ...	Mahogany. Growing well.
Syncarpia lانسifolia,
Tacsonia Van-Volxemii,
Tarrietia argyodendron,
Tecoma Nepalensis,
„ Australis,
Telopia speciosissima,
Torenia Bailoni,
Tritoma uvaria,
Tropæolum,
Tristania conferta,
Valerian, ...	Flowers freely.
Vanilla aromatica, ...	Growing fairly.
„ planifolia, ...	Do.
Veronica spicata,
Verbena, varieties,
Vitex heterophylla,
Wahlenbergia grandiflora,
Xanthorrhæa sp.,
Zea Mays,
Zinnia elegans,

ANNEXURE C.

List of Vegetables cultivated in the Experimental Nursery, Penang, 1885.

Name.	Variety best suited to this climate.	Remarks.
Asparagus, ...	... Giant, ...	Grows freely but not large.
Beans, ...	...	Failed to set the fruit.
„ runners,	...	Failed.
Beet, ...	... Egyptian Turnip rooted, ...	Did very well.
Borecole, ...	...	} Suffered greatly from the ravages of insects.
Brussels Sprouts,	...	
Cabbage, ...	...
„ sawy,	...	} Grows very freely.
Carrots, ...	... Short Horn, ...	
Cress, curled,	...	} Both kinds grow well.
„ American,	...	
Cucumber, ...	... Telegraph, ...	Fair.
Celery, ...	... Sandringham, ...	Grows freely.
Couve Tronchuda,	...	Fair.
Dandelion, ...	...	Grew well.
Leek, ...	... Musselburgh, ...	Grew well.
Lettuce, ...	... Tom Thumb, ...	Succeeded perfectly.
Melon, ...	...	Failed to set fruit.
Mustard, ...	...	Grew freely.
Onion, ...	... The Queen, ...	Grew well.
Parsnip ...	... The Student, ...	Grew well.
Parsley, ...	... Best curled, ...	Quite acclimatised.
Peas, ...	... Ringleader, ...	Grew well.
Potatoes, ...	... Early Ashleaf, ...	Small; season unfavourable.
Radish, ...	... All the kinds do well,	Grows well. [place.
Radish, Horse	...	Promises to overrun the
Rhubarb, ...	... Myatts Prolific. ...	Grows well for a time, but apt to die off suddenly.
Sage, ...	...	Growing well.
Sea Kale, ...	...	Failed to germinate.
Thyme, ...	...	Growing well.
Tomatoes, ...	... Small and medium kinds best, ...	Grew freely.
'Turnip, ...	... Early French, ...	Other kinds did poorly.

STRAITS SETTLEMENTS.

ANNUAL REPORT

ON THE

BOTANIC GARDENS,
SINGAPORE,

FOR THE YEAR

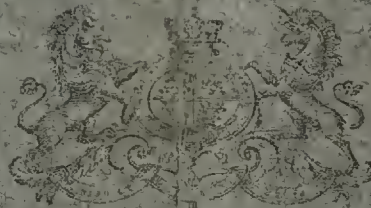
1886

BY

N. CANTLEY,

Superintendent.

PUBLISHED BY AUTHORITY.



SINGAPORE:

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1887.

ANNUAL REPORT ON THE BOTANIC GARDENS, SINGAPORE,
FOR THE YEAR 1886.

During the past year, much progress has been made. The improvements unfinished at the close of the preceding year have been completed, and other new works carried out, as far as the funds available would admit of. Every effort has been made to further improve the appearance of the grounds by the removal of dying, decayed and unsightly trees, the careful pruning of those that remain, and the planting of new ones and flowering plants in suitable positions.

2. *Front Entrance.*—The completion of the front entrance improvements is one of the most striking works of the year. At the close of the year 1885, the new pillars which replaced the heavy masses of masonry which previously did duty as pillars, and the levelling and reduction of the drive to a proper curve, were the only work completed by the Public Works Department.

3. During the year, the greater portion of the grass-bank on the right on entering the gate was shaped into proper form. In this operation, much soil had to be removed, and found a ready receptacle on the opposite side of the drive, which previously sloped southward, but has now been brought up to nearly level; which admits of the flower beds and plants on that side being better presented to the view on entering.

4. The carriage drive, which existed on the right of the entrance, has been reduced to a 6-foot path, as far as the junction with the main interior drive. The area of the lawn on that side has consequently been considerably increased, which gave more scope for arranging and grouping plants, and advantage was taken of this to re-arrange the plants accordingly, and to put down a number of flower beds on each side of the drive for a distance of about 90 yards within the gate; in these beds, Gaillardias and other flowering annuals, mixed with coloured-leaved plants, have done well. To form a back-ground to these, beds of a larger nature have been made and filled with Hibiscus and other plants, which have flowered and greatly contributed to the general effect. The open drain which carried the surface water from the high-ground surrounding the aviaries to near the entrance has been laid down in tile piping, and the surface brought up to the general level. In this operation, about 350 8-inch pipes were used (cost \$28). The new pillars have been painted and topped with handsome globe lamps, which give a finish to the improvements generally as well as the pillars themselves.

5. *Roads and Paths.*—Three hundred and ninety (390) square yards of the main-drive, from nearly on a line with the junction of the small walk leading to the aviaries, to the band-stand, have been re-metalled. The drive surrounding the stand has also been remodelled and heavily coated with laterite. Total area renovated, 2,790 square yards, requiring about 150 cart-loads of laterite. The other drives and walks have been repaired where required, and have been kept in good order.

6. A series of new walks, 6 feet in width and about 400 yards in length in all, have been made, leading from the band-stand to Garden-road, and towards the lake, to admit of easy access to the new fernery, which is being made in that quarter; and about an equal area of old walks had to be closed up to effect the necessary curves and alterations. The road to the Superintendent's quarters and the main drive through the Garden jungle will soon need extensive repairs.

7. *Lawns*.—These have been well looked after during the year under review, but their up-keep is a somewhat expensive item, the state in which they are maintained being quite equal to that of those of any nobleman's garden in Europe, and it is doubtful whether so much attention is paid to lawns in any other Public Garden in the East. The peculiar topography of the Garden admits of no classification, as first and second class lawn, to be kept in order accordingly, hence the expenditure. Where, however, the soil is very poor, bare patches are making an appearance, and top-dressing will soon have to be resorted to.

8. *Flower Beds, Shrubberies, &c.*—A large number of unsightly trees and bushes have been removed from the grounds; other trees have had dead branches cut off, and parasitical plants removed.

9. The removal of those trees has not only relieved the Gardens of untidy objects, but has brought many of the ornamental trees more into prominence.

10. A new shrubbery has been made in front of the bamboo hedge between the office and the front entrance, and may be looked upon as forming part of the improvements carried out in that quarter.

Front Entrance Improvement.—This border has an area of about 6,728 square yards, and in it many of the large specimens removed from the site of the new Fernery Reserve, have been successfully transplanted. Many flowering shrubs have also been added, and its outer edge kept gay with annuals, &c. Another border, with an area of about 80 square yards, has been made between the sago palm clump and the turnstyle entrance. A third, having an area of about 1,000 square yards, has been formed to screen from view the reserve for the new Fernery at the upper end of the main lake, as well as for landscape effect. The two former are continuations of the improvements begun in the previous year, when the shrubbery lying between the office and chief plant-house was made.

11. In all these shrubberies, the trees planted have grown well, while the shrubs, consisting of Allamanda, Hibiscus, Honeysuckle, Clereodendron, Tabernæmontana, Eranthemum, Justicia, Strobilanthes, Eucharis, Lilies, Roses, &c. have flowered well. The shrubberies which surround the aviaries have been thinned out to some extent, owing to the rapid growth of the trees. The plants removed have been used for various purposes.

12. The shrubbery borders on each side of the road leading from the old Fernery to the new Herbaceous Grounds, have been trenched about two feet deep and replanted, the plants being re-arranged, according to their sizes, in re-planting, and a liberal manuring given, a work very much required. The other borders have been dug over and kept in good order. The planted out specimens throughout the grounds have mostly received an application of manure.

13. The flower beds on the terrace below the band-stand, have not been much altered during the year, the employés being fully occupied with other works, but they have otherwise been well kept and have looked well throughout the year.

14. The Herbaceous Garden plants have been removed to ground maintained by the Forest Department, and the beds they occupied have been closed up where they could not be advantageously filled with flowering shrubs, &c.

15. A small Flower Garden, in which annuals only have been tried during the year, has been made on an area of 390 square yards on the site of the old aviary. As anticipated, the plants did not all come into bloom together, and the effect was consequently lost, but it may succeed on further trials with a better selection of plants and better timing as regards the flowering periods. The following annuals flowered well in the Gardens during the year, viz.:—Browallia, Calliopsis, Coreopsis, Cockscombs, Dahlia, Datura, Convolvulus, Gaillardias, Helianthus, Helichrysum, Heliotropium, Indian Pink, Ipomæa, Lobelia, Marigold, Marvel of Peru, Mignonette, Passiflora, Petunia, Phlox, Salvia, Solanum, Antirrhinum, Verbena, Tithonia, Zinnia and Torenia, as also the following bulbs:—Achimenes, Begonias, Gladiolus, Gesneria, Tydeas, Pancratium, Amaryllis, Crinum, and Gloxinias.

16. It is hoped that, by successive sowings of the above, as an auxiliary to the

flowering perennials, the flower beds, borders and plant-houses may be kept gay all the year round.

17. The following roses, introduced during the year and grown in tubs, have flowered, viz. :—Etoile de Lyon, La Boule d'Or, Pink China, Aline Sisley, Jean Ducher, Hon'ble Edith Griffard, Francesca Kruger, White Baroness, Crimson China, Clothilda, and Reine Maria Henrietta. Others are coming into bloom.

18. *Lakes.*—Little has been done to the lakes, except what work was required for their proper maintenance. Plants of Nymphæas were tried in the narrow end of the large lake, but they disappeared after a time. The Victoria Regia lily has been continually in flower and grown well all the year. The Lotus lily has taken complete possession of the second largest lake, in the front of which some further excavation is required to deepen the water and thus prevent the growth of grass and other weeds which form in it with great rapidity and give it an unsightly appearance. Some re-adjustment of the plants is also necessary.

19. *Plant-houses.*—The plants in the chief plant-houses have nearly all been potted during the year, and have grown well, but large specimens are still required to fully stock the house; numerous additions have, however, been made, notably a number of large tree ferns received through the assistance of the Forest Department, and by a special trip to Johor by the Head Gardener. These with the largest of the old collection, which have been potted in tubs, give the house now a more furnished appearance than has hitherto been possible. In this work, together with that of the other plant-houses, about 2,190 new pots and 170 tubs have been used up.

20. The outer line of posts on which the roof rests have been covered with a wire spiral for the accommodation of creepers, a selection of which have been judiciously put down and are already covering many of the posts, greatly to the enhanced appearance of the house. The cost of wiring amounted to \$49.30.

Between the posts in the centre of the house, plants in baskets have been hung, and over the path leading through the fern collection, plants of Elk's-horn fern and other ferns have been placed. A rock-work has been put down to form a back ground to the pot collection on the south side of the house and runs between the Hibiscus hedge and the staging the whole length of the house.

This rock-work has been planted with ferns, Begonias, and other small ornamental plants, which have grown well and contributed much to the picturesqueness of the surroundings.

21. Four circular plant stages have been constructed on a line with the diagonal paths within the house, which was part of the original plan of the house, and which had been postponed; viewed from the interior, these stages give the house a more finished appearance.

A new structure has been erected, at a cost of about \$91.00 for materials, for the propagation of ferns and other delicate plants requiring protection; the house is about 60 feet long by 30 wide, consists of a broad centre staging with two side-stagings, and has been found very useful.

22. Another small shed, for the accommodation of the finer orchids, has been made and filled with those and others. The orchid collection has been mostly re-potted.

23. *Propagation House.*—The propagation house has not been so well maintained during the year as could be desired, especially the collection for foreign exchanges, which is owing to the Head Gardener's time being too much occupied with other works, but a fairly good collection has been kept up. The greater part of the wooden staging in this house will soon require renewal.

24. *Buildings.*—A covered passage has been erected between the Superintendent's house and out-houses, and the stables have been repaired. The Overseer's house has been re-attaped, and the roof of the Carpenter's shop repaired. These repairs cost \$103. The Office has been renovated by painting and white-washing by the Public Works Department. The other buildings are in good order.

25. *Fernery*.—The fernery has been very attractive during the year; the ferns have grown well, especially the stronger growing kinds, which now form objects of great beauty and are much admired by visitors.

26. *New Fernery*.—A site for a new fernery is being prepared at the upper end of the main lake, where, it is believed, filmy ferns and other delicate plants can be grown under shade of the stronger growing kinds and trees, with the assistance of irrigation. To meet requirements, a reservoir for the retention and storage of rain water has been made close by the site; its dimensions are 160' x 60' x 6', and into it the drainage of nearly all the upper portion of the Gardens has been turned; from this reservoir pipes are run for the irrigation of the rock-work. The reservoir was brought almost to completion within the year by the Public Works Department, but the rock-work is still unmade, and will take time and careful thought.

27. *Labelling*.—Five hundred ballau labels, at a cost of \$30, were procured during the year, and nearly all used up. The amount of printing required has been greater during the year than formerly, and one man being unequal to the work, he was assisted for a short time by another printer.

28. *Nurseries and Propagation*.—The low ground near the Head Gardener's quarters was partly cleared during the year, dressed into nursery beds, and planted with cuttings and seeds of various plants. About an acre of the west slope of the hill in the same quarter has been cleared and levelled to a serviceable gradient, at a cost of \$100, for transplanting purposes. The fancy plant nursery near the plant-house has also been well kept up during the year. In these nurseries, about 20,000 plants have been propagated, and disposed of (approximately) as follows:—Sold in small lots to the public, 700; Government Institutions, 6,790; Colonial exchanges, 792; sent abroad, 1,210; used in improvements within the Gardens, 6,000; retained, 4,608.

29. During the past year, the lawns, flower-beds and plant-houses have been more directly than heretofore under the control of the Head Gardener (Mr. FOX), owing to the frequent absences of the Superintendent on Forest duty, and much credit is due to him for the numerous improvements which have been effected.

30. *Aviaries*.—The new aviaries, re-erected last year, answer the purpose well, and little trouble from rats, which were the pest in the old structure, has been experienced. Nearly all the cages on one side have been kept in reserve for a collection of birds expected from Australia in exchange for a collection sent, but the season there prevented their being sent within the year.

31. The following contributions to the Aviaries have been received, viz.:—M. BEAN, Esq., one eagle; Hon'ble E. E. ISEMONGER, one adjutant and one bittern; Hon'ble W. E. MAXWELL, one stork.

In addition to the above, a few cockatoos and paraqueets were purchased.

32. *Economic Plants*.—The collections of economic plants are now under the care of the Forest Department, and will be found detailed in the Report on Forests.

33. *Police Protection*.—The system of protecting the Gardens by special Police, works well upon the whole, but occasionally plants are stolen, and the past year has seen three plants of a new fern (*Adiantum Fergusonii*) removed in one night, and although every effort was made by the Police Force generally to recover them, nothing so far has been heard of them.

34. *Flower Show*.—The annual Flower Show was held on the 15th and 16th of June, the weather was exceedingly fine, which brought a very large attendance during the day as well as at the night illumination.

It is satisfactory to find that the chief plant-house still affords admirable accommodation for these exhibitions, there being no crowding anywhere.

35. *Interchange of Plants and Seeds*.—The number of plants received from abroad during the year was 1,319, and 729 packets of seeds. The number of plants sent out was 1,210, and 454 packets of seeds.

The following have been the chief contributors:—

The Botanical Gardens, Trinidad, 9 packets seeds, among which were the Mamme Apple, Davi Davi, Mohogany, and West Indian Palms; Royal Gardens, Kew, 35 plants and about 16 lb seeds, including the Mountain Papaya, the Lace Bark

tree of Jamacia, the Palmyra palm, Timber-tree seed and ornamental shrubs; Botanical Gardens, Java, 6 plants of the Cubeb Vine; Botanical Gardens, Sydney, 8 packets seeds of Araucaria and Australian Palms; Botanical Gardens, Mauritius, 1 case containing about 20lb Logwood seeds; Botanical Gardens, Jamaica, 19 packets West Indian Palms and other seeds; Botanical Gardens, Ceylon, a collection of 55 plants and 1 packet seeds, including the new vegetables—Arracacha esculenta, Ipomæa chrysorrhiza or Kumra, the Tree Tomato, and Ceylon ferns, &c.; Botanical Gardens, British Guiana, seeds of Indian Rubber plants, West Indian Palms, Rain-tree, &c.; Botanical Gardens, Hongkong, 100 kinds of various seeds chiefly that of vegetables grown in China; Botanical Gardens, Saharampur, 123 packets seeds, of which number 97 were vegetable and 26 various shrubs; Botanical Gardens, Calcutta, 238 seedling bamboos of sorts; L. BOEHMER, Esq., Japan, a collection of 153 Japanese plants, specially selected by the Hon'ble J. F. DICKSON, C. M. G., when on a tour in Japan; R. DERRY, Esq., Malacca, seeds of water lilies, vegetables, &c., in all 8 packets; the Consul-General for the Netherlands, a packet of seeds of a tree yielding vegetable fat; A. F. AYRE, Esq., Singapore, a plant of the beautiful Pteris serrulata variegata; G. PECHE, Esq., Moulmein, 18 Burmese orchids and 30 ferns; A. LAURIE, Esq., Ceylon, 31 plants Hibiscus of sorts; Mr. ANGUS, Singapore, 50 bulbs; the Pharmaceutical Society of Great Britain, 2 packets of seeds of Cape Aloes, &c.; Hon'ble J. F. DICKSON, C. M. G., Singapore, 1 fern.

The following were purchased during the year:—From Messrs. CARTER & Co., London, 120 kinds of annuals and 108 kinds of vegetables; Messrs. BARR & SONS, London, 551 kinds of bulbs, chiefly of flowering plants; Messrs PAUL & SONS, London, 64 rose plants assorted; Mr. B. S. WILLIAMS, London, 188 kinds of annuals; Messrs. CANNEL & SONS, London, 86 rose plants assorted.

36. The following have been the principal recipients:—

Royal Gardens, Kew, 38 plants and 13 packets seeds; Botanical Gardens, Brisbane, 43 packets seeds; Botanical Gardens, Melbourne, 118 plants and 39 packets seeds; Botanical Gardens, Hongkong, 25 packets seeds; Botanical Gardens, Mauritius, 54 plants and 30 packets seeds; Botanical Gardens, Adelaide, 37 plants and 26 packets seeds; Botanical Gardens, Cape of Good Hope, 26 packets seeds; Botanical Gardens, Natal, 43 packets seeds; Botanical Gardens, Saharampur, 39 packets seeds; Botanical Gardens, Cambridge, 8 packets seeds; Botanical Gardens, British Guiana, 4 packets seeds; Botanical Gardens, Java, 12 packets seeds; Botanical Gardens, Ceylon, 164 plants and 39 packets seeds; Botanical Gardens, Calcutta, 18 packets seeds; Botanical Gardens, Bangalore, 26 packets seeds; Botanical Gardens, Trinidad, 13 packets seeds; Botanical Gardens, Jamaica, 13 packets seeds; Botanical Gardens, Saigon and Reunion, 209 plants; Botanical Garden, Agri-Horticultural Society, Calcutta, 13 packets seeds; Acclimatization Society, Mauritius, 4 packets seeds; Mr. YANKIERSBILEK, Mauritius, 4 packets seeds; Agri-Horticultural Society, Moulmein, 4 packets seeds; A LAURIE, Esq., Ceylon, 36 plants; Captain GREEN, 20 plants; G. PECHE, Esq., Moulmein, 34 plants; W. BULL, Esq., London, 200 plants; HENRY WALKER, Esq., Sandakan, 65 plants and 7 packets seeds; L. BOEHMER, Esq., Japan, 25 plants.

EX-ESTABLISHMENT.

Government House Grounds.

The grounds surrounding Government House have been extensively overhauled during the year, as will be seen from the following details:—

37. *Old Orchards.*—In the old orchards, the greater number of the fruit trees had, owing to non-pruning, grown together in such a way as to act highly injurious to each other and diminish the fruit crop.

38. To remedy this, a liberal pruning and thinning became necessary, and the termination of the fruit-farms admitted of this being carried out. The orchard was found to contain, moreover, many common jungle trees, dead trees, and numerous others with stag-horn tops, *i. e.*, with the extremities of the branches dead. The orchard, therefore, required much labour to put it to right, and advantage was consequently taken of the absence of His Excellency and family in the Native States, to command all the available labour, which I daily supervised and directed, and by this means the orchard as well as the grounds generally have had attention.

39. On the removal of the timber and prunings, the orchard was drained over the low ground on each side of the front entrance, and the whole of the underwood and accumulation of débris brought down and deposited under the trees by the overflowing of the adjoining canal, were removed.

Much grass had also to be planted to cover places where the dense shade of the trees had killed it, and where it had been destroyed by the overflowing of the canal.

40. *Young Orchards.*—The young orchards between the Colonial Secretary's house and Cavenagh-road, and between the main house and Bukit Timah-road, have been cleared of scrub, and the young trees manured.

41. *Lawns.*—A good many trees and shrubs, which intercepted the view from Government House, have been removed from the lawns, and others which had lost their beauty; much sensitive plant and rank weed which disfigured the lawns have also been removed. The Lawn Tennis ground received several top dressings of a special compost for encouraging the growth of the grass, which has improved it.

