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REPORT

ON

THE PROGRESS AND CONDITION

OF

THE ROYAL GARDENS AT KEW,

During the Year 1881.



LONDON:

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REPORT

ON

THE PROGRESS AND CONDITION

OF

THE ROYAL GARDENS AT KEW,

During the Year 1881.

Royal Gardens, Kew, January 1, 1882.

SIR,

THE **Number of visitors** (836,676) to the Royal Gardens during the past year is larger than any hitherto recorded. It is 112,995 in excess of the previous year, and 111,254 in excess of that for 1878, which had so far remained the maximum.

The number of visitors on the Whit Monday, Bank Holiday, June 6 (50,688), was, as in 1880, the largest admitted on any single day in the year, though it fell considerably below the figure (61,831) for May 17, 1880.

Bank Holidays.—The following figures give the total numbers admitted during each, and also the numbers of persons who on each occasion entered before 1 a.m.

	Total Number during day.	Number before 1 p.m.
April 18	- 42,601	5,758
June 6	- 50,688	3,875
August 1	- 48,034	6,467
December 26	1,131	392

It may be interesting to give in one instance (June 6) the figures

showing the rate of arrival of the morning visitors:—

From 10-11	- 581
" 11-12	- 1,173
" 12-1	- 2,121
Total	- 3,875

By special permission of the Board the Members of the International Medical Congress were admitted to the Royal Gardens (including the houses and museums) on the morning of Sunday, August 7th.

The members of the International Pharmaceutical Congress were admitted to the Royal Gardens during private hours from 10 a.m. to 1 p.m. from August 1 to 6 inclusive.

The **Lessons given to the young gardeners** in the evening twice a week through about nine months of the year by members of the staff (assisted in the cases of elementary physics and chemistry by Mr. J. F. Harris, B. Sc., F.C.S.), have been well attended, and continue to give satisfactory results.

The iron house presented to the Royal Gardens by the India Office

(Kew Report, 1880, p. 59) has been divided by a brick wall. It had formerly belonged to the India Museum, and after the final distribution of the duplicates, not required for the permanent collection preserved at Kew, the entire space which it afforded was no longer needed for museum work. The separated portion affords a convenient lecture-room, and its contiguity to the Jodrell Laboratory gives the lecturer on chemistry, &c. every facility in the preparation of his demonstrations.

BOTANIC GARDEN.

The **flower-beds in front of the Palm House** have been entirely re-modelled, the narrow gravel paths done away with, and the box edging which had become very ragged and unsightly, removed. The whole area is now laid down in grass in six compartments, of which the four larger are girt with a flower bed. The spaces opposite the end of the Palm House have been similarly treated, and the collection of standard roses renewed.

The sunken areas with rhododendron, &c. beds at the back of the Palm House are in great want of reformation. These were made in 1848 upon an ill-drained piece of ground, in the depressions of which the water often stands in winter. As was the case with the ground in front of the Palm House, gravel paths were carried round the sunk areas, and these being damp and never walked upon by the public, were always being infested with weeds, entailing endless labour in cleaning. Arrangements have been made for carrying a drain through the adjacent lawn, which it is hoped will dry the ground, and the gravel paths will be removed. It will then remain to re-level the ground both in the sunk areas and above

them, and to reform the edges and slopes.

The yew hedge which encloses the Palm House area on the north, south, and west, is much damaged in many places, partly, no doubt, to the want of drainage. This is a very serious matter; various attempts have been made (by good soil, &c.) to induce a healthy growth in the diseased parts, but hitherto with no success; and, except the drainage of the site benefits the plants, extensive replantation will be necessary.

In the **Palm House** the work of re-arrangement goes on in, and partly together with, the destruction of duplicates and of plants of little public or scientific interest, in order to make room for the development of the better kinds. The benefit derived from the plan adopted of heating the dome by a flow and return pipe carried round the gallery is so pronounced, that it is proposed to extend the system by placing a flow and return under the long lanterns of the wings. I feel satisfied that the system of heating the upper parts of buildings of any considerable size has not been sufficiently resorted to as a means of ensuring the equable distribution of warm temperature with economy of fuel, and of avoiding the necessity of *driving* the furnaces in cold weather. As a means of checking condensation above, and thus of preventing drip, it is no less valuable.