42. *Planting.*—A number of ornamental plants have been planted near the house, among which were the red-stemmed Palm, and two nice plants of *Livistona sinensis* to replace two trees of the same kind killed by beetles during the year. Bamboos have been planted at points on the boundary and elsewhere where required to screen the neighbouring buildings and unsightly objects. A root of the large Bamboo—*Dendrocalmus giganteus*—has been planted in a suitable position near the front entrance, and is making strong growth. This fine bamboo was obtained from the Botanical Gardens, Ceylon, with the assistance of the Hon'ble J. F. DICKSON, C. M. G., who took great interest in the work generally.

43. *Hedges.*—The bamboo hedges which surround the grounds have been cleared of creepers and weeds, clipped and strengthened by horizontal strapping with strips of areca-palm, bamboo, &c., and a portion, 200 yards in length on right of main entrance where the dense shade cast by trees, now removed, had killed it, has been replanted.

44. *Plant-houses.*—The pot plants throughout the plant-houses have been repotted, and new tubs obtained for the repotting of the large plants in the verandahs and corridors of the main building.

An attap covered shed has been erected at the end of the bower near the house, under which a rockery has been made and planted with a variety of ferns, &c.

45. *Flower Beds and Borders.*—The flower beds adjoining the Tennis grounds have been mostly replanted and kept gay throughout the year with annuals and coloured-leaved plants. The ridge of laterite rock lying between the main entrances, and the Cadets' bungalow, has been planted around with a collection of flowering creepers, with a view to covering it from sight, and ferns have been planted on protected portions.

Notices prohibiting the making of foot-paths across the lawns have been put up, and a few cases of trespass punished, which has stopped encroachment and prevented the grass being rendered unsightly.

Esplanade and Grounds surrounding Government Offices.

46. The Esplanade has been kept mown and in order, together with the lawn lying between the main road and the sea, also the small grass plots which surround the Government Offices. In the latter, a few ornamental plants have been planted where required.

47. The trees along the outer edge of the Esplanade require attention, many of them will never grow so as to afford shade to the roads, which seems to have been the object the planter of them had in view. These trees are not considered to be under my care.

Revenue and Expenditure.

48. A statement of the Revenue and Expenditure for the year is annexed, from which it will be seen that the sum realised by sales of plant has considerably fallen off, being \$348.63 less than last year, owing principally to ornamental plants being less in demand than in the previous year.

The balance of \$318.77 shewn in annexed statement is only apparent, the amount having been expended, but not paid during the year.

N. CANTLEY,
Superintendent.

Singapore, 19th March, 1887.

Revenue and Expenditure of the Botanic Gardens Department, for 1886.

REVENUE.	\$ c.	EXPENDITURE.		
Balance in Bank, 1st January, ...	507.63	SALARIES.	\$ c.	\$. c.
Government Grant, ...	7,000.00	Propagator, ...	180.00	
Sale of Plants and Flowers, ...	220.98	Mason, ...	30.00	
Interest on Current Account, ...	40.35	Carpenters, ...	193.30	
Advances refunded, ...	100.00	Printers, ...	125.86	
		Aviary Keeper, ...	83.95	
		Bill Collector, ...	71.02	
		Chief Mandor, ...	23.22	
		Coolies, ...	2,403.38	
				3,110.73
		BILLS.		
		Water Reservoir, ...	1,205.98	
		Purchase of Plants and Seeds, ...	451.55	
		Contribution to Flower Show, ...	250.00	
		Inspector-General of Police, ...	270.00	
		Superintendent's Transport, ...	169.42	
		Head Gardener's Transport, ...	180.00	
		Birds' Food, ...	207.74	
		Manure and Cartage, ...	244.10	
		Wood for constructive purposes, ...	102.84	
		Purchase of Tools and Implements, ...	123.46	
		Flower Pots, ...	181.00	
		Freight on Plants and Seeds, ...	98.54	
		Laterite, ...	55.00	
		Petty Expenses, ...	143.74	
		Botanical Books, ...	50.56	
		Repairs to Buildings, ...	103.50	
		Materials for new Plant-house, ...	91.75	
		Advances (<i>Vide Receipts</i>), ...	100.00	
		Miscellaneous, ...	410.28	
				4,439.46
				7,550.19
		Balance in Bank, ...		318.77
				\$7,868.96
	\$7,868.96			\$7,868.96

N. CANTLEY,
Superintendent.

STRAITS SETTLEMENTS.

REPORT

ON THE

FOREST DEPARTMENT,

FOR THE YEAR

1886.

BY

N. CANTLEY, F.L.S.,

*Fellow of the Royal Geographical Society, London; Corr. Member
of the Royal Society of Arts and Sciences; Corr. Member
of the Meteorological Society; Hon. Member
of the Acclimatization Society, Mauri-
tius; Member of the Royal Asiatic
Society; and Superintendent of
the Botanic Gardens,
Singapore.*

LAI D BEFORE THE LEGISLATIVE COUNCIL BY COMMAND OF HIS EXCELLENCY THE GOVERNOR.



SINGAPORE:

PRINTED AT THE GOVERNMENT PRINTING OFFICE.

1887.

20/09

ANNUAL REPORT ON THE FOREST DEPARTMENT, STRAITS
SETTLEMENTS, FOR THE YEAR 1886.

Introductory Remarks.

Before detailing what has been accomplished during the past year, I would most respectfully beg to point out that all the recommendations contained in my preliminary Forest Report and approved of by His Excellency Governor Sir FREDERICK A. WELD, G.C.M.G., in the beginning in 1883, have now been carried out to a greater or less extent.

2. The recommendations then made comprised such items as were considered most urgent at the time, and which, as will be seen, have proved capable of practical application, and have met the end in view. The Government forests were, at that time, being recklessly cut down and fast disappearing; measures to check such fellings and encroachments were consequently the first to be considered and acted upon, and have occupied the attention of the Department almost up to date.

3. What has been accomplished will appear from the maps appended, which detail the restrictions placed on felling and the distribution of the Reserves established throughout the colony.

For the sake of clearness the original recommendations are briefly sketched in the margin, and the following will show what has been done to carry them out, viz. :—

4. Details shewing the internal organization of the Department and the duties apportioned to each Officer will be found in paragraph 3 of my Forest Report for 1884. Since then, however, another Officer has been appointed to the position of Assistant Superintendent, and the Overseership in Malacca has been abolished.

Mr. DERRY reported his arrival from British Guiana on the 8th August of the year under review, and after a brief initiatory stay in Penang, assumed charge of the Forest Department in Malacca in the following September.

5. A body of Forest Police who work under special rules, and who are assisted in their duties by an open boundary line, have worked well and have entirely prevented any serious encroachment on the Reserves.

6. The whole of the Reserves throughout the colony have now been demarcated by an 8-foot path, mostly by survey, except the Jus Reserve in Malacca, and some undetermined Reserves in Province Wellesley. Separate maps of all the Reserves have been procured, but are as yet of a temporary nature.

Original Recommendations.

R. 1st

The establishment of a Forest Department to take charge of all Crown Forests whether proclaimed Reserves or otherwise.

R. 2nd and 3rd

Preventing the felling of forests and clearing of forest lands.

The appointment of a body of Forest Police for protective purposes, to be quartered in the country districts throughout the Settlements.

R. 4th

The survey and demarcation of such Crown Forest lands as are still undetermined and the preparation of good and reliable maps shewing the forests and the topographical features of the country.

R. 5th

The marking out (or formation) of certain blocks of forest near the chief town in each Settlement of a sufficient size to serve as Reserves for the supply of fuel and small building wood.

R. 6th

The formation of local Forest Reserves for the supply of wood for general purposes and Mountain River Reserves for protection where necessary.

R. 7th

The redemption by exchange or otherwise of such private lands as are selected for planting.

R. 8th

The introduction of an Ordinance for the better conservation of the Crown Forests.

R. 9th

The immediate collection of seeds of the best indigenous timber trees and the formation of nurseries for the propagation of such seeds.

7. The Forest Reserves which may be looked upon as Town Reserves, are, in Singapore, the Bukit Timah, Jurong, and Military Reserves. For fuel, the Coast Reserves generally.

In Malacca, the Bukit Bruang and Sungei Udang Reserves. In Penang, the Balik Pulau Reserve, and Pulau Jerėjak; the latter has not yet been officially handed over.

8. All the other Reserves are either timber or village Reserves, or for the protection of streams, mountain crests, the equalization of showers, and storage of rainfall. The natural reproduction of trees has had every protection and encouragement.

9. It has fortunately been found unnecessary to purchase much land for forest purposes, what has been secured amounts only to a few acres, which interfered with a proper system of supervision being maintained over the Bukit Bruang Reserve in Malacca.

10. A detail of the more essential items for inclusion in a Forest Ordinance was drawn out during the year, but no case of direct friction with the ordinary law having occurred, further action was postponed for the present.

11. Much tree seed has been collected and many thousands of trees planted, as will be seen from details given in the body of this Report and in the Appendices.

12. The Nurseries established are of two kinds, viz.:—Temporary Nurseries, which precede planting generally, and those for special experimental planting or operations of *first instance*.

In the former, timber trees are propagated to the exclusion of all others, but in the latter economic plants of every kind likely to prove useful are admitted for trial and experiment.

13. The Waterfall Nursery in Penang has been extended, so as to provide means for recreation and instruction for the Penang public generally, and has thereby supplied a long-felt want.

14. Within the year, the scientific portion of the Botanic Gardens, Singapore, was, at the instance of the Botanic Gardens Committee, placed in charge of the Forest Department, and consisted of the herbarium, the economic garden and economic collection generally, the herbaceous arrangement, the medicinal garden, and the palmetum.

15. These additions, although not anticipated, place the Department on a botanical footing, and afford a wider field for investigation and usefulness. Considerable advantage has been already taken of these additions.

16. A Nursery for the cultivation of vegetables for sale, with cost chargeable to Forest vote, was begun within the year, and experiments have already proved conclusively that much can be done to augment and improve the bazaar supply.

17. Little has been done so far to collect revenue under the Department, but its organization is now sufficiently advanced to admit of attention being turned to the conservation of minor forest produce, and to the preparation of a rational working plan for the utilization of the resources of the forests generally, and for their requirements with reference to sustained yield and improvement.

18. In the preparation of a working plan of this kind, the forest in the adjacent States will necessarily require to be considered, and it is satisfactory to know that the nature of the Department is now such that, while fully occupied within itself, is nevertheless sufficiently elastic to stretch beyond the boundary and render assistance to dependent States whenever called upon to do so.

In the Appendices will be found a list of Economic Plants introduced almost entirely through the agency of the Forest Department, which has no connection with the Botanic Gardens. Plants are, however, freely exchanged between the two institutions.

19. The Department has now passed its infancy and assumed a fixed position among the public institutions of the colony. Its organisation has been a matter of no small difficulty, but the absence of failures has suppressed a large amount of that adverse criticism which, at the beginning, has fallen to the share of so many similar operations in other parts of the world.

SINGAPORE.

Demarcation of Reserves.

20. The following tabular statement shews the names, number, and areas of the Reserves demarcated, and the extent of boundary line opened during the year, from which it will be seen that the work in hand was of an extensive nature:—

Names of Forest Reserves.	Area added or demarcated during the year.	Length of 8-foot boundary line opened during the year.	Total Areas.	Total length of boundary line now opened and maintained.	Approximate length of water frontage protected.
	<i>a. r. p.</i>	<i>Miles.</i>	<i>a. r. p.</i>	<i>Miles.</i>	<i>Miles.</i>
Blukang, ...	1,514 0 32	8	1,514 0 32	8	11
Murai, ...	314 1 05	2½	314 1 05	2½	2
Kranji, ...	746 0 32	7	746 0 32	7	10
Selitar, ...	1,492 1 08	7	1,492 1 08	7	6
Ang Mo Kio, ...	290 1 04	3	290 1 04	3	...
Changi, ...	1,393 1 08	13	1,393 1 08	13½	4
Bukit Panjang, ...	117 2 16	3	117 2 16	3	...
Military, ...	...	0½	109 0 0	0½	...
Chan Chu Kang, ...	...	...	813 3 08	5	...
Mandai, ...	...	...	407 0 32	3	...
Sambawang, ...	...	...	936 0 32	7	...
Bukit Timah, ...	...	...	846 0 0	6	...
Pandan, ...	...	3	2,162 0 16	5	14
Jurong, ...	...	...	412 0 16	6	...
Total, ...	5,868 0 25	47	11,554 2 09	76½	47

Surveys.

21. The Reserves surveyed within the year were the Blukang, Murai, Kranji, Selitar, Ang Mo Kio, Bukit Panjang, and Changi Reserves; the cost being charged to the Forest vote.

Private Rights within Reserves.

22. The Reserves are very free from right of private entry, Changi and Sambawang being the only two where private holdings to any great extent have had to be demarcated within the boundaries. It is intended to purchase these holdings as favourable opportunity occurs, or include them when the leases expire. A detail of the boundaries was published during the year in the *Government Gazette*.

Classification of Reserves.

23. The Reserves established may be classified thus:—As town Reserves—Bukit Timah, Pandan and Military; as coast Reserves—Blukang, Murai, Kranji, Selitar, and Changi; as interior Reserves—Sambawang, Mandai, Chan Chu Kang, Bukit Panjang and Ang Mo Kio. The Reservoir Reserve is under the care of the Municipality.

Description of Reserves.

24. The Reserves cover the best forests that remain in the Settlement. The following table will show the nature of their contents, viz. :—

Names of Forest Reserves.	Approximate area under timber.	Approximate area under brushwood.	Approximate area under grass and fern.	Area artificially stocked during the year.	Total area artificially stocked.
	<i>Acres.</i>	<i>Acres.</i>	<i>Acres.</i>	<i>Acres.</i>	<i>Acres.</i>
Blukang, ...	1,400	114	...	...	...
Murai, ...	300	14	...	...	...
Kranji, ...	560	6	180	...	...
Selitar, ...	1,000	...	492	...	...
Ang Mo Kio, ...	200	...	90	...	...
Changi, ...	900	...	493	...	...
Bukit Panjang, ...	17	...	100	...	...
Military, ...	...	59	16	6	34
Mandai, ...	100	200	107	...	...
Sambawang, ...	378	100	458	...	...
Bukit Timah, ...	300	218	328	13	118
Pandan, ...	720	42	1,400	...	...
Jurong, ...	137	106	169	6	6
Chan Chu Kang, ...	200	200	413	...	...
Total, ...	6,212	1,059	4,246	25	158

25. The wooded portions of the Reserves comprise, in many cases, good timber of all kinds common to the country, and, as will be seen from the map appended, is rendered easy of removal by good roads and by water.

Planting Waste Lands.

26. In addition to the above, a belt of about 10 acres was planted behind Tanglin Barracks to protect the soldiers' quarters from the malarial miasma arising from adjoining swamps, and six miles of boundary line were planted with bamboo.

The number of young trees planted out during the year was 50,000, and comprised chiefly, Bintangor, Tembusu, Eucalyptus, Serayah, Kayu-minyak, Meranti, Kumpus, Casuarina, Eugenia, &c. ; and all have grown well.

27. The following are measurements of present size of seedlings planted in Bukit Timah Reserve in 1884-85, and which were about a foot in height at the time of planting :—

Mahogany,	8 feet.	Hymenaea,	5 feet.	Cassia florida,	10 feet.
Serayah,	6 "	Eugenia,	6 "	Teak,	2 to 15 "
Bintangor,	5 "	India Cedar,	4 "	Meranti,	3 "
Casuarina,	10 "	Dipterocarpus,	3 "	Ketapong,	3 "
Kelat,	8 "	Ebony,	6 "	Mirabau,	6 "
Dipterocarpus } tuberculatus, }	3 "	Jack,	10 "	Lagerstraemia,	3 "
		Kumpas,	3 "	Albizzia,	15 "

The cost of planting was found to be about \$20 per acre, including cost of raising the seedlings in the Nursery. The state of natural reproduction in some of the Reserves is very satisfactory; young seedlings are now making their appearance in places which shewed no traces of them before protective measures were adopted; the same can be said of the Reserves in the other Settlements.

Weeding.

28. About 80 acres of the plantations made at Bukit Timah in 1884-85 and about 20 acres of the Military Reserve have been gone over, and the young trees cleared of obstructive vegetation. It would be an advantage to the trees as well as recoup possibly the cost of weeding, if some crops such as indigo or sweet potatoes were cultivated between the lines of trees.

Protection and Up-keep of Boundaries.

29. It will have been seen that the total reserved area in Singapore amounts to 11,554 acres, or about one-twelfth of the Island, and that about 71 miles of boundary are kept in order. The watchmen being 20 in all, this gives an average charge per man of 577 acres to protect, and 3 miles of boundary to keep in order, exclusive of 2 miles of water frontage requiring patrol by boat. A boat for the purpose was purchased during the year, at a cost of \$140. The average cost of protection at present is about 8 cents per acre protected, but as this amount will be reduced when the boundaries are better established, the probable permanent cost will be about 5 cents an acre.

30. There were five arrests made during the year for illicit timber cutting, and conviction was obtained in every case. The Magistrates inflicted fines on the depredators to the amount of \$104.

Fires and Damage.

31. No fires of any importance have taken place during the year within the Reserves boundaries, but they have raged in the open country. On coming into contact with the cleared boundary line the fire was promptly stopped. In a few cases, the fire followed the boundary for over a mile without being able to cross into the Reserve.

Forest Nurseries.

32. About 80,000 plants have been propagated from seeds in the Forest Nurseries at Bukit Timah and Jurong. The seedlings raised consisted of the following:—

Mahogany, 20,000; Mirabau, 20,000; Eugenia, 10,000; Casuarina, 10,000; Cassia florida, 8,000; Serayah, 7,000; Tembusu, 5,000.

The Jurong Nursery has been enlarged by about one acre.

Experimental Nursery.

33. For detailed information regarding the progress of plants planted in the Experimental Nursery, see Appendix C. Much success has attended the experimental planting, and the Nursery as a whole is considered by visitors the most interesting institution connected with the Forest Department in the Settlement. The area of the Nursery has been increased during the year by about 3 acres.

Herbarium.

34. The whole of the herbarium collection has been mounted on white paper during the year, and arranged into their natural families. About 3,000 have been determined or compared, and a portion of the monocotyledons is now about ready for printing.

Systematic Arrangements.

35. A new garden of herbaceous plants, arranged after the natural system, has been made in the grounds temporarily handed over by the Botanic Gardens; also a palmetum with the palms arranged and named according to Sir J. D. HOOKER'S last Kew Report. Ground has been put in order for the planting of a medicinal garden and an Arboretum, but, owing to the pressure of other work, it was found impossible to complete the planting of them within the year.

Vegetable Nursery.

36. A small Vegetable Nursery has been opened on the top of Bukit Timah, and a larger one on a portion of the Military Reserve, Cluny Road. In these Nurseries, very good lettuces, radishes, tomatoes, turnips, peas, cucumbers, parsley, beetroot, &c. have been grown. The cultivation will be continued during the ensuing year on a scale sufficiently large to afford a bazaar supply, and discontinued as soon as it is seen that Chinese market-gardeners can produce a sufficiency to meet requirements, and with this in view seeds of various vegetables have been distributed among them.

Buildings.

37. The buildings connected with the Department are in good order. Wooden quarters for the herbarium keeper were erected during the year at a cost of about \$126, and the herbarium has been painted. Rent has been paid in country districts for coolie quarters, it having been found more advantageous to rent than build temporary quarters for temporary work.

Interchange of Plants and Seeds.

38. Interchanges of plants and seeds of an economic nature are now made with every part of the world; ornamental plants being in request for the Waterfall Garden in Penang only.

Inspection and Valuation of Land.

30. Forty requisitions for information as to the advisability of leasing forest lands have been received from Government, and dealt with during the year—a work which required much hard travelling and occupied much of my time.

Meteorological Observations.

40. An account of the rainfall has been carefully recorded during the year at Bukit Timah and at Tanglin, the results shew a greater distribution of showers in the vicinity of the hills and Forest Reserves.

Supply of Forest Produce.

41. The Municipal Department has been kept supplied with timber and small wood for the renewal and repair of culverts on country roads. About 500 trees have been supplied within the year.

MALACCA.

42. The work in the early part of the year in Malacca was carried on under the supervision of Mr. JOHN WALKER, Acting Overseer of Forests. On Mr. DERRY'S arrival in September, Mr. WALKER was transferred to Penang.

Demarcation of Reserves.

43. The following statement will show the extent to which demarcation has been pushed during the year:—

Name of Reservē.	Area added or demarcated during the year.	Length of 8-foot boundary path opened during the year.	Total area.	Total length of boundaries now opened and maintained.
	<i>Acres.</i>	<i>Miles.</i>	<i>Acres.</i>	<i>Miles.</i>
Sungei Udang,	2,000	8	4,800	15
Ayer Panas,	1,900	4½	3,900	4½
Bukit Panchor,	2,600	7	3,640	10½
Merlîmau,	2,000	6½	6,000	12
Brisu, ... ..	...	10½	2,247	10½
Bukit Bruang,	1,000	6	1,734	8½
Total,	9,500	42½	22,321	61

The undemarcated area at Jus amounts to about 29,000 acres, which, when demarcated, will bring up the total area to about one-tenth of the Settlement.

Surveys.

44. The Reserves surveyed during the year were Merlîmau, part of Sungei Udang, and Brisu; the latter by the Government Survey Department, the two former by a special survey under the Forest Department.

Private Rights within Reserves.

45. Several Malay families possessing rights over restricted areas for the removal of fuits and small timbers for domestic purposes reside within the reserved boundary at Ayer Panas, Brisu, and Panchor.

Classification of Reserves.

46. The Forest Reserves in Malacca may be thus classified:—town Reserves—Bukit Bruang and Sungei Udang; timber, village and climatic Reserves—Merlîmau, Ayer Panas, Panchor, Brisu, and Jus.

Description of Reserves.

47. The following table shows the nature of the growing stock within the Reserves. It will be observed that the proportion of timber-covered area in Malacca is much larger than in Singapore.

Name of Reserves.	Area under timber.	Area under brushwood and small trees.	Area under grass and fern.	Area planted during the year.	Total area artificially re-stocked.	Remarks.
	<i>Acres.</i>	<i>Acres.</i>	<i>Acres.</i>	<i>Acres.</i>	<i>Acres.</i>	
Bukit Bruang, ...	700	1,000	34	1	3	
Sungei Udang, ...	3,000	1,000	800	...	...
Ayer Panas, ...	3,000	900	...	...	...
Bukit Panchor, ...	2,000	1,640	...	...	...
Merlîmau, ...	6,000	...	...	...	...
Brisu, ...	1,000	1,247	...	...	...
Total, ...	15,700	5,787	834	1	3	

Planting.

48. But little planting has been done in Malacca, and little is required, except, perhaps, the introduction of Gutta Percha and other trees producing commercial produce other than timber into Reserves occupying positions from which timber transport might be attended with difficulty, and with a view of restoring to the colony its lost commerce in these articles.

Protection and Up-keep of Reserves.

49. A staff of ten watchmen have been at work during the year, the average charge per man being about 2,232 acres. Cost about three cents per acre per annum. Ten arrests for illicit wood-cutting were made, and eight convictions obtained. Fines to the amount of \$147 were imposed and paid.

Nurseries.

50. In the Bukit Bruang Nursery, the following plants have thriven well, notwithstanding the uncongenial soil, viz.:—Mahogany, Cedrela, Furcraea, Bassia, Hevea, Oranges, &c., but native timber trees do best, Tampinis especially, a large number of which was sent to Singapore during the year for plantation in the Reserves there. The Nursery is on the point of being closed, and the stock transferred to a new Nursery at Bukit Sa'Bokor, where the formation of an Experimental Nursery on the same principle as that at Singapore was begun before the year closed. The object of the Nursery is to test the adaptability to the soil of an immense number of foreign economic plants at present little known in Malacca. Compensation for growing crops on land taken up for this Nursery cost \$834.

51. A small Nursery for the propagation of forest trees was opened towards the close of the year within the Sungei Udang Reserve, and in it a number of the seedling Mahogany raised from Kew seed, have been planted, for trial in the waste lands surrounding the Nursery, and to which they will be transferred when sufficiently grown.

PENANG.

Demarcation of Reserves.

52. All the Forest Reserves in Penang may now be looked upon as demarcated. The following statement shows the work of the year and the approximate areas of the Reserves generally, viz. :—

Name of Reserve.	Area added or demarcated during the year.	Length of boundary line opened during the year.	Total areas.	Length of boundary now opened and maintained.	Length of water frontage protected.
	<i>Acres.</i>	<i>Miles.</i>	<i>Acres.</i>	<i>Miles.</i>	<i>Miles.</i>
Boetong, ...	475	6	475	6	...
Ghinting, ...	40	1	40	1	...
Penara, ...	234	4	234	4	...
The Highlands, ...	...	...	227	4	...
Main Range, ...	...	...	3,664	30	...
Laksamana, ...	...	...	1,160	8	...
Feringgy, ...	...	...	225	3	...
North West Reserve, ...	...	...	2,808	3	8
Total, ...	749	11	8,833	59	8

Surveys.

53. No systematic survey of the Reserves has so far been completed, but is being proceeded with under the general survey of the Island now in progress. The boundaries have been opened by a rough survey conducted by the Assistant Superintendent of Forests (Mr. CURTIS), to whom much credit is due for the way in which he has carried the boundaries through exceptionally difficult country.

Private Rights within Reserves.

54. The number of small lots of alienated land lying within the boundaries of the Reserves are wonderfully few, considering the late date at which conservancy measures have been adopted. The paucity of such holdings appears to have arisen from the disinclination of land-purchasers to ascend the mountains; the cultivation at high elevations was consequently found to be chiefly that of squatters without permit or claim.

Classification of Reserves.

55. The Reserves in Penang may be classified thus:—as town Reserves, Boetong, Pulau Jerėjak, and in some measure "The Highlands"; fuel Reserves—N. W. Reserve and Pulau Jerėjak; as protection Reserves, the Hill Reserves generally. These distinctions are not, however, arbitrary in any Settlement. In a working plan all available produce of whatever nature and from whatever locality, would be utilised for the public good.

Description of Reserves.

56. The internal condition of the Reserves with reference to growing stock may, in the absence of a forest survey, be roughly classified according to the following table :—

Name of Reserve.	Area under timber.	Area under brush-wood.	Area under grass and fern.	Area artificially re-stocked.
	<i>Acres.</i>	<i>Acres.</i>	<i>Acres.</i>	<i>Acres.</i>
Boetong, ...	400	55	20	...
Ghinting, ...	40	...	...	...
Penara, ...	100	100	34	...
The Highlands, ...	150	77	...	...
Main Range, ...	2,000	1,600	62	2
Laksamana, ...	600	560	...	...
Feringgy, ...	125	100	...	...
N. W. Reserve, ...	2,000	808	...	...
Total, ...	5,415	3,300	116	2

57. The wooded portion of the Reserves contain timber suitable for most purposes, and, as pointed out in my last year's report, contains a much larger proportion of the better kinds than has generally been known. Investigation into the nature of the trees was continued during the past year, and several new species and one new genus were discovered. The re-wooding of the watershed of the Penang River was ruled to be a Municipal undertaking, and my duty has, therefore, been confined to advising that body.

Protection and Up-keep of Boundaries.

58. The amount disbursed last year on protection of Reserves and up-keep of boundaries was \$561.34, which gives an average of about 8 cents per acre protected.

The Forest guards made three arrests, each case being convicted and fined \$10, which was paid.

Fires and Damage.

59. The Reserves have been free from fires throughout the year.

Nurseries.

60. The Experimental Nurseries in Penang rival those of Singapore in some respect, owing chiefly to the scope which a command of temperature and climate gives them.

It is known that, to obtain the best results from botanic experiments, provision for planting at various elevations must be made, and in Penang these conditions exist, where there are three Nurseries—one on the plain, one at about 1,900 feet, and one at 2,550 feet elevation, respectively. Of the work carried out during the year in the 1,900 feet elevation Nursery, I quote the following from the report of Mr. CURTIS:—

61. "Peaches and other plants have been propagated freely, and experiments are in course of progress in grafting and inarching the cultivated fig on an indigenous species, and which promise to be successful."

"The fruit trees introduced last year from Australia, India and China are for the most part growing vigorously, especially the olives and oranges.

"Two of the apple trees planted in September, 1885, have already borne fruit of excellent quality, as also have the peach trees, which have grown very freely.

"Cardamums planted in a semi-shaded position have grown well. (*Vide Appendix C.*)

62. "His Excellency the Governor having expressed a desire, when last here, that every encouragement should be given to vegetable cultivators, 150 packets of European vegetable seeds easy of cultivation, as proved by a series of sowings in this Nursery, have been distributed to Chinese growers, whose gardens are at an altitude where they cannot fail to command success. Also a number of that admirable West India vegetable (*Sechium edule*) have been propagated and distributed to Chinese market-gardeners. This plant, though some years in the Settlement, has been confined almost exclusively to Penang Hill top, and believed to refuse to grow elsewhere, but its botanical origin having been determined by the Superintendent, this was found to be erroneous. It is hoped that its distribution among the Chinese will be the means of bringing into the bazaars a plentiful supply for the whole community."

63. The Hill Top Nursery includes the grounds which belong to the Government bungalow and convalescent bungalow. Economic plants tried in the Nursery have given less promise of satisfactory growth than elsewhere, which I attribute to exposure and to the scarcity of manure. The sum apportioned for the up-keep of the Nursery is no more than used to be expended on the bungalow grounds before they came under the control of the Department, and is found no more than sufficient for their proper maintenance now, which necessarily gives little scope for alteration or improvement.

Waterfall Nursery Garden.

64. The Waterfall Nursery Garden has become very popular, and now supplies means of recreation and instruction. The garden has an advantage of natural ornament, which few public gardens can boast of. Regarding this garden, Mr. CURTIS writes as follows:—

65. "So far as means would permit, the extension of the Waterfall Garden has been steadily pushed on during the year, and judging by the increased number of visitors, the work is thoroughly appreciated by the general public. A small plant-house has been erected near the entrance. The main road has been reduced to

“proper gradients, and one of the old bridges has been entirely re-constructed. A foot bridge to connect the grounds already laid out with the proposed extension has also been put up.”

66. “Additional flower-beds have been formed and clumps of trees and shrubs planted. The making and turfing of the steep banks which remained unfinished at the close of last year has been completed. A new site for seed sowing has been cleared and stocked. One thousand and seven hundred trees have been supplied during the year for road-side planting in Penang, Province Wellesley and Pêrak. One hundred Eucalyptus were supplied for planting in the vicinity of the Leper Hospital, Pulau Jerėjak, and the rate of growth of the young trees is very satisfactory.”

67. In addition to its general usefulness, the Waterfall Garden acts as the emporium of all plants arriving for Penang and Province Wellesley, and in a great measure for the Native States. In the latter capacity, its utility is only becoming known, and I think it has a future to which the Singapore Gardens cannot aspire.

PROVINCE WELLESLEY.

68. In Province Wellesley, one Reserve only has been established so far, namely at Kubang Ulu, about 8 miles from the coast. The Reserve has an area of 72 acres, and within the boundary is an Experimental Nursery into which a considerable collection of economic plants have been planted during the year for trial, among which were hemp, coffee, patchouly, jalap, oil-plants, sugar-cane, &c.; also numerous forest trees for planting in the Reserve, which included a good stock of Mahogany (raised on the spot from seed received from Kew), Merabau, Cedar, Adenanthrea, Kranji, &c. Several of the sugar-canes have proved new to the Province, and orders have been received from planters for supply. (*Vide Appendix C.*)

69. The boundary line of the Reserve has been extended to 10 feet in breadth and thoroughly cleared, in order to prevent the entry of fire from the outer wind-swept country.

The 8,000 trees planted in the Reserve last year have been weeded, and about 12,000 more added to the number. The Dadup cuttings planted in the Reserve for the benefit of pepper planters have been much attacked by white ants, and many eaten off close to the surface of the ground.

GENERAL.

Working Plan.

70. It will be seen from details already supplied, that the Forest Department has now passed its preliminary stages, and that attention to the preparation of a working plan, the conservancy of minor forest produce, and to the development of revenue is now desirable.

In this connection, I would call attention to remarks in Mr. SWETTENHAM'S Report on the collections of Straits timbers sent to the Indian and Colonial Exhibition, and would observe that the specimens sent from the Forest Department were sufficiently large for testing under the common process, but for some unexplained reason the experimenters seem to have confined their attention to *logs* which was, of course, not anticipated, nor was it known that any test experiments were to be made. The specimens were consequently prepared with a view to exhibition only, and shaped so as to shew the grain of the wood in every section.

Steps should now be taken, however, to have as many as possible of the good native timbers properly tested, and when a collection is sent to the Colonial Institute a ticket shewing the test results should be attached to each log or specimen.

Grazing and Fencing.

71. The extent to which grazing can be advantageously practised within the reserve boundaries is not now clear, probably but to a very limited extent. At present grazing leases are issued for the Military Reserve only; which Reserve, from its position near Town and main thoroughfare, requires to be strongly hedged with bamboo or logwood.

Introduction of Plants and Seeds.

72. Two hundred and forty-six kinds of plants and seeds have been introduced during the year, among them being plants of economic value from every part of the

world having a climate similar to the Straits, and have been lodged in the Experimental Nurseries. (*Vide* para. 12.)

Forest Legislation.

73. The preparation of a Forest Ordinance has been for the present postponed, in the belief that, so far, no case has occurred which cannot be dealt with by laws already in force in the colony. I would beg to point out, however, that what gives most trouble is the inveterate habit which most men have of looking upon forest as "every man's" or "no man's" property, hence the temptation to the acts of mischief and trespass complained of. To check such offences it is desirable the public should be quite clear what may not be done in a forest.

73. What is wanted is a simple mode of dealing with petty forest offences. All modern nations recognise the difference between small forest offences and crimes of a graver sort implying criminality of character in the perpetrator, and I hold that it is but fairness to the public and to those who have to administer the Department that clear and simple rules for guidance should be catalogued by law.

Summary.

74. In conclusion, I would briefly summarise the more important works carried out, during the year, as follows:—area demarcated, 16,117 acres; length of boundary line opened, 100 miles; maintained of previous years' demarcation, 95 miles; total length of boundary and coast line now under protection, 254 miles; area protected, 42,708 acres; average per watchman employed, 1,256 acres; cost of protection per acre, 6 cents; area planted, 38 acres; area weeded, 104 acres; cost of planting per acre, \$20; number of plants propagated about 100,000; planted, 65,000; herbarium specimens collected, 3,000; quantity of seed collected, 200lbs.; number of kinds of seeds received, 250; number of prosecutions, 18; convictions, 16; amount of fines imposed, \$281.

75. The annexed comparative statement shows the progress of the principal works since the commencement of the Department in 1884, exclusive of erection of quarters and purchase of lands.

76. Appendices detailing the progress of economic plants, the distributions of Reserves, the contents of the Experimental Nurseries, and the Revenue and Expenditure of the year, are also annexed.

N. CANTLEY,
Superintendent.

Singapore, 4th July, 1887.

APPENDIX A.

Comparative Statement shewing the Principal Works carried out since the Commencement of the Forest Department in 1884.

YEAR.	SINGAPORE.							MALACCA.						PENANG.					PROVINCE WELLESLEY.									
	Contemplated.	Demarcated.	Boundary opened.	Surveyed.	Waste Lands planted.	Nurseries made.	Protected.	Contemplated.	Demarcated.	Boundary opened.	Surveyed.	Waste Lands planted.	Nurseries made.	Protected.	Contemplated.	Demarcated.	Surveyed.	Boundary opened.	Waste Lands planted.	Nurseries made.	Protected.	Contemplated.	Demarcated.	Boundary opened.	Surveyed.	Waste Lands planted.	Nurseries made.	Protected.
	Acres.	Acres.	Miles.	Miles.	Acres.	Acres.	Acres.	Acres.	Acres.	Miles.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Miles.	Acres.	Acres.	Acres.	Acres.	Acres.	Miles.	Acres.	Acres.	Acres.	Acres.
1884, ...	14,000	1,463	16	...	50	7	1,453	42,000	...	...	2,000	...	4	...	9,000	4,000	...	30	...	16	3,000	6,000	...	...	...	...	...
1885, ...	...	4,223	13	...	55	7	7,299	...	10,000	19	8,865	...	...	13,000	...	4,084	...	18	...	...	6,000	...	72	3	...	4	2	72
1886, ...	...	5,868	47	47	25	4	11,554	...	9,500	42½	11,747	3	6	22,321	...	749	...	11	2	6	8,833	...	...	...	4	...	72	
Total, ...	14,000	11,554	76	47	130	18	11,554	42,000	19,500	61½	22,612	3	10	22,321	9,000	8,833	...	59	2	22	8,833	6,000	72	3	...	8	2	72

APPENDIX B.

REVENUE AND EXPENDITURE OF THE FOREST DEPARTMENT,
STRAITS SETTLEMENTS, 1886.

REVENUE.

		\$
Government Grant, Singapore, ...	...	7,000
Do., Penang, ...	...	7,000
Do., Malacca, ...	...	6,000
		\$20,000

EXPENDITURE.

	SINGAPORE.		PENANG.		MALACCA.	
	\$	c.	\$	c.	\$	c.
Salaries, ...	1,287	87	2,276	72	858	10
Demarcation of Reserves, ...	1,766	21	966	05	734	39
Planting Waste Lands and Weeding, ...	132	79	520	40	20	00
Formation and Up-keep of Nurseries, ...	1,331	20	784	22	306	02
Erection of Quarters, ...	152	50	45	43	...	...
Compensation for Crops, ...	...	...	...	...	834	00
Surveys, ...	230	00	...	...	345	67
Rent of Quarters, ...	10	00	420	00	110	00
Manure and Cartage, ...	139	20	31	56	...	...
Foreign Seeds and Plants purchased, ...	104	55	39	56	...	...
Herbarium Specimens and collecting Seeds, ...	...	...	...	...	400	42
Transport, ...	465	85	447	75	555	84
Botanical Books, ...	...	...	52	63	...	...
Personal and Field Allowances, ...	37	12	400	45	103	00
Uniforms, Tools and Implements, ...	180	00	355	16	220	31
Protection and Up-keep of Boundaries, ...	979	19	561	54	796	00
Miscellaneous and Petty Expenses, ...	183	52	91	99	270	25
Balance, ...	...	...	6	54	446	00
Total, ...	7,000	00	7,000	00	6,000	00

APPENDIX C.

NOTES ON ECONOMIC PLANTS.

The following Notes on Economic Plants are made with a view to the encouragement of minor industries. Sufficient time has not yet elapsed since the establishment of the Experimental Nurseries to obtain complete information, but that given below may be useful in shewing the tendency towards results, in the absence of more complete details.

FIBRES.

MAURITIUS HEMP (*Furcræa gigantea*) continues to grow with great vigour in the Nurseries, and several thousand plants have been disposed of to planters for trial. The price realized for good fibre is about £28 per ton in London, and if the fibre can be prepared here at say 5 cents per pound, its profitable cultivation is no doubt possible.

MANILA HEMP (*Musa textilis*) grows well. When first planted it takes longer to send up suckers than the common Banana does, but once established it grows freely.

In Manila, on good soil, the plantations are renewed only after a period of about 20 years. The present market value of the fibre is from £30 to £40 per ton in London, and as labour is about equally as cheap in the Straits as in Manila, the plant is no doubt capable of profitable cultivation in favourable localities.

SUNN HEMP (*Crotalaria juncea*).—Common in a wild state all over the Settlements, and grows well in ordinary soil. Some attempt to utilize the plant should be made, as the fibre commands a good price in the market.

PENGUIN HEMP (*Bromelia sylvestris*) grows with remarkable vigour. It is one of the pine-apple tribe, but the leaves are much longer than those of the pine-apple plant. It succeeds best under the treatment pine-apples require.

RHEA or CHINA GRASS (*Boehmeria nivea*) grows well in rich moist soils, and now that a simple process for the extraction of the fibre from the wood by steaming has been hit upon, its manufacture, considering the high price obtained for the fibre, is worthy of careful trial, especially on land where sugar cultivation has ceased to be remunerative owing to low prices, and where the ground is not marshy.

PLANTAIN and BANANA FIBRE (*Musa sapintum*).—The common plantain or banana yields a good fibre worth about £15 a ton. I observed when in Sélângor a wild banana which grew there with great luxuriance, in appearance the plant looked very like *Musa textilis* and it is probable it will be found to yield a very good marketable fibre.

From the *Kew Gardens Bulletin* of April last I learn that in Jamaica a red banana produces fibre worth £25 per ton; the plant is probably the same as the red banana of the Straits.

LALANG (*Imperatia Kænigii*).—Lalang has been found to produce good paper-making material, but as the grass had to be transported to England in bales, only the longest grass containing stout fibrous stems was found to pay. The land that will support grass of such a robust nature, will also grow more valuable crops. The quantity of material available for paper-making in the Straits, including bamboos, pine-apple leaves, wood, &c., would seem to warrant the establishment here of a permanent paper factory.

PINE APPLE FIBRE (*Ananassa sativa*).—In reference to pine-apple fibre, Mr. MORRIS writing in the *Kew Bulletin*, already referred to, observes as follows:—
 “Although not much at present in commercial use, the fibre has a future of considerable importance before it. It is finer and stronger than that yielded by any other plant.
 “A beautiful fabric known as Piña cloth is made from it. A rope of pine-apple fibre
 “ $\frac{3}{4}$ inches in circumference bore a strain of 57 cwt.”

MUDAR FIBRE (*Calotropis gigantea*).—Plants of Mudar have been in demand during the past year. The plant on hand is apparently the white variety, and grows very freely in almost any soil. The downy substance contained in the follicles or seed pods is the part most valued, but the stem also yields a fibre, which is said to be superior to the common *Calotropis* which by branching more is less valuable. The plant also yields a Gutta. The juice of ten average plants is said to yield about a pound of Gutta.

COTTON (*Gossypium arboreum*).—Cotton is found to do well on alluvial deposits on the plains and also on hills up to an elevation of about 2,000 feet as a first crop after the removal of virgin forest, but the soil of the Straits generally is unsuited for the cultivation of Cotton, being too clayey and retentive.

KAPOK (*Eriodendron anfractuosum*).—The cultivation of Kapok is attracting much attention. The plant is of rapid growth and succeeds well on ordinary soils. Its cultivation in the Straits can hardly fail to be profitable under good management.

INDIAN HEMP (*Cannabis sativa*) grows, but shews no hope of profitable production, the fibre being five times shorter than it naturally is when grown in a congenial climate.

OTHER FIBRES.—The following fibre-producing plants are also found to grow well in the Straits:—American aloe, Hibiscus of sorts, Bowstring hemp of sorts, Cus-cus, Palm and Pandan fibres, and numerous plants belonging to the Urticaceæ, Verbenaceæ and Malvaceæ families. Jute has not been tried, the seed requisitioned not having arrived in time, but I have hope of the plant succeeding.

OILS.

CITRONELLA GRASS (*Andropogon nardus*) and LEMON GRASS (*Andropogon citratus*).—The cultivation of these grasses would appear not to receive sufficient attention. Their growth in the Straits is all that can be desired, and the cultivation pays well when properly attended to.