Very active steps have been taken for several years to complete the **collection of Cycads** in the Palm House, to promote which the Assistant Director has devoted himself. The collection has long been possessed of the finest individuals of the South African *Encephalarti* in Europe; but it has been only lately that the splendid specimens of the tropical Australian, African, and Eastern Asiatic Cycads have been

added; and for the most remarkable of the former of which the Royal Gardens are indebted to the exertions of Sir Ferdinand Mueller, of Melbourne.

In **No. 1 (Tropical House)** the dilapidated wooden shelves have been replaced by slate ones. This has necessitated the shifting of the whole collection of Palms, Scitamineæ, and especially of climbing aroids, which clambered up the walls, or were attached to poles 15 feet long, that reached from the shelves to the roof. These have been replaced with few losses; but it will be some time before the back wall presents the mantle of green foliage of varied forms and hues for which it was so long admired. The noble collection of 27 Brazilian tree ferns contributed by M. Glaziov, of the Botanical Gardens of Rio, and which arrived in fine order during the summer, are now placed in this house.

The **collection of Tropical and Temperate Economic Plants** (in Nos. 11 and 12) are in good condition, but so crowded and cramped for room that they cannot be satisfactorily either grown to a size that shows their natural habit, or inspected by visitors, who justly complain of such an interesting and instructive series of plants being so straitened for room. It is a noteworthy fact, that when these houses were built, only 12 years ago, some of the most conspicuous and now widely spread and even commercially important of the plants for which they were intended, were either absolutely unknown in Europe, or known only as botanical curiosities of no known use to mankind; such are some of the Cinchonas, of the American and African indiarubbers, the Liberian coffee, &c. A list of the economic plants at present grown under glass in the Royal Gardens is given in Appendix II.

In the **Propagating department** sufficient accommodation has been provided (by re-glazing part of No. 18 in a more modern fashion) for the better culture of specimens of tropical plants of a very delicate nature, as the Mangosteen, Durian, &c., and to the want of which I alluded in the last years' Report (p. 7). A small heated pit has also been constructed out of some inconvenient frames for propagating plants for exhibition in the Conservatory (No. 4).

The Temperate House.—A great improvement has been effected in this building by removing the stacks of pipes which were placed on both sides of the main walk, where they formed a very ugly feature, to the side aisles, where they are practically hidden. They have further been reduced in number, with the result of giving off more heat; this is due to the fact that as formerly connected the flow was very sluggish, and indeed was arrested in some of the pipes. A low belt of rock-work planted with Ferns, Lycopods, &c. has replaced the pipes in the main walk.

Mr. Peacock's collection of Succulents, mentioned in my Report for the year 1878 (p. 6), as having been deposited for exhibition in the South Octagon on loan for three years, has been returned (with the thanks of the First Commissioner of Works) to the owner, who liberally presented the Kew collection with some of its desiderata from his own. Though possessed of great interest to the botanist, and containing also some unique specimens of singular aspect, the collection never appeared at home in the Octagon of the Temperate House; in which, owing to its size and airiness, and the distance of the specimens from the glass, they looked mere dwarfs, and made no vigorous growth. The

Octagon will now be devoted to plants of temperate regions, requiring at certain seasons more heat than can be obtained in the body of the house, and especially to such Cacti, Aloes, Agaves, &c. as shall outgrow the accommodation of the Succulent House (No. V.) That it is evidently suited for such a purpose is proved by the *Doryanthes Palmeri* of Queensland, which has never before flowered in this country, having perfected its magnificent head of scarlet flowers 3 feet high, and these being now followed by copious fruits which are approaching to maturity.

As in the Palm House, so in this, the transplanting, removing, and replacing of large specimens is constantly going on.

The following **Plants of special botanical interest**, amongst others of less importance, have **flowered** during the past year in the Royal Gardens:—

Aglaonema malaccense, N. E. B.;
sp. nov.