RUSA OIL GRASS (*Andropogon schœnanthes*) does not seem to be known in the Straits, and so far I have not been able to procure plants, but that it will succeed here there is but little doubt.

CROTON OIL (*Croton tiglium*).—Among recent introductions, this is by far the most promising. It seems to have found a climate and soil entirely to its liking in the Straits. The plant bears heavy crops of fruit, its cultivation will no doubt prove a profitable investment.

ILLUPI OIL (*Bassia latifolia*).—Plants of this valuable oil tree do not appear to succeed well in Singapore. They are much preyed upon by insects, and although the tree is found in a wild state at no great distance, it has refused so far to grow satisfactorily in this island.

CASTOR OIL (*Ricinus communis*).—Castor oil is now largely used in the manufacture of soap, for machinery and other purposes. In the Straits the plant grows with great vigour, and under proper treatment its cultivation should pay. Some Chinese made an attempt to cultivate the plant in Malacca some years ago. The attempt was a failure in point of profitable return, and no one else seems to have tried it since then. I have strong reason to think, however, that the plant used was an inferior variety, *i. e.*, the variety common in the Straits, the cultivation of which could hardly have been expected to be profitable. The failure has had the effect of discouraging others, but there would seem no good reason to be discouraged so long as the plant has not had a proper trial.

COCOA-NUT OIL (*Cocos nucifera*).—Little need be said of this well-known oil, but it is found that the plant does not yield sufficient crops to pay, when grown more than about half-a-mile from the sea; when grown in the interior of Singapore the crops obtained are said to be only sufficient to cover cost of labour.

OLIVE OIL (*Olea europea*).—The olive plants introduced in 1885 and planted on

Penang Hill are making very satisfactory growth, and I am in hope of its proving well adapted for cultivation on mountains and high lands generally.

BEN OIL TREE (*Moringa pterogysperma*) is everywhere cultivated in the Straits for its leaves and roots, which are used as vegetables, but apparently no attempt has been made to manufacture oil from the tree.

KAYU PUTEH OIL (*Melaleuca leucodendron*).—Whole forests of this tree exist in Malacca, but little attention seems to be given to the manufacture of oil from the plant as is done elsewhere. The tree yields many useful produce, but oil may be looked upon as the most valuable, and it could, no doubt, be extracted from it at a rate which would give a good margin of profit.

GINGELLY OIL (*Sesamum indicum*) grows wild all over the country, and bears abundance of seed from which oil might be profitably extracted. The seed contains 50% of oil, and some three crops a year may be had. The oil is used for soap-making, in perfumery, and to adulterate almond oil, which it much resembles. In India one million acres is said to be under cultivation of *Sesamum*.

WOOD OIL (*Dipterocarpus spp.*).—At present wood oil in paying quantity is obtained only from primeval forest. I would however suggest that indigenous trees yielding wood oil and gutta percha be planted for pepper supports. The time they will require to make supports will be about seven years, at which date the temporary supports (Dadup or deadwood) could be removed. Acting on this principle, a time would arrive when the supports would become a source of considerable revenue, probably greater than the pepper crop, whereas at present they are generally a source of trouble and expense.

FRUITS.

PEACH (*Amygdalus persica*).—The successful acclimatization of the peach tree in the Straits is a work of the Forest Department which has already borne fruit, and very excellent fruit too; the trees have now borne three crops in succession, which shews that they are in earnest, and it is not too much to hope that, when the tree gets widely distributed among Chinese cultivators, peaches will become a common fruit in the bazaars of the colony.

APPLE (*Pyrus malus*).—Very good apples have been produced by the plants introduced from Sydney. I did not attach much importance to the first crop, as plants with fruiting branches (buds) ripened before their arrival will generally produce a first crop, but that the plants are now producing good fruits from Colonial ripened wood shews that they have adapted themselves to the altered circumstances of climate.

COCOA PLUM (*Chrysobalanus icaco*).—The cocoa plum of the West Indies came into bearing during the year for the first time in the Straits. The plants were received originally from Kew. On being removed from their pots and planted in the open ground they grew with great rapidity, and when about six feet in height came into fruit which they have ripened in fair quantity.

PINE-APPLE (*Ananassa sativa*).—The following pine-apple plants have been collected from various sources and are now growing in the Experimental Nursery, viz.:—Black Jamaica, Cayenne, Queen, Mauritius and New Providence. It is unfortunate that of all those just named the Mauritius, a very inferior kind, is the only one extensively cultivated here; time only will work a change. I would here mention that the profitable introduction of a new product (fruit or vegetable) into a Chinese bazaar is a more difficult thing than most people imagine, the Oriental taste once educated to a certain thing, even though an inferior article, is clung to with a persistence truly remarkable. I would observe further that the pine-apple everywhere known here under the name "Mauritius" is not known in that colony, and that the sugar-cane known in Mauritius under the name of "Penang" is not found here.

LIME BERRIES (*Triphasia trifoliata*).—The fruit of this plant is preserved in Manila and sent to the London market. The plant produces fruit here in great plenty, and will no doubt be found to grow here as well as in Manila.

BREAD NUT (*Brosimum alicastrum*), and BRAZIL-NUT (*Bertholetia excelsa*).—These plants continue to grow with unabated vigour, the first planted are now about twelve feet in height, and I have hopes of their producing useful fruit in the Colony.

ALLIGATOR PEAR (*Persea gratissima*).—This highly esteemed fruit tree is now in bearing in the Nursery. About two years ago when only a small plant it was removed from the Botanic Gardens where its growth had stood stationary for some years, but since being planted in more congenial soil it has grown with great freedom.

DATE PALM (*Phœnix dactylifera*).—Being often asked as to the possibility of dates being grown in the Straits, I may observe that our climate is altogether unsuitable for the cultivation of the plant or any of its varieties, of which there are over a hundred. The date grows well only in hot, dry climates, in localities where its roots can find a sufficiency of moisture. The plant exists in this Colony.

COMMON FIG (*Ficus carica*).—The common fig ripens fruit in the Straits very freely, but is much subject to attack from insects. A few drops of kerosine oil applied to the parts attacked will keep the ants away for about a week when another application becomes necessary. The underground portion of the stem is generally the part attacked first. Fruits which have attained full size but are backward in ripening may be brought to maturity in a few days by the application of a little olive oil to the extremity of the fruit.

NATIVE FRUITS.—It is notorious that the supply of native fruits, such as Durian and Mangosteen, is not sufficient to meet the local demand, and still orchards are not being extended with any great rapidity. So far as I have been able to discover, there seems two causes for this. The first is, that nearly all the land accessible to small cultivators on which fruit trees can be grown *easily* in Singapore and Penang is already under cultivation; and the second appears to be, that the growers in Malacca where land is available and who are chiefly Malays, are indifferent to money-making further than sufficient for their daily requirements.

The foreign demand for Mangosteen plants has become somewhat excessive since the tree has been found to fruit in East Africa and East and West Indies.

ORANGES.—Every effort has been made to get together as large a collection of orange plants as possible in the hope that at least a few may be found to fruit freely. So far, orange cultivation in the Straits has not been very successful, the plants grow freely enough, but produce but little fruit. Some China oranges planted on the Woodneuk Estate in Singapore produced during the first year a perfect crop of yellow oranges, next year a crop of a greener nature, and the third crop was entirely green. For some years past they have ceased producing edible fruit. How far cultivation may be to blame for these results is not known, but the stock now on hand will shew what can be done to acclimatize and cultivate this favourite fruit.

BEVERAGES.

LIBERIAN COFFEE (*Coffea liberica*) is becoming an established product of the Straits, but its proper cultivation is far from being properly understood. Drainage is too little attended to by some; others by starting the plant in very rich compost change the character of the roots to an extent that unsuits them for penetration of the natural soil. When these errors and some others get corrected, the adaptability of the plant for cultivation here will then shew itself in its true character. Plants of this Coffee are under various treatment in the Experimental Nursery, but it would be premature at present to detail these, I may state however that the plant will not bear manuring in the ordinary way when in fruit, manure should therefore be applied in liquid form, or as top dressing, when given to encourage the welling of the berries. When the soil is disturbed around the plant when in fruit, a large number of the berries wither and die owing to the destruction of rootlets in the manuring process, and which renders the act a loss instead of a gain.

MAROGOGEPIC COFFEE (*Coffea sp.*).—Three plants of the Coffee known as "Marogogepic" and very favourably reported on some little time ago by the Brazilian Minister of Agriculture, were received from Kew during the year and have grown with less vigour than the Liberian kind, but with almost double that of Arabian Coffee (*Coffea arabica*). The leaves are somewhat larger than the Arabian kind, so that the plant seems from its growth to approach an intermediate form between *Coffea liberica* and *Coffea arabica*, and is not as yet affected by the disease. Should it prove as well adapted to our soil as *Coffea liberica* does, keep free from disease, and have a distinct cropping season, it will no doubt supersede all other kinds in the Straits.

ARABIAN COFFEE (*Coffea arabica*).—The Arabian coffee planted in the Nursery Hooks healthy, but grows slowly. Hybridization may probably re-establish it in cultivation.

BENGAL COFFEE (*Coffea bengalense*).—The growth made by Bengal coffee does not look promising, the plants are still small however and may not shew their true character.

CHOCOLATE (*Theobroma cacao*).—Some plants of Chocolate which stood for some years leaf-eaten, extremities of the branches dead, and looking in a dying state had, on the land coming under the control of the Forest Department, a number of Dadup trees planted among them for experiment. The Dadup trees have now grown to about twenty-five feet in height and their branches having nearly met, the solar rays are prevented from striking the Chocolate plants directly.

The result has been that the latter have thrown off their lethargy and started into determined competition for light with the Dadups and have grown remarkably, the insects have given up attacking the leaves, and robust health has returned to them, but on other plantations where the plants have had shade from their infancy they have mostly died.

The Chocolate plant has proved very capricious in the Straits, whole plantation 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. It has been said that animals or plants located in large numbers together are liable to epidemic disease, which looses its grasp only after the individuals are thinned down to health permitting numbers. There is doubtless such a law in nature. What seems required is a knowledge of how far one can safely go without danger of calling its working into activity.

TEA (*Assam hybrid*) grows with a freedom which would seem to insure profitable cultivation, the question is more one of cheap manipulation than of plant growth.

I have lately inspected tea cultivation on some estates in Ceylon, and I see no good reason why its cultivation should not be taken up freely in the Straits on selected soils and made remunerative.

SPICES.

CLOVE (*Caryophyllum aromaticum*).—The Clove trees raised from Singapore grown seed and planted in the Tanglin Nursery look remarkably healthy, both in swampy ground and on the hill sides. They could hardly succeed better anywhere than they are doing.

NUTMEG (*Myristica fragrans*).—Nutmegs planted in the same Nursery look very promising and seem as if prepared to begin another cycle of satisfactory growth in the Settlement. Their successful cultivation seems to depend on what nearly all other crops depend on in the Straits, *i. e.*, liberal manuring.

ALLSPICE (*Pimenta vulgaris*).—A plant of allspice raised from seed some nine years ago is now about twelve feet in height and is for the moment covered with blossom and small fruit.

GINGER (*Zingiber officinale*).—Ginger grows satisfactorily, low prices only prevent its cultivation being freely developed. It is, however, an exhausting crop, soon wearing out the land in which it is planted in the absence of liberal manuring.

CHINESE GINGER (*Zingiber sp.*).—Some plants of this species, which produces the well-known preserved ginger of the shops, were received during the year from the Royal Gardens Kew. It has grown well, but shews no sign of flowering. It is believed to be an entirely new species, but this cannot be determined in the absence of flowers.

PEPPER (*Piper nigrum*).—The cultivation of pepper is being gradually taken up by Europeans. If present prices (\$41 per picul for white) keep up, large areas will soon be placed under pepper cultivation.

CAYENNE PEPPER (*Capsicum annum*).—No pepper from this plant seems to be made in the Straits, but chillies of all kinds grow freely. The value of chillies is about 45 shillings per hhd. in London.

CHINESE CASSIA (*Cinnamomum cassia*).—The plants of this, introduced from Hongkong in 1884, have grown with remarkable rapidity and are now large pyramidal bushes of 25 feet in height, but the substitution of Ceylon Cinnamon leaves for those of this Cassia will probably put an end to its cultivation, which has never been very profitable.

ROOTS AND CULINARY VEGETABLES.

TAPIOCA (*Fatropa manihot*).—The rise in the price of Tapioca flour has stimulated planting afresh. The estates lately closed are getting into working order again.

Of Tapioca, there are many varieties; so far I have been able to secure the following:—Red and white Brazilian, Singapore, and Mauritius. These are all in cultivation here, and the time they take to mature is about as follows:—Brazilian, nine months; Singapore, fifteen months; and Mauritius, eighteen months.

ARROW-ROOT (*Maranta arundinacea*) grows perfectly in the Experimental Nursery. It is not much cultivated here except by Cottagers for home consumption, but the produce is said to be very superior in quality.

KUMARA (*Ipomœa chrysorrhiza*).—This is a new vegetable received from the Royal Gardens Kew, and has grown with remarkable vigour. The tubers have grown to a fair size at date, but the crop is not yet ripe. I have no doubt that it will realize its high reputation as a vegetable and prove a most beneficial acquisition.

ARRACACHA ESCULENTA.—Native of New Grenada and said to be an excellent vegetable. The plants received from Ceylon have all failed.

Among the more common European vegetables which have been found on trial to grow well are the following, which may be ordered from Europe with every hope of success by those desirous of cultivating them:—

- Radish, early varieties (*Raphanus sativus*).
- Carrot, early varieties (*Daucus carota*).
- Lima Bean (*Phaseolus lunatus*).
- Watercress, of sorts (*Nasturtium officinale*).
- Parsley, of sorts (*Pteroselinum sativum*).
- Tomato, all the varieties (*Lycopersicum esculentum*).
- Beet, Turnip rooted (*Beta vulgaris*).
- Horse Radish (*Cochlearia armoracia*).
- Jerusalem Artichokes (*Helianthus tuberosus*).
- Basella alba (*Basella alba*).
- Lettuce, mixed (*Lactuca sativa*).
- Cho-cho, or Jamaica Cucumber (*Sechium edule*).
- Turnips, American Strop leave (*Brassica rapa*).
- Kohl-Rabi (*Brassica oleracea Caulo-rapa*).

DYES.

INDIGO (*Indigofera tinctoria*).—Not yet under cultivation by Europeans here, but largely cultivated by Chinese. The plant succeeds equally well on hill and swamp.

DIVI-DIVI (*Cæsalpinia coriaria*) is a new product for the Straits. The plant has shewn satisfactory growth. At the late flower show, Mr. ALLEN exhibited some pods from plants grown on his estate and which seemed quite equal to Indian produce. Its cultivation will no doubt be found profitable.

ARNOTTO (*Bixa orallina*) has found apparently a congenial home in the Straits, and grows with all the vigour of its native habitat. It yields abundance of dye which might surely be profitably utilised.

DYERS CASSIA (*Cassia auriculata*).—This plant is quite at home in Singapore soil, and its profitable cultivation is believed to be possible.

OTHER DYES.—Among other unutilised dyes, the growth of which leave nothing to be desired, may be mentioned, *Cæsalpinia sappan*, *Fibraurea tinctoria*, *Henna*, *Phytotacca*, &c.

INDIA-RUBBER, CAUTCHOUC, AND GUMS.

GUTTA PERCHA (*Dichopsis gutta*).—From statistics afforded by plants growing in the Nursery, this plant, the best variety of Gutta Percha tree, seems a moderately fast grower. A plant planted in 1879 is now twenty-five feet in height and twelve inches in circumference at six feet above the ground. This gives an average yearly growth in height of about three and a half feet, and an annual increase in circumference of about one and one-fourth inch.

NATIVE CREEPING GUTTA.—The various Willoughbeias and others from which a very large proportion of East Indian Gutta is drawn, grow with great vigour when planted on cleared land, and where, in the absence of anything to climb upon, they form large bushes in twelve months. Results of growth seem to show that it would be more profitable to plant these than the larger trees requiring some fifteen years to produce a first return.

FOREIGN CREEPING GUTTA.—The Foreign creeping Guttas on hand are the African and Madagascar creepers; these are planted side by side with the native kinds, and although they grow freely are far behind the native kinds in rate of growth and general vigour.

Other foreign rubber, such as Para, Ceara and Panama rubbers grow well, but so far as experiments have gone, the produce of latex is very watery and it is doubtful whether they will hold their own against the better native kinds. The other Gums under cultivation are, Gum Tolu, Gum Benzoin, and Gum Arabic, all growing satisfactorily.

DRUGS.

KOLA (*Cola acuminata*) a native of western Africa and acclimatised in our West Indian Colonies, produces a pod which contains several seeds about the size of horse chestnuts, which are used for many purposes by the Negroes, but one of its newest uses is that of an antidote for the effects of alcohol, or cure for inebriety, a nut powdered and taken in a little water is said to at once restore the most intoxicated mind to a state of sobriety. It is also used to heal wounds, as a remedy for indigestion, and a substitute for coffee, &c. The plant grows well in the Straits.

IPECACUANHA (*Cephalis ipecacuanha*), a native of Brazil, and a plant which has been found generally very difficult to cultivate, seems to grow in the Straits with all the luxuriance of its native country when a proper situation is hit upon. It enjoys a very moist still atmosphere and somewhat dense shade. In the Straits it forms a compact little bush of about eighteen inches in height and is very ornamental when well in flower. I lately visited a plantation of the plant in Johor and saw thousands of plants in excellent health. They were protected from the sun by palm leaves laid side by side on artificial supports about 6 feet in height; hedges of the same material were put down a few yards apart. Soil chocolate colour, rich in vegetable matter, wood ashes, &c.

TOBACCO (*Nicotiana tabacum*)—The soil of the Straits is generally not sufficiently rich for the successful cultivation of tobacco, except perhaps as a first crop after the removal of virgin forest, or in specially prepared compost. The plant requires heavy manuring to keep it growing satisfactorily on ordinary ground, as it exhausts the soil so quickly and thoroughly. Where the soil is not congenial, to start with its cultivation can hardly prove remunerative. Seed of the best kinds have however been distributed amongst the planting community.

CAMPHOR (*Camphora officinarum*), or Formosa Camphor, is not of much interest to Straits people so far as its cultivation is concerned, the climate being unsuitable for its proper growth. It nevertheless grows fairly well in Singapore.

SUMATRA CAMPHOR (*Dryobalanops aromatica*), also known as Borneo Camphor, is sparingly found on the Peninsula; and its importance in the afforestation of the Settlements is not overlooked. Private enterprise will hardly ever successfully cultivate the plant, owing to the time which is required to elapse between first outlay and first income.

JALAP (*Ipomæa purga*) } The climate of the Straits is not found suitable
 GENSENG (*Panax ginseng*) } for the cultivation of either of these valuable drugs.
 The former sell at 1s. 2d. a pound, the latter at (occasionally) \$400 the ounce.

SIAMESE BENZOIN (*Styrax sp.*).—The cultivation of Siamese Benzoin might pay, as it seems greatly in demand. I frequently receive letters offering long prices for plants or produce. The plant is supposed to be a variety of the common Benzoin (*Styrax benzoin*) but until proper specimens are obtained, this cannot be settled.

CUBEBS (*Piper cubeba*).—Experiments with Cubebs on a small scale seem to shew that the plant prefers a shady moist situation. Plants exposed to the full sun grew much more slowly. The cultivation of Cubebs plants does not receive the amount of attention in the Straits it deserves. The crop pays well, but for the present the monopoly of its cultivation remains in the hands of the Dutch, through apparently no other reason than a want of enterprise on the part of planters on this side of the water. In Johor the plant grows remarkably well, bearing heavy crops of fruit, but details of its cultivation as practised in Java is still a desideratum.

MISCELLANEOUS.

SAGO (*Sagus Rumphiana* and *S. lævis*).—The cultivation of native Sago is deservedly receiving increased attention in the Straits. The trees prefer rich swampy ground and become productive in about six years after planting from seed. When grown on other than swampy land the seed seldom matures. The tree can be increased from seed or from suckers or off-shoots, but when the latter process is adopted a large percentage generally fail to grow.

PATCHOULI (*Pogostemon patchouli*).—Plants of Patchouli have been in demand for experimental planting, and a good number have been supplied. Picked leaves are now selling at \$17 per picul. The plants grow freely with but little care, and should figure among Colonial products. Plants raised from seed are reported to grow well, but to have no scent, but retain it when produced from cuttings. I have not been able to verify these statements, but it is well known that plants do sometimes play tricks of this kind—Sandal-wood frequently.

TONQUIN BEAN (*Dipterix odorata*).—A plant of this, received from Kew some three years ago, has made very fair growth, being now about ten feet in height.

GUINEA CORN (*Sorghum vulgare*).—A quantity of seeds of Guinea Corn was received during the year from His Excellency the Governor. The plant grew well and produced an abundance of fruit, but the seeds were so much attacked by insects when near maturity that it was with difficulty a sufficiency was saved to retain the plant in stock. It is said to succeed well wherever Indian Corn will grow. The plant is of rapid growth and makes excellent fodder.

INDIAN CORN (*Zea mays*).—Indian Corn tried in the Nursery grew with great ease and ripened fine heads of fruit. Why the plant is not more largely cultivated here is difficult to understand. The plant comes to maturity in about sixty days, which admits of numerous crops in a year being reaped under energetic treatment.

TREE TOMATO (*Cyphomandra betacea*) } These two excellent fruits have
MOUNTAIN PAPAYA (*Carica candamarcensis*) } been introduced, but a proper place to plant them has not yet been procured. They would no doubt grow admirably on the Thaeping Range in Pêrak at about four thousand feet elevation, or on the Sêlângor hills, and be within range of practical use. I hope to obtain permission to plant them there under my personal directions. I had the advantage of seeing both of these fruits growing when lately at Hakgala in Ceylon, and of tasting them, and can testify to their excellence. The fruit of the mountain Papaya had some of the flavour of a peach and a very agreeable odour. Some of the Papaya plants I observed had partly left mother earth and were establishing themselves as sub-epiphytes, growing with but scanty support and fruiting freely in the crevices of stone walls, &c.

DAHL (*Cajanus indicus*) grew and produced fruit freely. Considering the large Indian population in the Straits, the plant might be profitably cultivated.

RICE (*Oxyra sativa*).—The mode of cultivating rice is as varied as the nations who cultivate it. The Malays are good cultivators in their particular way; they take only one crop a year, and which has been ascribed to indolence, but enquiry has led me to the conclusion that this is not the case. What the Malay does is simply this,

he grows a crop of rice during one half of the year, and a crop of manure during the other half. One he harvests, the other he digs into the ground to enrich it for his principal crop, and thus obviates the necessity of purchasing manure.

BAMBOOS (*Bambusa dendrocalmus, gigantochlia, &c.*).—The absence of serviceable Bamboos in Singapore must be a sore point with Indian immigrants. Clumps of Bamboos are common enough near villages, but are protected on account of their being used as a vegetable in a young state, and do not belong to the species used in house building, &c. Attention has been turned to the introduction of more serviceable kinds, and among those procured are the male Bamboo possessing an almost solid stem, the giant Bamboo, Sikkim Bamboo, green and yellow Java Bamboo and several unnamed kinds from Calcutta.

SUGAR CANE.—The new varieties of Sugar Cane which have been planted in the Province Wellesley Experimental Nursery have attracted much attention. Planters have expressed a belief that some promising kinds have never been tried in the Colony. The following descriptive summary of some of them will, therefore, be of interest. The summary is taken from results obtained by Mr. MORRIS in Jamaica:—

Hillu.—Of slender habit; 16 canes in a clump; height 9 feet; length of joint 5 to 6 inches, circumference $3\frac{1}{2}$ inches; leaves heavy; round stem, 4 feet long, 3 inches wide; stands drought well; stools freely; a prolific small black cane suitable for poor soils. Percentage of trash 35; juice 65 (6.0 gals.); density of juice 1.067: Arnaboldi 22.

Seeti.—Of stout habit; 12 to 16 canes in a clump; height 8 feet; colour a greenish yellow when young, white when matured; length of joint 4 inches, circumference 3 inches; foliage very heavy, length 4 feet, breadth 3 inches; stands drought moderately well; a good cane for experimental trial in soft soils. Percentage of trash 30; juice 70 (6.5 gals.); density of juice 1.082: Arnaboldi 28.

Nagapoury.—Of strong vigorous habit; 16 canes to a clump; colour cream white; length of joint 4 inches; circumference 5 inches; foliage heavy; does not stand drought but grows well in fairly moist situations; an excellent cane under irrigation. Percentage of trash 31; juice 69 (6.4 gals.); density of juice 1.065: Arnaboldi 21.

Vulu-Vulu.—Of stout habit; 10 to 12 canes in a clump; height 8 to 10 feet; length of joints 4 inches; colour fine yellow; foliage light; stands drought well; not liable to lodge; free from rust. Percentage of trash 35.75; juice 64.25 (5.9 gals.); density of juice 1.078: Arnaboldi 26.

Liguanea.—Of short stunted habit; number of canes in each clump 10 to 12; height 6 to 8 feet; colour dark purple and black; length of joint $3\frac{1}{2}$ inches, circumference 5 inches; foliage light; length $4\frac{1}{2}$ feet; breadth 3 inches; stands drought very well. Percentage of trash $33\frac{1}{3}$; juice $66\frac{2}{3}$ (6.2 gals.); density of juice 1.076: Arnaboldi 25.

Nain.—Habit strong, with large stools ratooning freely; canes in each clump 35; height 10 feet; colour light brown; length of joint 5 inches, circumference 5 inches; foliage of a fine texture and dark green, leaves short and broad. This cane stands drought well; a clean healthy cane of very vigorous habit. Percentage of trash 34; juice 66 (6.1 gals.); density of juice 1.066: Arnaboldi 23.

Lahina.—Of rather delicate habit at first, but afterwards a strong fine cane; canes in each stool 18; height 9-11 feet; colour yellow; length of joint 5 inches, circumference $5\frac{1}{2}$ inches; foliage pale green and moderately light. This cane does not stand drought well and is liable to get lodged. A bright free growing cane under irrigation, very much like the best type of Bourbon canes. Percentage of trash $37\frac{1}{2}$; juice $62\frac{1}{2}$ (5.8 gals.); density of juice 1.076: Arnaboldi 25 (Beaumé 10.).

Keni-Keni.—Of slender habit; 12-15 canes in a clump; 8-10 feet high; length of joints 5 inches, circumference 4 inches; colour white; leaves green, 4 feet 6 inches long, $2\frac{1}{2}$ inches broad; fine healthy cane suitable for seasonable districts; does not stand drought well. Percentage of trash 33; juice 67 (6.2 gals.); density of juice 1.080: Arnaboldi 26.

China.—Very similar in habit, size and characteristics to last. Percentage of trash 35; juice 65 (6.0 gals.); density of juice 1.066: Arnaboldi 22.

Po-a-ole.—This would appear to be identical with the Mauritius cane No. 96 already distilled and tested in 1880. "A stout black cane of fine habit and growth; leaves rather heavy; stands drought well; rind rather hard; not subject to lodge; makes a good grain of sugar and yields at the rate of $2\frac{1}{2}$ hhds. per acre."

Ko-poapa.—Of strong rapid growth; 18 canes in a clump; about 11 feet high; length of joints 4 inches, circumference 5 inches; colour white; leaves moderately heavy, 5 feet long, $2\frac{1}{2}$ inches broad; stands drought well; not liable to get lodged; a fine white cane, one of the best in the collection for dry districts; always healthy and throwing good large stools. Percentage of trash 28; juice 72 (6.4 gals.); density of juice 1.063: Arnaboldi 21 (Beaumé 8.2-5.)

Lakona.—Of upright and somewhat slender habit; about 12 feet high; length of joint 6 inches, circumference 4 inches; colour white; leaves dark green; 5 feet long, 3 inches broad; healthy, vigorous cane and free from rust. Percentage of trash $30\frac{1}{2}$; juice $69\frac{1}{2}$ (6.4 gals.); density of juice 1.074: Arnaboldi 24 (Beaumé 9.4-5.)

Vituahaula.—Strong, vigorous habit; 30 canes in a clump; about 11 feet high; length of joints 3 inches, circumference 4 inches; colour pale when young, growing into a light purple; leaves dark green $4\frac{1}{2}$ feet long, 3 inches broad; somewhat liable to lodge; free from rust. Percentage of trash 25; juice 76 (7.0 gals.); density of juice 1.055: Arnaboldi 18 (Beaumé $7\frac{1}{3}$.)

Sacuri.—Of strong habit and very rapid growth; 20 canes in a clump; average height 11 feet; length of joints 6 inches, circumference 5 inches; leaves somewhat heavy, 5 feet long, 3 inches broad; likely to lodge; free from rust. Percentage of trash 25; juice 75 (7.9 gals.); density of juice 1.076: Arnaboldi 25 (Beaumé 10.)

Cubun.—Habit light; 12 canes in each clump; height 10 feet; joints long and straight; leaves light green, 5 feet long, $2\frac{1}{2}$ inches broad; suitable for moist districts only; a clean healthy cane resembling the Bourbon. Percentage of trash $33\frac{1}{3}$; juice $66\frac{2}{3}$ (6.2 gals.); density of juice 1.074: Arnaboldi 24 (Beaumé 9.4-5.)

Horne.—Habit strong; 20-25 canes in each clump; height 10 feet; colour pale with purple and violet stripes; length of joint $4\frac{1}{2}$ inches, circumference 5 inches; leaves heavy, 5 feet long, 3 inches broad; stands drought well and not liable to get lodged. Percentage of trash $24\frac{1}{4}$; juice $65\frac{3}{4}$ (6.1 gals.); density of juice 1.076: Arnaboldi 25 (Beaumé 10.)

Samuri.—Of slender habit; 16 canes in each clump; average height 8 feet; colour black with pale purplish stripes; length of joints $2\frac{1}{2}$ inches, circumference 4 inches; leaves light, 5 feet long, $2\frac{1}{2}$ inches broad, rather hard rind; stands drought well. Percentage of trash 40; juice 60 (5.5 gals.); density of juice 1.079: Arnaboldi 26 (Beaumé $10\frac{1}{2}$.)

Brèhèret.—Of strong habit; 14 canes in each clump; height 8 feet; colour black; length of joints $2\frac{1}{2}$ inches, circumference 5 inches; foliage light, 4 feet long, $2\frac{1}{2}$ inches broad. The joints of this cane are strikingly short and heavy; it stands drought well and would be very suitable for dry districts. Percentage of trash $33\frac{1}{2}$; juice $66\frac{2}{3}$ (6.2 gals.); density of juice 1.079: Arnaboldi 26 (Beaumé $10\frac{1}{2}$.)

Mamuri.—Of strong habit and rapid growth; 30 to 40 canes in each clump; height 10-12 feet; colour light brown with the outer epidermal layer dry and chaffy; length of joints 4 inches, circumference $3\frac{1}{2}$ inches; foliage light; leaves 4 feet long, 3 inches broad; a clean healthy but somewhat peculiar looking cane; stands drought well. Percentage of trash 34; juice 66 (6.1 gals.); density of juice 1.084: Arnaboldi 28 (Beaumé 11.1-5.)

In favourable localities the Elephant cane, where it has been tried, throws immense canes looking almost like clumps of bamboos: the yield per acre has not, however been quite equal to the show of the canes, but it has yielded at the rate of two, to two and-a-half tons of sugar per acre, which is far beyond the average of ordinary canes in Jamaica."

The following have not yet been tested:—

Vico,	Meligeli,	Kokeia,
Kamba Vati,	Lahria,	Mozambique,
Chyaca,	Vagabonde,	Samoa,
Canne Morte,	Dark red striped cane,	Claret coloured cane,
Diard,	Loma Loma,	Loa,
Dama,	Nova Java,	Green and yellow,
Tamarind,	Large green,	Karaka Rawa.
Davanboota,	Meera,	
Samoan,	Ila,	

LIST OF THE PRINCIPAL ECONOMIC
PLANTS CONTAINED IN THE FOREST EXPERIMENTAL
NURSERIES.

<i>Systematic Name.</i>	<i>Local Name.</i>	<i>Native Country.</i>
Abrus precatorius, ...	Crabs' eyes, ...	E. Indies.
Abutilon indica, ...	Chinese lantern, ...	Do.
Acacia arabica, ...	Gum Babool, ...	Arabia.
Acacia Catechu, ...	Cutch, ...	E. Indies.
Acacia decurrens, ...	Black Wattle, ...	Australia.
Acacia Farnesiana, ...	Cassia, ...	S. America.
Achros sapota, ...	Chicko or Bullet Wood, ...	Trop. America.
Acrocomia sclerocarpa, ...	Gru-gru Palm, ...	W. Indies.
Adansonia digitata, ...	Boabab, ...	Africa.
Adenanthera pavonina, ...	Circassian Bean, ...	E. Indies.
Ægle marmelos, ...	Bael Fruit, ...	Do.
Æschynomene aspera, ...	Shola, ...	India.
Azalia plembanica, ...	Merabou, ...	Malaya.
Azalia sp., ...		British Guiana.
Agati grandiflora, ...	Trong Merah, ...	India.
Agati grandiflora alba, ...	Trong Puteh, ...	Do.
Agave mexicana, ...	Mexican Aloe, ...	S. America.
Agave americana, ...	American Aloe, ...	Do.
Alternanthera sessilis, ...	Kruma, ...	Asia.
Albizia procera, ...	Safed Siris, ...	E. Indies.
Albizia stipulata, ...	Bummaizale, ...	Do.
Albizia Lebbek, ...	Bois Noir, ...	Travancore.
Aleurites triloba, ...	Otaheite Walnut, ...	Polynesia.
Aleurites vernicifera, ...	Chinese Varnish Tree ...	China.
Aleurites sp., ...		Cochin China.
Alpinia galanga, ...	Galangal, ...	E. Indies.
Allium cepa, ...	Onion, ...	Africa.
Allium porrum, ...	Leek, ...	Switzerland.
Allium ascalonicum, ...	Bawang, ...	Palestine.
Do. do. var. ...	Bawang Kechil, ...	Do.
Do. do. var. ...	Bawang Merah, ...	Do.
Do. schænoprasum, ...	Chives, ...	Britain.
Alocasia indica, ...	Taro, ...	India.
Amaranthus spinosus, ...	Bayam Durie, ...	Do.
Do. gangeticus, ...	Bayam, ...	Do.
Do. tristis, ...	Bayam Pasir, ...	Do.
Amygdalus persica, ...	Peach, ...	Asia.
Anacardium occidentale, ...	Cashew Nut, ...	W. Indies.
Ananassa sativa, ...	Pine-apple, ...	Do.
Do. var. ...	Mauritius Pine, ...	Tropics.
Do. do., ...	Black Jamaica Pine, ...	Do.
Do. do., ...	Hen and Chicken Pine, ...	Do.
Do. do., ...	Queen Pine, ...	Do.
Do. do., ...	New Providence Pine, ...	India.
Do. do., ...	Smothe Cayenne Pine, ...	Do.
Ancilema nudiflorum, ...	Tapak Etek, ...	Asia.
Andropogon nardus, ...	Citronella-oil Grass, ...	India.
Andropogon citratus, ...	Lemon Grass, ...	Central India.
Andropogon muricatus, ...	Cus Cus, ...	India.
Anamirta paniculata, ...	Cocculus, ...	E. India.
Anethum foeniculum, ...	Fennel, ...	England.
Anethum graveolens, ...	Dill, ...	Spain.
Anona reticulata, ...	Custard-apple, ...	W. Indies.
Anona cherimolia, ...	Cherimoyer, ...	S. America.
Anona muricata, ...	Sour-sop, ...	Trop. America.
Anona squamosa, ...	Sweet-sop, ...	Do.
Anona montana, ...	Mountain Custard-apple, ...	
Anisogonium esculentum, ...		Malaya.
Anthriscus cerefolium, ...	Chervil, ...	Europe.
Antiaris toxicaria, ...	Upas, ...	Malaya.
Apium graveolens, ...	Celery, ...	Britain.
Areca monostachya, ...	Walking-stick Palm, ...	N. S. Wales.

<i>Systematic Name.</i>	<i>Local Name.</i>	<i>Native Country.</i>
<i>Areca Catechu</i> , ...	Areca-nut, ...	Ceylon.
<i>Areca nebong</i> , ...	Nibong, ...	Malaya.
<i>Areca oleracea</i> , ...	Mountain Cabbage Palm, ...	Trop. America.
<i>Arachis hypogaea</i> , ...	Earth-nut, ...	E. W. Tropics.
<i>Araucaria Bidwellii</i> , ...	Bunya Bunya, ...	Australia.
<i>Arenga saccharifera</i> , ...	Sugar Palm, ...	Malaya.
<i>Artocarpus incisa</i> , ...	Bread Fruit, ...	Malacca.
<i>Artocarpus integrifolia</i> ...	Jack Fruit, ...	E. Indies.
<i>Artocarpus echinatus</i> , ...	Monkey Jack, ...	Malaya.
<i>Artocarpus Blumeii</i> , ...	Gutta Tarrap, ...	Malaya.
<i>Artocarpus polyphemia</i> , ...	Tampang, ...	Malaya.
<i>Artocarpus sp.</i> , ...	Kledang, ...	Malaya.
<i>Asclepias curassavica</i> , ...	Bastard Ipecacuanha, ...	W. Indies.
<i>Asparagus officinalis</i> , ...	Asparagus, ...	Europe.
<i>Averrhoa bilimbi</i> , ...	Blimbing, ...	India.
<i>Averrhoa carambola</i> , ...	Carambolla, ...	India.
<i>Azaderachta indica</i> , ...	Nem, ...	E. Indies.
<i>Aberia Caffra</i> , ...	Kei Apple, ...	Cape of Good Hope.
<i>Artanthe elongata</i> , ...	Matico, ...	India.
<i>Aloe Perryii</i> , ...	Socotrine Aloe Tree, ...	Socotra.
<i>Arduina grandiflora</i> , ...	Natal Plum, ...	Natal.
<i>Bambusa nana</i> , ...	Hedge Bamboo, ...	China.
<i>Bambusa arundinacea</i> , ...		E. Indies.
<i>Bambusa verticillata</i> , ...		China.
<i>Bambusa vulgaris</i> , ...	Common Bamboo, ...	E. Indies.
<i>Bambusa vulgaris var aurea</i> , ...	Yellow Bamboo, ...	E. Indies.
<i>Bambusa vulgaris var striata</i> , ...	Striped Bamboo, ...	E. Indies.
<i>Barbarea præcox</i> , ...	American Cress, ...	England.
<i>Barringtonii speciosa</i> , ...	Bois de jolie cœur, ...	Seychelles, &c.
<i>Bassia butryacea</i> ...	Butter Tree, ...	India.
<i>Bassia latifolia</i> , ...	Mahwa, ...	E. Indies.
<i>Basella alba</i> , ...	Indian Spinach, ...	Bengal.
<i>Berrya amonilla</i> , ...	Trincomalee-wood, ...	N. Australia.
<i>Beesha travancorinsis</i> , ...		Travancore.
Do. <i>Rheedii</i> , ...	Quill Reed, ...	Do.
<i>Beta vulgaris</i> , ...	Beetroot, ...	S. Europe.
<i>Bixa orellana</i> , ...	Arnatto, ...	Trop. America.
<i>Boehmeria nivea</i> , ...	Rhea or China Grass, ...	China.
<i>Borago officinalis</i> , ...	Borage, ...	England.
<i>Boxus sempervirens</i> , ...	Box Wood, ...	Europe.
<i>Brassica actinophylla</i> , ...	Umbrella Tree, ...	Australia.
<i>Brassica oleracea acephala</i> , ...	Borecole or Kale, ...	Europe.
Do. do. <i>CaULO-rapa</i> , ...	Kohl-Rabi, ...	Do.
<i>Brassica napa</i> , ...	Turnip, ...	Britain.
<i>Bromelia Pinguin</i> , ...	Pinguin Fibre, ...	W. Indies.
<i>Brosimum alicastrum</i> , ...	Bread-nut Tree, ...	Jamaica.
<i>Butea frondosa</i> , ...	Bengal Kino, ...	Bengal.
<i>Bertholletia excelsa</i> ...	Brazil-nut, ...	Brazil.
<i>Bombax, malabaricum</i> , ...	Malabar Silk Cotton Tree, ...	E. Indies.
<i>Blighia sapida</i> , ...	Akee Apple, ...	W. C. Africa.
<i>Caesalpinia ferrea</i> ...	Brazilian Iron Wood, ...	Brazil.
<i>Caesalpinia coriaria</i> , ...	Divi-Divi, ...	E. Indies.
<i>Caesalpinia Nuga</i> , ...		China.
<i>Caesalpinia sappan</i> , ...	Sappan-wood, ...	E. Indies.
<i>Caesalpinia sepiaria</i> , ...	Mysore Thorn, ...	E. Indies.
<i>Cajanus indicus</i> , ...	Kachang Dahl, ...	E. Indies.
<i>Calophyllum inophyllum</i> , ...	Poon Spar, ...	E. Indies.
<i>Calamus Rotang</i> , ...	Rotang, ...	Malaya.
<i>Calamus arboresceus</i> , ...	Rotang, ...	Malaya.
<i>Calamus fasciculatus</i> , ...	Rotang, ...	Malaya.
<i>Calamus longipes</i> , ...	Rotang, ...	Malaya.
<i>Calodendron Capense</i> , ...	Natal Wild Chestnut, ...	Natal.
<i>Coscinium fenestratum</i> , ...	False Calubra, ...	Malacca.
<i>Chloranthus inconspicuus</i> , ...		China.
<i>Calamsogus hernifolius</i> , ...	Rotang, ...	Malaya.
<i>Calamsogus Wallichifolius</i> , ...	Rotang, ...	Malaya.
<i>Calotropis gigantea</i> , ...	French Cotton, ...	E. Indies.
<i>Calocasia esculenta</i> , ...	Kladi Klamomo, ...	Do.
Do. do., <i>var.</i> , ...	Kladi China, ...	Do.
<i>Cajanus indicus</i> , ...	Pigeon Pea, ...	Do.
<i>Canavalia villosa</i> , ...	Do., ...	Do.
Do. <i>gladiata</i> ...	Kachang Parang, ...	India.
<i>Cannabis sativa</i> , ...	Hemp, ...	Do.
<i>Cannabis gigantea</i> , ...		Do.
<i>Canna Indica</i> , ...	Indian Shot, ...	China.
<i>Cananga odorata</i> , ...	Kananga, ...	W. Indies.
<i>Carica papaya</i> , ...	Papaya, ...	Columbia.
<i>Carica Candamarcensis</i> , ...	Mountain Papaya, ...	E. Indies.
<i>Carypha flabelliformis</i> , ...	Lantor, ...	E. Indies.
<i>Carissa Carandas</i> , ...	Karaundas, ...	Moluccas.

<i>Systematic Name.</i>	<i>Local Name.</i>	<i>Native Country.</i>
<i>Caryophyllum aromaticum</i> , ...	Clove, ...	Panama.
<i>Carludovica palmata</i> , ...	Panama Hat Palm, ...	India and Ceylon.
<i>Caryota urens</i> , ...	Jaggery Palm, ...	E. Indies.
<i>Cassia auriculata</i> , ...	Dyers Cassia, ...	E. Indies.
<i>Cassia fistula</i> , ...	Purging Cassia, ...	E. Indies.
<i>Cassia florida</i> , ...	Waa Tree, ...	E. & W. Indies.
<i>Cassia occidentalis</i> , ...	Payavera, ...	E. Indies.
<i>Cassia grandis</i>, ...	...	India.
<i>Cassia alata</i> , ...	Ringworm Shrub, ...	Malaya.
<i>Castenopsis</i> sp., ...	Brangan or Native Chestnut, ...	Malaya.
<i>Casuarina equisetifolia</i> , ...	Beef-wood, ...	E. Indies.
<i>Casuarina sumatrana</i> , ...	Sumatra Beef-wood, ...	Panama.
<i>Castelloa elastica</i> , ...	Panama Rubber, ...	Moreton Bay.
<i>Castanospermum australe</i> , ...	Moreton Bay Chestnut, ...	Sumatra.
<i>Ceratonia Siliqua</i> , ...	Carob Bean, ...	S. Europe.
<i>Ceratopteris thalictroides</i> , ...	Rawan Rawan, ...	Malaya.
<i>Cerus triangularis</i> , ...	God Ochro, ...	...
<i>Cedrela toona</i> , ...	Toon, ...	E. Indies.
<i>Cedrela odorata</i> , ...	West India Cedar, ...	W. Indies.
<i>Ceropegia bulbosa</i>, ...	...	...
<i>Cephaelis ipecacuanha</i> , ...	Ipecacuanha, ...	Brazil.
<i>Cerasus vulgaris</i> , ...	Cherry, ...	Barbadoes.
<i>Cinchona saccirubra</i> , ...	Chinchona, ...	S. America.
<i>Cinnamomum Cassia</i> , ...	Cassia Buds, ...	China.
<i>Cinnamomum Zeylanicum</i> , ...	Cinnamon, ...	Ceylon.
<i>Cinnamomum iners</i> , ...	Wild Cinnamon, ...	Malaya.
<i>Cinnamomum camphora</i> , ...	Camphor, ...	E. Asia.
<i>Cichorium Endivia</i> , ...	Endive, ...	E. Indies.
<i>Cicer arietinum</i> , ...	Gram, ...	India.
<i>Cicca disticha</i> , ...	Cambling, ...	India.
<i>Citrullus vulgaris</i> , ...	Water Melon, ...	...
<i>Citrus Aurantium</i> , ...	Sweet Orange, ...	India.
<i>Citrus aurantium</i> var <i>Bergamia</i> , ...	Bergamot Orange, ...	India.
Do. do. var <i>Bigaradia</i> , ...	Bitter or Seville Orange, ...	India.
Do. do. var <i>melitense</i> , ...	Blood Orange, ...	...
Do. <i>decumana</i> , ...	Shaddock, ...	India and China.
Do. <i>Limetta</i> , ...	Sweet Lime, ...	India and China.
Do. <i>Limonum</i> , ...	Lemon, ...	India and China.
Do. <i>medica</i> , ...	Citron, ...	Persia.
Do. <i>nobilis</i> var <i>Tangerina</i> , ...	Tangerine Orange, ...	N. Africa.
Do. do. var <i>major</i> , ...	Mandarin Orange, ...	China.
<i>Cissampelos Pareira</i> , ...	Brava, ...	Jamaica.
<i>Chavica betel</i> , ...	Betel Pepper, ...	Java.
<i>Chloroxylon swietenia</i> , ...	Satin Wood, ...	Ceylon.
<i>Chlorophora tinctoria</i> , ...	Dindie, ...	B. Columbia.
<i>Chilocarpus</i> sp., ...	Gutta sp. ...	Perak.
<i>Chrysophyllum Cainito</i> , ...	Star Apple, ...	W. Indies.
<i>Chrysobolanus Icaco</i> , ...	Cocoa Plum, ...	Trop. America.
<i>Cleome viscosa</i> , ...	Mamum Këchil, ...	E. Indies.
<i>Cookia punctata</i> , ...	Wampee, ...	China.
<i>Cochlearia Armoracia</i> , ...	Horse Raddish, ...	England.
<i>Coffea Bengalense</i> , ...	Bengal Coffee, ...	Bengal.
<i>Coffea arabica</i> , ...	Arabia Coffee, ...	Arabia.
<i>Coffea</i> sp, ...	Marogogipe Coffee ...	Mexico.
<i>Coffea liberica</i> , ...	Liberian Coffee, ...	W. Africa.
<i>Cocos nucifera</i> , ...	Cocoa-nut, ...	Tropics.
<i>Cocos nucifera</i> var, ...	Kalapa Gading, ...	Do.
Do. do., ...	Do. Pooyoh, ...	Do.
Do. do., ...	Do. Dadeh, ...	Do.
Do. do., ...	Do. Sapang, ...	Do.
Do. do., ...	Do. Logee, ...	Do.
Do. do., ...	Do. Hijau, ...	Do.
Do. do., ...	Do. Tandok, ...	Do.
Do. do., ...	Do. Kapal, ...	Do.
Do. do., ...	Do. Manis, ...	Do.
Do. do., ...	Do. Chin Chin, ...	Do.
Do. do., ...	Do. Pooyoh Panjang, ...	Do.
Do. do., ...	Do. Wangi, ...	Do.
Do. do., ...	Do. Laut, ...	Do.
<i>Coleus parviflorus</i> , ...	Ubie, ...	Java.
<i>Coix Lachrynea</i> , ...	Job's Tears, ...	Tropics.
<i>Cola acuminata</i> , ...	Kola-nut, ...	Africa.
<i>Coccoloba uvifera</i> , ...	Sea-side Grape, ...	W. Indies.
<i>Convolvulus repens</i> , ...	Kangkong, ...	China.
<i>Crotolaria juncea</i> , ...	Sun Hemp, ...	Asia.
<i>Crescentia cujete</i> , ...	Calabash, ...	W. Indies.
<i>Croton eluteria</i> , ...	Cascarilla Bark, ...	Bahamas.
<i>Croton tiglium</i> , ...	Croton-oil Tree, ...	E. Indies.
<i>Cucumis sativus flavus</i> , ...	Loba Ayer, ...	Moluccas.
<i>Curcuma zedoaria</i> , ...	Zedoary, ...	Java.
<i>Curcuma longa</i> , ...	Turmeric, ...	India.
<i>Cucurbita pepo</i> and vars, ...	Kaundon, ...	Moluccas.
<i>Cucurbita moschata</i> , ...	Kitula (Pumpkin), ...	Moluccas.
<i>Cyphomandra betacca</i> , ...	Tree Tomato, ...	Peru.
<i>Cycas revoluta</i> , ...	Sago, ...	Japan.
<i>Cycas circinalis</i>, ...	...	Malaya.

<i>Systematic Name.</i>	<i>Local Name.</i>	<i>Native Country.</i>
<i>Cycas rumphiana</i>, ...	...	Australia.
<i>Cycas media</i>, ...	...	E. Australia.
<i>Cynara scolymus</i> , ...	Artichoke, ...	S. Europe.
<i>Cynometra cauliflora</i> , ...	Nam Nam, ...	E. Indies.
<i>Dalbergia sissoo</i> , ...	Sissu, ...	E. Indies.
Do. <i>frondosa</i> , ...	Black Wood, ...	E. Indies.
<i>Dammara robusta</i> , ...	Kauri Pine of Queensland, ...	Queensland.
Do. <i>orientalis</i> , ...	Dammara, ...	Malaya.
<i>Datarium senegalense</i> , ...	Senegal Plum, ...	Senegal.
<i>Datura stramonium</i> , ...	Thorn Apple, ...	Trop. America.
<i>Daucus carota</i> , ...	Carrot, ...	Britain.
<i>Derris elliptica</i> , ...	Tuba, ...	Malaya.
<i>Dendrocalamus strictus</i> , ...	Male Bamboo, ...	E. Indies.
Do. <i>spinosus</i> , ...	Prickly Bamboo, ...	E. Indies.
Do. <i>tulda</i>, ...	...	Bengal.
Do. <i>sp. sikkim</i>, ...	...	E. Indies.
<i>Dialium indicum</i> , ...	Kranji, ...	Malaya.
<i>Dichopsis gutta</i> , ...	Gutta Percha, ...	Malaya.
<i>Diospyros discolor</i> , ...	Mabola, ...	Malaya.
Do. <i>ebenum</i> , ...	Ebony, ...	Ceylon.
<i>Dioscorea batatis</i> , ...	Sweet Potato, ...	E. Indies.
Do. <i>bulbosa</i>, ...	...	E. Indies.
Do. <i>bulbifera</i>, ...	...	India.
<i>Dipterocarpus laevis</i> , ...	Kayu Minyak, ...	Malaya.
<i>Dipterix odorata</i> , ...	Tonquin Bean, ...	Cayenne.
<i>Doona trapeziformis</i> , ...	Doon, ...	Ceylon.
<i>Dolichos tetragonolobus</i> , ...	Kashing Boty, ...	India.
<i>Doryanthes Palmeri</i> , ...	Palm Lily, ...	Queensland.
<i>Dolichos sesquipedalis</i> , ...	Kachang Prot Ayam, ...	India.
<i>Dryobolanopsis aromatica</i> , ...	Borneo Camphor, ...	Borneo.
<i>Dolichos sesquipedalis</i> var, ...	Kachang Prot Ayam Panjang, ...	India.
<i>Durio Zebethiuns</i> , ...	Durian, ...	Malaya.
<i>Dyera costulata</i> , ...	Gutta Jelutong, ...	Malaya.
<i>Dorstenia Contrayerva</i> ...	Contrayerva Root, ...	Trop. America.
<i>Dracæa Draco</i> , ...	Dragons Blood, ...	...
<i>Davidsonia pruriens</i> , ...	Queensland Plum, ...	Queensland.
<i>Elaeocarpus serratus</i>, ...	...	Australia.
<i>Elais giuneensis</i> , ...	African Oil Palm ...	Africa.
<i>Elettaria cardamomum minor</i> , ...	Cardamum, ...	Malabar.
<i>Erythrina corallodendron</i> ...	Coral Bean Tree, ...	W. Indies.
<i>Erythrina umbrosa</i> , ...	Bois Immortelle, ...	W. Indies.
<i>Erythroxylon Coca</i> , ...	Coca Leaf, ...	W. Indies.
<i>Eriobotrya Japonica</i> , ...	Loquat, ...	Japan.
Do. Do., improved, ...	...	Do.
<i>Eriodendron anfractuosum</i> , ...	Silk Cotton Tree or Kapok, ...	Trop America.
<i>Epipremnum mirabile</i> , ...	Tonga, ...	Fiji, Malaya.
<i>Eucalyptus Baileyana</i>, ...	...	Australia.
Do. <i>corymbosa</i> , ...	Blood Tree, ...	Queensland.
Do. <i>pilularis</i> , ...	Black Butt, ...	N. S. Wales.
Do. <i>Planehowiana</i>, ...	...	Australia.
Do. <i>fibrosa</i> , ...	Stringy Bark, ...	N. S. Wales.
Do. <i>rostrata</i> , ...	Red Gum of South Australia, ...	S. Australia.
Do. <i>resinifera</i> , ...	Red Mahogany, ...	N. S. Wales.
Do. <i>obliqua</i> , ...	Stringy Bark, ...	N. S. Wales.
Do. <i>piperata</i> , var <i>eugeneoides</i> , ...	Stringy Bark, ...	N. S. Wales.
Do. <i>coriacea</i> , ...	White Gum, ...	N. S. Wales.
Do. <i>tereticornis</i> , ...	Bastard Box, ...	N. S. Wales.
Do. <i>amygdalina</i> , ...	Peppermint Tree, ...	Tasmania.
Do. <i>homostoura</i> , ...	Spotted Gum, ...	Queensland.
Do. <i>siderophlora</i> , ...	Iron Bark of N. S. Wales, ...	N. S. Wales.
Do. <i>citradorea</i> , ...	Spotted Gum, ...	Queensland.
Do. <i>fasiculata</i> , ...	Iron Bark, ...	N. S. Wales.
<i>Eugeissonia triste</i> , ...	Bertam, ...	Malaya.
<i>Eugenia brasiliensis</i> , ...	Brazil Cherry, ...	Brazil.
<i>Eugenia magnifica</i> , ...	New Caledonian Apple, ...	N. Caledonia.
<i>Eupatorium Ayapana</i> , ...	Ayapanah, ...	E. Indies.
<i>Euterpe edulis</i> , ...	Maurcole, ...	Brazil.
<i>Exostemma caribacum</i> , ...	West Indian Bark ...	Jamaica.
<i>Fagraea peregrina</i> , ...	Tembusu, ...	Malaya.
<i>Fibraurea tinctoria</i> ...	Dye-root, ...	Malaya.
<i>Ficus religiosa</i> , ...	Peepul Tree, ...	E. India.
<i>Ficus Carica</i> , ...	Fig, ...	S. Europe.
<i>Flacourtia Sepiaria</i> , ...	Rukum, ...	Tropics.
Do. <i>Rukam</i> , ...	Do., ...	Do.
<i>Furcraea gigantea</i> , ...	Mauritius Hemp, ...	S. America.
<i>Fatsia papyrifera</i> , ...	Rice-paper Plant, ...	China.
<i>Garcinia Livingstonii</i> , ...	African Mangosteen, ...	Africa.
Do. <i>Xanthochymus</i> ...	...	Malaya.
Do. <i>Sp.</i> ...	Siam Gamboge, ...	Siam.
Do. <i>Gambogea</i> , ...	Gamboge, ...	India.
Do. <i>Morella</i> , ...	Ceylon Gamboge, ...	Ceylon.
Do. <i>Mangostana</i> , ...	Mangosteen, ...	Malaya.
<i>Genderussa vulgaris</i> , ...	Gendarussa, ...	Malaya.
<i>Gigantochloa Aspera</i> , ...	Bitong, ...	China.

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<i>Systematic Name.</i>	<i>Local Name.</i>	<i>Native Country.</i>
Gmelina arborea, ...		E. Indies.
Do. asiatica, ...		Do.
Gluta velutina, ...	Rûngas, ...	Malaya.
Gnetum Gnemon, ...		Malaya.
Grevillea robusta, ...	Silky Oak, ...	Moreton Bay.
Grias cauliflora, ...	Anchovy Pear, ...	Jamaica.
Gossypium arboreum, ...	Tree Cotton, ...	S. America.
Do. flaviflorum, ...		
Guaiacum officinale, ...	Lignum Vitæ, ...	W. Indies.
Guilandina Bonducella, ...	Bonduc, ...	E. Indies.
Gynandropsis pentaphylla, ...	Mamum, ...	Asia.
Gonolobus Cundurango, ...	Cundurango, ...	New Grenada.
Galactodendron utile, ...	Milk Tree, ...	S. America.
Haematoxylon campechianum, ...	Logwood, ...	Central America.
Hardwickia binata, ...	Acha, ...	E. Indies.
Helianthus tuberosus, ...	Jerusalem Artichoke, ...	Brazil.
Hevea Brasiliensis, ...	Para Rubber, ...	Brazil.
Hippamane mancinella, ...	Manchinel Tree, ...	W. Indies.
Hibiscus Sabderaffa, ...	Indian Sorrel, ...	E. Indies.
Do. esculentus, ...	Kachang Bendie, ...	India.
Hopea cernua, ...	Serayah, ...	Malaya.
Hopea meranti, ...	Meranti, ...	Malaya.
Heriteria littoralis, ...	Looking-glass Tree, ...	E. Indies.
Hura crepitans, ...	Sand Box, ...	Trop. America.
Hydrocotyle asiatica, ...	Pungga, ...	Asia.
Ilex paraguayensis, ...	Paraguay Tea, ...	Paraguay.
Illicium anisitum, ...	Star Aniseed, ...	Japan.
Indigofera tinctoria, ...	Indigo, ...	E. Indies.
Inga dulcis, ...	Manila Tamarind, ...	India.
Inga laurina, ...		W. Indies.
Inga Xylocarpa, ...		E. Indies.
Inocarpus edulis, ...	Otaheite Chestnut, ...	Malaya.
Ipomæa purga, ...	Jalap, ...	Mexico.
Ipomæa chrysoarrhiza, ...	Kumara, ...	New Zealand.
Jateorrhiza palmata, ...	Calomba Root, ...	Mozambique.
Jatropha curcus, ...	Physic-nut, ...	E. Indies.
Do. manihot, ...	Tapioca, ...	W. Indies.
Do. do. var, ...	Mauritius Tapioca, ...	W. Indies.
Do. do. do., ...	Brazil do., ...	Brazil.
Jambosa vulgaris, ...	Rose Apple, ...	Malaya.
Kigelia pinnata, ...		Nubia.
Kumpussia Malaccensis, ...	Kumpas, ...	Malaya.
Lactuca sativa var, ...	Sawi (Lettuce), ...	Asia.
Lagenaria vulgaris var striata, ...	Ketula Ular (Gourd), ...	India.
Lagetta lintearia, ...	Lace Bark Tree, ...	Jamaica.
Lancium domesticum, ...	Dukoo, ...	Malaya.
Landolphia Watsonii, ...	African Rubbers, ...	Africa.
Do. Patersonii, ...	Do., ...	Do.
Do. Kirkii, ...	Do., ...	Do.
Lavendula vera, ...	Lavender, ...	S. Europe.
Lablab cultriformis, ...	Kachang Kara Puteh, ...	Moluccas.
Lawsonia inermis, ...	Henna, ...	Egypt.
Do. var rubra, ...		
Licula acutifida, ...	Penang Lawyer, ...	Penang.
Limnophila punctata, ...	Brëmis, ...	Malaya.
Linum usitatissimum, ...	Flax, ...	Europe.
Lepidium sativum, ...	Garden-cress, ...	Persia.
Leucaena glauca, ...	Soah-wood, ...	Tropics.
Lonchocarpus sp., ...	Yurabo Indigo, ...	W. Indies.
Lucuma Sapota, ...	Mammee Sapota, ...	New Grenada.
Luffa acutangula, ...	Strainers Vine, ...	India.
Luffa petola, ...	Timon, ...	Moluccas.
Lycopersicum esculentum, ...	Love Apple or Tomato, ...	S. America
Latania borbonica, ...	Latanier Palm, ...	Reunion.
Macadamia ternifolia, ...	Queensland Nut, ...	Queensland.
Malpighia urens, ...	Barbados Cherry, ...	Barbados.
Manihot glaziovii, ...	Ceara Rubber, ...	Trop. America.
Marrubium vulgare, ...	Hoarhound, ...	Britain.
Mammea americana, ...	Mammee Apple, ...	W. Indies.
Maranta arundinacea, ...	Arrow-root, ...	S. America.
Mangifera, indica, ...	Mango, ...	India.
Do. do. vars, ...		Do.
Do. caesa, ...	Benje, ...	Malaya.
Do. foetida, ...	Bachang, ...	Malaya.
Monstera deliciosa, ...	Monstera, ...	Mexico.
Melianthes Major, ...	Honey Shrub, ...	Cape of Good Hope.
Melia composita, ...	Limbarra, ...	E. Indies.
Melia sempervirens, ...	West Indian Lilac, ...	India.
Melaleuca leucodendron, ...	Kayu Puteh Oil, ...	Malaya.
Melissa officinalis, ...	Balm, ...	S. Europe.
Messua ferrea, ...	Ceylon Iron-wood, ...	Ceylon.
Mentha viridis, ...	Mint, ...	Britain.
Mimosa arborea, ...		W. Indies.
Michelia champaca, ...	Champac, ...	E. Indies.

<i>Systematic Name.</i>	<i>Local Name.</i>	<i>Native Country.</i>
Mimusops elengi, ...	Elangi, ...	India.
Do. indica, ...	Smaram, ...	Malaya.
Do. sp. ...	Sou, ...	Malaya.
Mirabilis jalapa, ...	Marvel of Peru, ...	Peru.
Momordica charantia and vars, ...	Pria Paddy (Bitter Gourd), ...	India.
Momordica balsamina, ...	Pria, ...	Do.
Moringa pterygosperma, ...	Ben Oil Tree, ...	Trop. Asia.
Morus alba, ...	Mulberry, ...	Persia.
Murraya exotica, ...	China Box, ...	China.
Musa textilis, ...	Manila Hemp, ...	E. Indies.
Musa superba, ...		E. Indies.
Musa sapientum, ...	Pisang Mas, ...	} Malaya.
Do. var., ...	Do. Tandok, ...	
Do. " ...	Do. Pinang, ...	
Do. " ...	Do. Sooson, ...	
Do. " ...	Do. Nipah, ...	
Do. " ...	Do. Kling, ...	
Do. " ...	Do. Raja, ...	
Do. " ...	Do. Raja Udang, ...	
Do. " ...	Do. Bakar, ...	
Do. " ...	Do. Bata, ...	
Do. " ...	Do. Hijau, ...	
Do. " ...	Do. Lang, ...	
Maclura tinctoria ...	Fustisk-wood, ...	Brazil.
Marsilea macropus, ...	Nardoo, ...	
Mucuna puriens, ...	Cow Etch, ...	E. Indies.
Machærium firmum, ...	Palissander-wood, ...	
Myrospermum Peruiferum, ...	Balsam of Peru, ...	Peru.
Nasturtium officinale, ...	Water Cress, ...	Britain.
Nectandra Rhodiæi, ...	Green Heart, ...	Guiana.
Nerium oleander, ...	Oleander, ...	S. Europe.
Nicotiana tabacum, ...	Tobacco, ...	Trop. America.
Nephelium Lappaceum, ...	Rambutan, ...	Malaya.
Do. Litchi, ...	Litchi, ...	China.
Do. Longan, ...	Longan, ...	Do.
Do. Mutabile, ...	Polesan, ...	Malaya.
Ocimum basilicum, ...	Basil, ...	E. Indies.
Olea Europea, ...	Olive, ...	Europe.
Opuntia Cochinillifera, ...	Cochineal Plant, ...	Trop. America.
Do. Ficus-indica, ...	Indian Fig, ...	Trop. America.
Origanum marjoram, ...	Marjoram, ...	Europe.
Oreodoxa oleracea, ...	Cabbage Palm, ...	Antilles.
Ouvirandra fenestralis, ...	Madagascar Yam, ...	Madagascar.
Pachyrrhizus anglutus, ...	Měng Kawang, ...	India.
Paederia foetida, ...	Bedolee Sutta, ...	Malaya.
Pandanus utilis, ...	Sugar Mat Plant, ...	Madagascar.
Panicum spectabile, ...	Guiana Grass, ...	Guiana.
Parmentiera cerifera, ...	Candle Tree, ...	Panama.
Parkia Roxburghii, ...	Saputi, ...	Malaya.
Payenia Learii, ...	Gutta Sundak, ...	Malaya.
Passiflora quadrangularis, ...	Grenadilla, ...	W. Indies.
Passiflora laurifolia, ...	Sweet Cup or Water Lemon, ...	W. Indies.
Passiflora macrocarpa, ...	Gigantic Granadilla, ...	
Persea gratissima, ...	Avocado Pear, ...	Trop. America.
Petroselinumsativum, ...	Parsley, ...	Sardinia.
Petiveriæ alliaciæ, ...	Tooth-ache Tree, ...	Trop. America.
Phaseolus lunatus, ...	Kachang Kara (Lima Bean), ...	Brazil.
Phaseolus vulgaris, ...	French Bean, ...	India.
Do. sp., ...	Kachang Hijau, ...	
Physalis alkekengi, ...	Water Cherry, ...	S. Europe.
Phyllanthus emblica, ...	Malacca, ...	Malaya.
Do. reticulatus, ...	Chēkop manis, ...	
Phoenix sylvestris, ...	Wild Date, ...	India.
Phytelephas macrocarpa, ...	Ivory-nut, ...	S. America.
Phytolacca decandra, ...	Dye Wort, ...	India.
Phormium tenax, ...	New Zealand Flax, ...	New Zealand.
Pimenta vulgaris, ...	Allspice, ...	W. Indies.
Pimpinella Anisum, ...	Anise or Aniseed, ...	Egypt.
Pierarda dulcis, ...	Rambe, ...	Malaya.
Piper Betel, ...	Betel Leaf, ...	E. Indies.
Piper nigrum, ...	Pepper, ...	E. Indies.
Piper cubeba, ...	Cubebs, ...	Java.
Piper Futokadsura, ...	Japanese Pepper, ...	Japan.
Pinus longifolia, ...	Long-leaved Pine, ...	E. Indies.
Pisum sativum, ...	Pea, ...	Levant.
Piscidia erythrina, ...	Dog-wood, ...	W. Indies.
Plumiera lutea, ...	Frangipani, ...	Trop. America.
Pogostemon patchouli, ...	Patchouli, ...	E. Indies.
Pongamia glabra, ...	Pongam, ...	E. Indies.
Portulaca oleracea, ...	Daun Galang (Purslane) ...	Tropics.
Pterocarpus indica ...	Rose-wood, ...	E. Indies.
Do. marsupium, ...	Kin o, ...	E. Indies.
Psophocarpus tetragonolobus, ...	Kachang, ...	Trop. Africa.
Poinciana regia, ...	Flamboyant, ...	Madagascar.

<i>Systematic Name.</i>	<i>Local Name.</i>	<i>Native Country.</i>
<i>Psidium cattleianum</i> , ...	Guava, ...	W. Indies.
Do. <i>guava</i> , ...	Do., ...	S. America.
Do. <i>do. varigata</i> , ...	Do., ...	
Do. <i>acre</i> , ...	Do., ...	
<i>Punica granatum</i> , ...	Pomegranate, ...	E. Indies.
<i>Premna cordifolia</i> , ...	Buas-Buas, ...	Malaya.
<i>Pyrus malus</i> , ...	Apple, ...	Persia.
Do. <i>communis</i> , ...	Pear, ...	Persia.
<i>Paritium elatum</i> , ...	Cuba Bast, ...	Cuba
<i>Prosopis juliflora</i> , ...		
<i>Paullina sorbilis</i> ...	Guarana Tea Plant, ...	
<i>Putranjiva Roxburghii</i> , ...	Putranjiva, ...	E. Indies.
<i>Pistacia terebinthus</i> , ...	Turpentine Tree, ...	
<i>Pisonia sylvestris</i> , ...		Moluccas.
<i>Quassia amara</i> , ...	Quassia or Bitter-wood, ...	W. Indies.
<i>Quercus salicina</i> , ...	Chinese Oak, ...	China.
<i>Quisqualis indicus</i> , ...	Rangoon Creeper, ...	E. Indies.
<i>Raphanus sativus var.</i> , ...	Lobak (Long Raddish), ...	China.
<i>Ravensara aromatica</i> , ...	Ravensara, ...	Madagascar.
<i>Rheum officinale</i> , ...	Rubarb, ...	Asia.
<i>Ricinus communis</i> , ...	Castor-oil Plant, ...	E. Indies.
<i>Ruta graveolens</i> , ...	Rue, ...	S. Europe.
<i>Roupellia grata</i> , ...	Cream Fruit, ...	W. Indies.
<i>Rhmex patientia</i> , ...	Patience, ...	Italy.
<i>Rhus vernicifera</i> , ...	Japanese Lacquer Tree, ...	
<i>Rhus succedaneum</i> , ...	Japanese Wax Tree, ...	Japan.
<i>Sabal palmetto</i> , ...	Palmetto, ...	S. America.
<i>Sagus rumphiana</i> , ...	Sago, ...	Malaya.
<i>Sagus laevis</i> , ...	Sago, ...	Malaya.
<i>Sandoricum indica</i> , ...	Sentol, ...	E. Indies.
<i>Sapindus saponaria</i> , ...	Soap Berry, ...	
do. <i>inaequalis</i> , ...	Do. ...	W. Indies.
<i>Sansevieria Zeylanica</i> , ...	Bow String Hemp, ...	Ceylon.
<i>Santalum album</i> , ...	Sandal-wood, ...	E. Indies.
<i>Sarcocephalus cordata</i> ...	Negro Peach ...	Australia, &c.
<i>Sechium edule</i> , ...	Cho-Cho, ...	Jamaica.
<i>Scorodocarpus Borneensis</i> , ...	Bawang Hutan, ...	Malaya.
<i>Senecio chinensis</i> , ...	Tang Ho, ...	
<i>Sesamum orientale</i> , ...	Gingelly-oil Plant, ...	E. Indies.
<i>Semecarpus anacardium</i> , ...	Marking-nut, ...	India.
<i>Shorea Dyeri</i> , ...		Ceylon.
<i>Sinapsis alba</i> , ...	Mustard, ...	Britain.
<i>Sideroxylon Malaccense</i> , ...	Daroo, ...	Malaya.
<i>Solanum melangena</i> , ...	Trong (Egg Plant), ...	
do. <i>coagulans</i> , ...	Trong Manis, ...	
do. <i>tuberosum</i> , ...	Potato, ...	S. America.
<i>Sorghum Saccharatum</i> , ...	Millet, ...	Tropics.
do. <i>vulgare</i> , ...	Guinea Corn, ...	E. Africa.
<i>Sloetia sideroxylon</i> , ...	Tampinis, ...	Malaya.
<i>Stenochlaena palustris</i> , ...	Paku Akar, ...	
<i>Stillingia sebifera</i> , ...	Tallow Tree, ...	China.
<i>Strombosia Javanica</i> , ...	Petaling, ...	Malaya.
<i>Strychnos nux-vomica</i> , ...	Nux-vomica, ...	E. Indies.
do. <i>colubrina</i> ...	Shakewood, ...	E. Indies.
<i>Styrax Benzoin</i> , ...	Benzoin, ...	Sumatra.
<i>Sterospermum chelonoides</i> , ...	Padrie Marum, ...	E. Indies.
<i>Saccharium officinarum</i> , ...	Sugar Cane, ...	Tropics.
<i>Salvadora persica</i> , ...	Mustard Tree of Scripture, ...	Central Africa.
<i>Smilax sarsaparilla</i> , ...	Sarsaparilla Vine, ...	India.
<i>Tabernaemontana Crassa</i> , ...		Senegal.
<i>Taraxacum officinale</i> , ...	Dandelion, ...	Europe.
<i>Tecoma pentaphylla</i> , ...	Fiddle-wood, ...	Jamaica.
Do. <i>leucoxylon</i> , ...	Tecoma, ...	Madagascar.
<i>Terminalia Catappa</i> , ...	Wild Almond, ...	E. Indies.
<i>Terminalia Bellerica</i> , ...	Myrabalans, ...	India.
<i>Tetragonia expansa</i> , ...	New Zealand Spinach, ...	New Zealand.
<i>Thamnopteris nidus</i> , ...	Samber, ...	
<i>Thea chinensis var assamica</i> , ...	Assam Hybrid Tea, ...	China.
<i>Theobroma Cacao</i> , ...	Chocolate or Cacao, ...	W. Indies.
Do. <i>var condeamar</i> , ...		Do.
Do. <i>criollo</i> , ...		Do.
Do. <i>Forbsteri</i> , ...		Do.
Do. <i>Cavenne</i> , ...		Do.
Do. <i>Ferdilico</i> , ...		Do.
Do. <i>Sangle toro</i> , ...		Do.
<i>Thevetia neriifolia</i> , ...	Exile Tree ...	India.
<i>Triphasia trifoliata</i> , ...	Lime Berries, ...	China.
<i>Tropæolum majus</i> , ...	Nosturtium, } or Indian Cress, ...	Peru.
Do. <i>minus</i>	Small do., }	
<i>Tacca pinnatifolia</i> , ...	Tacca, ...	Australia.

<i>Systematic Name.</i>	<i>Local Name.</i>	<i>Native Country.</i>
Uncaria gambir, ...	Gambier, ...	Malaya.
Urena lobata ...	Beng Fibre, ...	E. Indies.
Vanilla planiifolia, ...	Vanilla, ...	Trop. America.
Do. aromatica, ...		W. Indies.
Do. Sp., ...		Singapore.
Vahea gummifera, ...	Madagascar Rubber Vine, ...	Madagascar.
Vitex umbrosa, ...	Box-wood, ...	W. Indies.
Vitis Martenii, ...	Saigon Vine, ...	Saigon.
Vitis vinifera, ...	Grape Vine, ...	E. and W. Hemispheres.
Vitex trifoliata, ...	Chaste Tree, ...	E. Indies.
Vangueria edulis, ...	Edible Vangueria, ...	
Willoughbeia firma, ...	Gutta Gegrip, ...	Malaya.
Wrightia tinctoria, ...	Ivory-wood, ...	India.
Yucca aloifolia, ...	Dagger Fibre, ...	Jamaica.
Zalacca edulis, ...	Salak, ...	Malaya.
Zea mays, ...	Indian Corn, ...	
Zingiber officinale, ...	Ginger, ...	E. and W. Indies.
Zingiber sp, ...	Chinese Ginger, ...	China.
Zizyphus mucronatus ...	Wild Injob, ...	Australia.
Zizyphus Jujuba, ...	Jujube Tree, ...	China.

LIST OF THE FOREST DEPARTMENT PALMETUM,
SINGAPORE.

(*Vide Para. 35.*)

TRIBE I.—ARECEÆ.

SUB-TRIBE EUARECEÆ.

Genus ARECA, Linn.

- A. catechu, Linn. Betel-nut Palm. Tropical Asia.
A. concinna, Thwaites. Ceylon.
A. triandra, Roxb. Molouccas.

Genus PENANGA, Blume.

- P. maculata, Porte.
P. malaiana, Scheff.

Genus HYDRIASTELE, Wendl. & Dr.

- H. Wendlandiana, W. & D. Tropical Australia.

Genus HEDYSCEPE, Wendl. & Dr.

- H. Canterburyana, W. & D. "Umbrella Palm." Lord Howe's Island.

Genus LOXOCOCCUS, Wendl. & Dr.

- L. rupicola, W. & D. Ceylon.

Genus ARCHONTOPHENIX, Wendl. & Dr.

- A. Alexandræ, W. & D. Queensland.

Genus RHOPALOSTYLIS, Wendl. & Dr.

- R. Baueri, W. & D. Norfolk Island.

Genus DICTYOSPERMA, Wendl. & Dr.

- D. aureum, W. & D. Rodriguez Island.
D. album, W. & D. Mauritius.
D. rubrum, W. & D. Mauritius.

SUB-TRIBE II.—PTYCHOSPERMEÆ.

Genus PTYCHOSPERMA, Labill.

- P. filifera, Wendl. Fiji Islands.
P. Macarthurii, Wendl. Tropical Australia.

Genus CYRTOSTACHYS, Blume.

C. Renda, Blume. Malay Archipelago.

Genus DRYMOPHLOEUS, Zippel.

D. Singaporensis, Hook. Singapore.

SUB-TRIBE III.—ONCOSPHEREÆ.

Genus ONCOSPHERA, Blume.

O. filamentosum, Blume. "Nibung Palm." Java.

Genus EUTERPE, Gœrtn.

E. edulus, Mart. "Assai Palm." Tropical America.

E. oleracea, Mart. "Mountain Cabbage Palm." Tropical America.

Genus ACANTHOPHŒNIX, Wendl.

A. crinita, Wendl. Mauritius and Bourbon.

A. rubra, Wendl. Mauritius and Bourbon.

Genus OREODOXA, Willd.

O. oleracea, Mart. West Indies.

O. regia, Kunth. "Royal Palm." West Indies.

Genus PHYTELEPHAS, Ruitz et Pav.

P. macrocarpa, R. et P. Ivory-nut Palm. New Grenada.

Genus NIPA, Wurmbr.

N. fructiens Thumb, Nipa Palm. Trop. Estuaries.

Genus PHOLIDOCARPUS, Blume.

P. Ihur, Bl. Moluccas.

Genus LIVISTONA, Br.

L. altissima, Zoll. Java.

L. australis, Mart. Eastern Australia, Temperate and Tropical.

L. Hoogendorhffii, Teysm. & Binn. Hab.?

L. humilis, Br. Tropical Australia.

L. olivæformis, Mart. Java.

L. rotundifolia, Mart. Malay Islands, Moluccas, Penang.

Genus RHAPIS, Linn. f.

R. flabelliformis, Ait. China.

Genus THRINAX, Linn.

T. argentea, Lodd. "Silver-Thatch Palm." West Indies.

T. parviflora, Swartz. West Indies.

TRIBE IV.—LEPIDOCARYEÆ.

SUB-TRIBE CALAMEÆ.

Genus CALAMUS, Linn.

C. callicarpus, Griff. Malacca.

C. fissus, Blume. Borneo.

C. marginatus, Blume. Borneo.

C. periacanthus, Miquel. Sumatra.

C. rotang, Linn. Bengal, Assam, and Coromandel.

Genus ZALACCA, Reinwtd.

Z. edulis, R. Java, Moluccas.

Genus CERATOLOBUS, Blume.

C. glaucescens, Bl. Java.

Genus PLECTOCOMIA, Mart.

P. elongata, Blume. Java, Malacca, Penang.

Genus RAPHIA, Beauv.

R. Ruffia, Mart. Madagascar.

R. sp. West Africa.

TRIBE V.—BORASSEÆ.

Genus BORASSUS, Linn.

B. flabelliformis, Linn. "Palmyra Palm." Tropical Africa.

Genus LATANIA, Comm.

L. Commersonii, Linn. Mauritius and Bourbon.

L. Loddigesii, Mart. Round Island.

L. Verschaffeltii, Linn. Rodriguez Island.

Genus HYPHÆNE, Gartn.

H. thebaica, Mart. "Doum Palm." Upper Egypt, Nubia and Abyssinia.

TRIBE VI.—COCOINEÆ.

Genus ACROCOMIA, Mart.

A. sclerocarpa, Mart. "Macau Palm." Brazil and West Indies.

Genus MARTINEZA, Ring and Pav.

M. caryotæfolia, Humb and Kth. New Grenada.

SUB-TRIBE II.—ELÆIDEÆ.

Genus ELÆIS, Jacq.

E. guineensis, Jacq. "Oil Palm" West Tropical Africa.

SUB-TRIBE III.—EUCOCOINEÆ.

Genus COCOS, Linn.

C. flexuosa, Mart. Brazil.

C. nucifera, Linn. "Cocoa-nut Palm." Tropics.

C. plumosa, Lodd. Brazil.

C. Weddelliana, Wendl. Brazil.

Genus MAXIMILIANA, Mart.

M. Martiana, Karst. N. Brazil and Guiana.

SUB-TRIBE IV.—LINOSPADICEÆ.

Genus CALYPTROCALYX, Blume.

C. spicatus, Bl. Moluccas.

Genus BACULARIA, F. Muell.

B. monostachya, F. Muell. "Walking-stick Palm." North South Wales and Queensland.

Genus HOWEA, Beccari.

H. Forsteriana, Becc. "Flat or Thatch-leaf Palm." Lord Howe's Island.

H. Belmoreana, Becc. "Curley Palm." Lord Howe's Island.

SUB-TRIBE VII.—CEROXYLEÆ.

Genus CEROXYLON, Humb. and Bonpl.

C. andicola, H. & B. "Wax Palm." New Granada and Venezuela.

SUB-TRIBE VIII.—MALORTIEÆ.

Genus MALORTIEA, Wendl.

M. intermedia, Wendl. Costa-Rica.

SUB-TRIBE IX.—IGUANUREÆ.

Genus HETEROSPATHE, Scheff.

H. elata, Scheff. Amboyna.

Genus NEPHROSPERMA, Balf. fil.

N. Houtteanum, Balf. fil. Seychelle Islands.

Genus STEVENSONIA, Duncan.

S. grandifolia, Wendl. Seychelle Islands.

Genus VERSCHAFFELTIA, Wendl.

V. splendida, Wendl. Seychelle Island.

Genus DYPISIS, Norohn.

D. madagascariensis, Hort. Madagascar.*D. pinnatifrons*, Mart. Madagascar.*D. sp?* Madagascar.

SUB-TRIBE X—CHAMÆDOREÆ.

Genus CHAMÆDOREÆ, Willd.

C. elegans, Mart. Mexico.

Genus SYNECHANTHUS, Wendl.

S. fibrosus, Wendl. Guatemala.

Genus HYOPHORBE, Goertn.

H. amaricaulis, Mart. Round Island. Mauritius.*H. Verschaffeltii*, Wendl. Rodriguez Island, Mauritius.

Genus CHRYSALIDOCARPUS, Wendl.

C. lutescens, Wendl. Mauritius and Bourbon.

SUB-TRIBE XI.—GENOMICÆ.

Genus CALYPTOGYNE, Wendl.

C. Swartzii, H. F. Mountain Thatch Palm. West Indies.

SUB-TRIBE XII.—CARYOTIDEÆ.

Genus WALLICHIA, Roxb.

W. caryotoides, Roxb. Eastern Bengal, Chittagong, and Burma.

Genus ARENGA, Labill.

A. obtusifolia, Mart. Java and Sumatra.*A. saccharifera*, Labill. "Gomuti Palm." Malay Archipelago, Moluccas and Bourbon.

Genus CARYOTA, Linn.

C. Cumingii, Lodd. Philippine Islands.*C. furfuracea*, Bl. var. *Timbala*. Java.*C. obtusa*, Griff. Upper Assam.*C. sobolifera*, Wall. Arracan and Andaman Islands.*C. urens*, Linn. "Wine Palm." East Bengal and Malay Peninsula.

Genus ORANIA, Zipp.

O. macrocladus, Mart. Malacca.

TRIBE II.—PHŒNICEÆ.

Genus PHŒNIX, Linn.

P. acaulis, Roxb? Central India, Bengal and Burma.*P. dactylifera*, Linn. "Date Palm." North Africa.*P. Hanceana*, Naud. China.

- P. reclinata*, Jacq. South East Africa.
P. rupicola, T. Anders. "Sikkim." Himalaya.

TRIBE III.—CORYPHÆ.

Genus CORYPHA, Linn.

- C. Gebanga*, Blume. "Gebang Palm." Java.

Genus SABAL, Adans.

- S. Adansoni*, Guerns. "Dwarf Palmetto." Southern United States.
S. glaucesens, Lodd. Trinidad.
S. Palmetto, Lodd. "Cabbage Palmetto." Southern United States.
S. Princeps, Hort. Versch. Hab.?

Genus WASHINGTONIA, Wendl.

- W. filifera*, Wendl. South California.

Genus TEYSMANNIA, Reichb. f. & Zoll.

- S. altifrons*, R. & Z. Malaya.

Genus CHAMÆROPS, Linn.

- C. humilis*, Linn. South Europe and North America.
C. Humboldtii.

Genus PRITCHARDIA, Seem & Wendl.

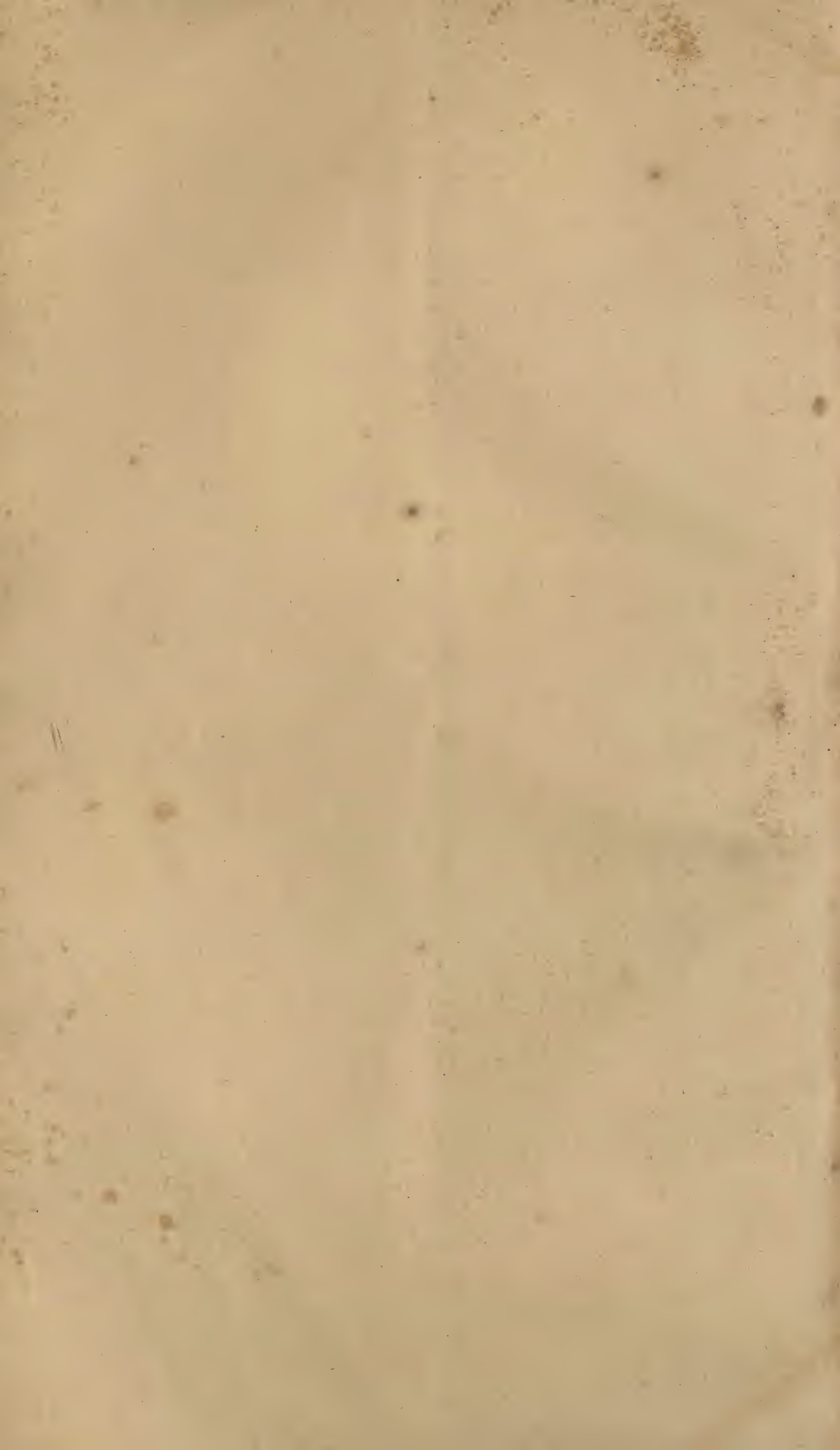
- P. pacifera*, Seem & Wendl. Fiji Islands.
P. Thurstonii, G. O.
P. sp. novo.

Genus LICUALA, Thunt.

- L. acutifida*, Mart. "Penang Lawyer." Singapore and Penang.
L. peltata, Roxb. Bengal, Assam, Burma, Tenasserim, &c.

N. CANTLEY,
Superintendent

Singapore, 4th July, 1887.



STRAITS SETTLEMENTS

ANNUAL REPORT

ON THE

BOTANIC GARDENS, SINGAPORE

FOR THE YEAR

1888

BY

H. N. RIDLEY

Director

PUBLISHED BY AUTHORITY



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

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 (*Iolianthes 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, Calatheas, 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 DALZELLS—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*, *Aerides 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, Sēlangor.
 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.

20/100

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

RECEIPTS.	\$	c.	EXPENDITURE	\$	c.
By Balance in Bank,		7 49	<i>Salaries.</i>		
„ 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
			<i>Balance in Bank,</i>	1,391	17
				8,869	06
		\$8,869 06			

H. N. RIDLEY,
Director.

STRAITS SETTLEMENTS

ANNUAL REPORTS

ON THE

FORESTS DEPARTMENTS

SINGAPORE, PENANG AND MALACCA

FOR THE YEAR

1888

PUBLISHED BY AUTHORITY



SINGAPORE

PRINTED AT THE GOVERNMENT PRINTING OFFICE

1889

50/1889

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 sěráya 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.

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 *Fatropa* 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 Caledonia 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 roadsides 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.		
		<i>Salaries of Establishment.</i>		
			\$	c.
		Assistant Superintendent of Forests, ...	1,500	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 Fo-		
		rest Guards, ...	240	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
Grant for Maintenance of Forest Reserves, ...	\$4,000.00			
Grant for Improvement of Bungalow Garden, ...	\$1,000.00			

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

REVENUE.		EXPENDITURE.		
Grant for Maintenance of Expt. Nursery and Bungalow Garden, } \$1,750.00	}	<i>Salaries.</i>		
		Coolies and Tindal, Bungalow Garden and Experimental Nursery, ...	\$ 1,435	c. 50
		<i>Bills.</i>		
		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
Grant for Maintenance of Waterfall Garden, ... } \$3,500.00	}	<i>Salaries.</i>		
		Coolies and Gardeners, ...	2,629	85
		<i>Bills.</i>		
		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 Personal 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*, *Měřebau*, *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 gětah 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 tress 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 Tunggal 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 Simpít 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 E.

Analysis of Canes introduced by the Forest Department, Straits Settlements.

	Cane.													
	Name, ...	Seetee.	Vulu Vulu.	Noon Jawa.	Tamarind.	Melicah.	Chyasa.	Camar morte.	Horne.	Davam- boota.	Green and yellow.	Po-a-able.	Elephant.	
Colour, ...	...	Pink and green.	Appearance of polished horn.	Black purple.	Green.	Light purple.	Purple to salmon pink.	Dark violet and yellow.	Purple.	Apple blossom pink and green.	Rhubarb pink and green.	Appearance of polished horn.	Pink and green with dark purple blotches below.
Appearance and other qualities,	Very fine long canes with long thick joints with vivid colours.	Very soft cane having long even joints.	Average even jointed cane.	Do.	Do.	Extremely hard short-jointed canes.	Average fairly soft cane rather thin joints.	In appearance by far the finest. All along very large and thick joints and extremely soft.	Extremely hard short-jointed canes.	Average cane.	Next to Horne for fine appearance; longest cane with fine thick long joints; kind, however, very hard.	Medium length, even-jointed canes.		
Woody Fibre, per cent.,	...	11.00%	11.37%	9.12%	9.50%	11.00%	12.5%	11.75%	7.90%	11.30%	8.50%	10.15%	...	
Analysis of Juice.	Appearance, ...	Ordinary.	Ordinary.	Very dark brown, on crushing cane the rind gives pink colour off.	Ordinary.	Dark brown almost as much colouring matter given after crushing as Noon Jawa.	Ordinary.	Ordinary.	Ordinary.	Ordinary.	Ordinary.	Ordinary.	Ordinary.	
	Specific gravity, ...	1.0639	1.0714	1.0597	1.0644	1.0612	1.0616	1.0834	1.0576	1.0577	1.0594	1.0788	1.0645	
	Banme, ...	9.0°	10.0°	8.4°	9.0°	8.6°	8.6°	11.4°	8.0°	8.0°	8.3°	10.8°	9.0°	
	Total Solids, per cent.,	12.20	18.04	15.11	16.20	15.47	15.47	20.61	14.38	14.38	14.92	19.51	16.20	
	Crystallizable, ...	12.73	14.70	12.00	11.08	12.09	11.65	17.32	9.94	9.48	8.92	16.4	9.82	
	Mueryst, ...	2.04	1.84	2.44	4.13	2.39	2.55	1.96	3.77	4.03	4.31	2.29	5.33	
	Ash, ...	0.33	0.21	0.17	0.11	0.12	0.37	0.16	0.15	0.14	0.38	0.14	0.11	
Water and organic matter, ...	84.90	85.25	85.39	84.73	85.40	85.50	80.56	86.14	86.35	86.39	81.43	84.74		
Total, ...	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00		
Total Sugar calculated as cryst,	14.67	16.45	14.32	14.95	14.36	14.07	19.18	13.52	13.31	13.01	18.32	14.88		

C. CURTIS,
Assistant Superintendent of Forests, Penang.

APPENDIX F.

WATERFALL GARDEN,
Penang, 23rd August, 1888

SIR,—I have the honour to report that, in accordance with Misc. $1\frac{21}{8}$, I left Penang at 6.30 A.M. on the 18 inst., and arrived at Kwála Malacca at 4. P.M. the same day. Landed at once and proceeded to the village to make inquiries as to the habitat of *Cypripedium niveum*. The Pěnghúlu said that none were obtainable near, and that it would require at least four or five days to procure a thousand.

Eventually he agreed to come on board the following morning and go with me to Pulau Trutau, where I had heard before leaving Penang this plant could be got. At 8.30 P.M. I returned to the launch.

The night was squally with heavy rain, and as there was no sign of its clearing at daybreak, I landed and went to Telaga Tujoh, and collected several interesting plants on the way.

On returning to the launch, I found that the Pěnghúlu had arrived, but had changed his mind about going to Trutau, so we went on without him. From Kwála Malacca to Tělok Noh in Trutau, occupied exactly three hours, and we arrived at 3 P.M.

The village consists of half a dozen houses, and is quite hidden from the anchorage by a belt of mangrove, through which it is necessary to wade knee deep in mud, except at high water, when a boat can go up the creek.

The Orang Tua soon understood the plant wanted, and agreed to go out the following morning with eight or ten men to collect them.

Having made this arrangement on moderate terms, I felt at liberty to turn my attention to collecting other plants, and the result is very satisfactory.

Owing largely to the facilities afforded by the launch, and the boats belonging to her, I made the best collection ever made by me in the same time.

The vegetation is so different from Penang that it is like being a thousand miles away instead of only a few hours. Several orchids collected had, so far as I am aware, previously been collected in Burma only, and the general features of the Flora appears to be Burmese rather than Malayan. One clear day did not admit of very extended observations, but I have no doubt that a detailed examination would well repay the trouble.

At 5 P.M. we returned to the launch, and found that the Malays had collected one thousand *Cypripediums*, while I and my men had about two hundred more, and between four and five hundred other orchids, ferns, aroids, &c., besides a bundle of botanical specimens for drying, including an excellent timber tree near Damarlaut called here Malaut.

We were occupied until after dark in counting and arranging the plants, and at 3 A.M. the launch was turned homeward. We anchored again at Kwála Malacca for an hour, as the Pěnghúlu had promised to obtain a specimen of an orchid that I did not recognize from his description when we were there on Sunday. This proved to be an interesting species, and I regret that it was impossible to remain another day to look for more plants of this kind. At 7.40 A.M. we left Kwála Malacca, and arrived in Penang at 4.15 P.M.

This collection is an important addition to the Gardens, and will enable us to supply the requisitions on hand, for which, in many cases, we have already received value.

C. CURTIS,
Assistant Superintendent of Forests, Penang.

APPENDIX G.

Principal Contributors and Recipients of Plants, 1888.

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

C. CURTIS,

Assistant Superintendent of Forests, Penang.

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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 Běřendan 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 Tampines (*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 Pangkálan 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 Pangkálan 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:—

Měřebau (<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:—

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

5

STRAITS SETTLEMENTS.

Paper to be laid before the Legislative Council by Command
of His Excellency the Governor.

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 Trianae, *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*, *Newwiedia 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 develop leaves and leafbuds upon the raceme instead of flowers. It is especially unfortunate that the dry period of the Burmese region, when the *Dendrobium* 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 vernaus*) "

One Pied-fruit Pigeon (*Carpophaga bicolor*) presented by Capt. WOORTMAN.
 One Green Fruit Pigeon (*C. ænea*) " "
 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 Kelautan. 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.

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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.
- HOOKE.—“Species Filicum,” 5 vols., purchased.
- HOOKE.—“Illustrations of Floras of Malaya and Africa,” purchased.
- “On Nepenthes” purchased.
- HOOKE.—“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 Botanicæ,” purchased.
- HASSKARL.—“Catalogus Plantarum in Hort Bogor,” purchased.
- TREUB, Dr.—“Annales Botanical 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, Riow 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 Phytographiæ,” 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 Indicæ,” 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

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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.

Murei.—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
	-----	-----
	100.00	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 diphtheria, 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/>		<hr/>
	\$4,170 83		\$4,170 83
	<hr/>		<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, turving 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, turving, 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, Devonensis, 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,	\$	c.	
		Salaries by Public Works Department,	199	48	
		Seeds and Bulbs,	268	75	
		Manure,	50	00	
		Tools,	35	90	
		Wire Netting,	11	29	
		Material of Plant-shed and Frames, ...	52	50	
		Flower Pots,	89	89	
		Cartage,	38	65	
			...	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, Expen- ses 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 Plantations, Perak.
Superintendent Government Plantations, Perak.	T. FRASER, Esq., Perak.
T. FRASER, Esq.	H. H. the Sultan of Kedah.
S. P. CHATTERJEE, Esq., Calcutta.	The Hon'ble W. E. MAXWELL, C. M. G.
C. MARIES, Esq., Gwalior, India.	C. WRAY, Esq., Perak.
STANLEY, PRICE & Co., Calcutta.	S. P. CHATTERJEE, Esq., Calcutta.
G. PECHE, Esq., Moulmein.	Messrs. JAS. VEITCH & SONS, London.
P. HONSTON, Esq., Pangkor.	Assistant Superintendent of Forests, Malacca.
A. STALLARD, Esq., Do.	C. MARIES, Esq., Gwalior.
A. T. BRYANT, Esq., Do.	The Hon'ble J. M. B. VERMONT.
T. DRYSDALE, Esq., Timor.	The Municipal Commissioners, Penang.
The Agri-Horti. Society, Madras.	P. HONSTON, Esq., Pangkor.
" " " Rangoon.	Major WALKER, Perak.
C. WRAY, Esq., Perak.	G. PECHE, Esq., Moulmein.
Messrs. JAS. VEITCH & SONS, London.	District Officer, Bukit Mertajam.
W. BOXALL, Esq., London.	J. G. OLIFANT, Esq., Calcutta.
The Hon'ble J. M. B. VERMONT.	

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>Fagræa 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

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 or 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 of lalang 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 laevis*), Tembusu (*Fagrea fragrans*), Kambang Sa'mangko, Jelutong, Berombong, Penaga, Kempas, Rambei Daun (*Shorea acuminata*), fairly abundant; Merebau, Resak, Petaliug, 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.

STRAITS SETTLEMENTS

ANNUAL REPORT

ON THE

BOTANIC GARDENS

AND

FOREST DEPARTMENT

FOR THE YEAR

1890

BY

H. N. RIDLEY

Director

PUBLISHED BY AUTHORITY



SINGAPORE:

PRINTED AT THE GOVERNMENT PRINTING OFFICE

1891

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 Cocos 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 *Cycadææ* 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 *Calatheas* 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:—*Stauranthera 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. Cecilix*, *Cattleya eldorado* (with four flowers), *C. Trianæ*, *C. Gaskelliana*, *Arundina densiflora*, *Spathoglottis Wrayii*, *Renanthera histrionica* and *Lowii*, *Aerides Lawrenciæ*, *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. MUGLISON.

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 Sereh-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 dæmonum*), *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 *Dipterocarpeæ* 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 *Eugenis* 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		

	\$ 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.

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	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
 Bentham 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., 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.	<i>Salaries.</i>	\$ c.
By Balance in Bank, ...	789 90	Herbarium Keeper, ...	180 00
„ Government Grant,	8,500 00	Chief Mandor, ...	174 00
„ Sale of Plants and		Carpenter, ...	167 00
Flowers, ...	559 54	Assistant Carpenter, ...	82 00
„ Interest, ...	35 34	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 pur-	
		poses, ...	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 Man-	
		dore, ...	63 00
		Miscellaneous, ...	316 40
			4,394 97
			9,026 15
			9,720 12
		Balance, ...	73 46
			\$9,884 78
	\$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
				\$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
					<u>\$3,858.33</u>
			Balance,	...	141.67
					<u>Total, ... \$4,000.00</u>

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 show 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 75
	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
		Balance, ...	1,497	54
			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
		Balance, ...	1,999	40
			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
		Balance, ...	799	60
			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
		Balance, ...	159	81
			190	19
			\$350 00	
		Total Expenditure for the year, ...	\$13,437 92	

C. CURTIS,

Assistant Superintendent of Gardens and Forests, Penang.

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>Azelia 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 chiefly lalang, 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.

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.

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.....	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>Azelia 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
<i>At the Sago ground.</i>						
<i>Sagus lævis</i>,	...	...	Rumbia sago,	...	...	1,600
<i>At Bukit Bruang.</i>						
<i>Calamus sp.</i>,	...	...	Rotan manau,	...	...	200
					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.

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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.

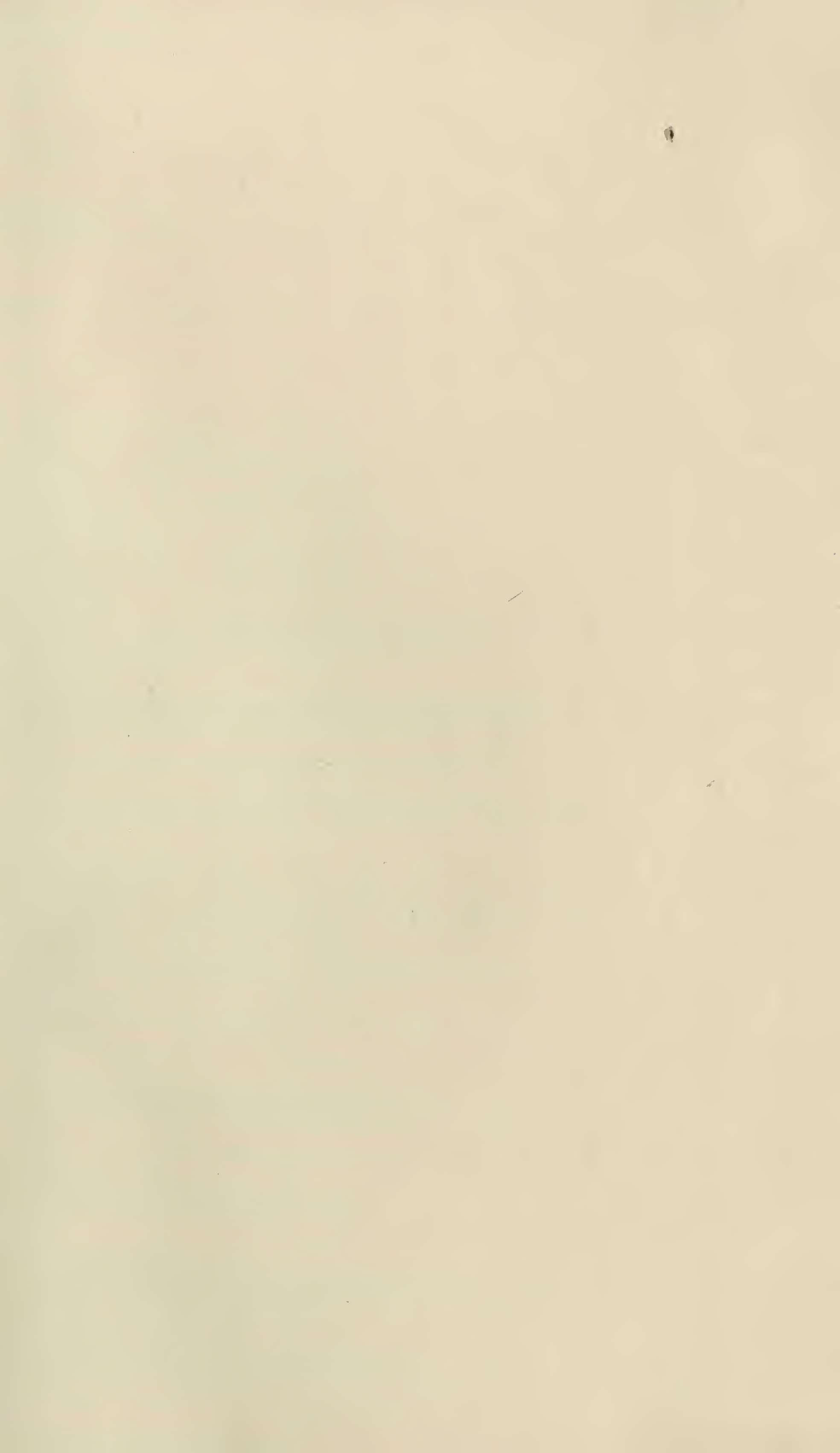
GARDENS AND FOREST DEPARTMENT, MALACCA.
REVENUE FOR THE YEAR 1890.

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,	13	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
			1	37
Balance,			\$5,800	00

R. DERRY,
Assistant Superintendent of Forests, Malacca.



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