Aloe macracantha, Baker; Bot.
Mag., t. 6580.

„ *Perryi*, Baker, sp. nov.;
Bot. Mag., t. 6596.

Anæctochilus Roxburghii, Bl.

Anthurium Andraeanum, Lind.;
Bot. Mag. 6616.

„ sp. nov.

Anthericum sp. nov., Socotra.

Arnebia Griffithii, Boiss.

Aster gymnocephalus, A. Gray;
Bot. Mag. t. 6549.

Babiana socotrana, Hook f., sp.
nov.; Bot. Mag. t. 6585.

Begonia sp. nov. Ceylon.

Ceratostylis teres, Rehb. f.

Chlorophyllum brevicaupum, Dalz.
Clematis coccinea, Engelm.; Bot.

Mag. t. 6594.

Celia bella, Rehb. f.; Bot. Mag.
6628.

Crinum leucophyllum, Baker, sp.
nov.

„ sp. nov.

Cranfordia luteo-viridis, Clarke;
Bot. Mag. t. 6539.

Curculigo orchioides, Roxb.

Cyperus tetracarpus, Boeckler.

Dendrobium sp. nov., Australia.

Dioscorea multicolor, Lind. et
Andre.

Fockia glabra, Dene.

Galtonia clavata, Baker, sp. nov.

Gerrardanthus, sp.

Gesnera maculata, Mart.

Glyphosperma, Palmeri, Wats.

Goodyera macrophylla, Lowe.

Hedychium gracile, Roxb.; Bot.
Mag. 6638.

Incarvillea Koopmanni, Lauche;
Bot. Mag. t. 6593.

Kalanchoe sp. nov., Socotra.

Melanocarpum Sprucei, Hook f.

Microstylis chlorophrys, Rehb. f.

„ *metallica*, Rehb. f.

„ *Wallichii*, Ldl.

Mucuna capitata, Wight & Arn.

Nunnezharia tenella, Hook.; f.
Bot. Mag. t. 6584.

Nepeta pinetorum, Aitch.

Nymphæa flava, Lietr.

„ *odorata*, var. *rubra*.

Octadesmia montana, Benth.

Parnassia nubicola, Wall., Bot.
Mag. 6609.

Panax sp. nov. (*Aralia splendi-*
dissima, Hort.)

Pericome caudata, A. Gray.

Phalanopsis violacea, Rehb. f.

Phyllanthus submarginatus,
Klotzsch.

Pelargonium aconitophyllum, E.
& B.

„ sp. nov., Zanzibar.

Pinguicula caudata, Schlecht.;
Bot. Mag. 6624.

Piptospatha insignis, N. E. B.,
Bot. Mag. t. 6598.

Pitcairnia alta, Hassk.; Bot.
Mag. 6606.

Pogonia flabelliformis, Ldl.

Polystachya capensis, Lour.

Saccolabium gemmatum, Ldl.

Sarcophilus Hartmanni, Muell.

Schismatoglottis, sp. nov.

Scilla subsecunda, Baker, sp. nov.

Scilla microscypha, Baker, sp. nov.
Sempervivum Moggridgei, Hook.
 f.; Bot. Mag. 6610.

Solanum aviculare, Forst.
Stapelia Desmetiana, Hort., sp.
 nov.

Stimpervillum littorale, Juss.;
 Bot. Mag. 6623.

Utricularia Endresii, Rehb. f.;
 Bot. Mag. 6656.

Wallichia nana, Griff.

THE ARBORETUM.

In my last year's Report, I had to describe the damage done to the limbs and branches of the trees by the gales, and by the premature October's snow falling on them when laden with foliage, and in the case of the oaks with fruits also. No less destructive was the October cyclone of 1881, which levelled some of the largest trees, elms especially, both in the Arboretum in the Queen's grounds and in Kew Green, doing, however, comparatively little damage in the Botanic Garden. Besides uprooting many trees, others were broken off short at varying heights above the ground, others so mutilated that they will have to be removed, and still others so loosened in the soil as to be unsafe. To remove the timber it was necessary to obtain an additional staff of labourers, and it was considered expedient to take this opportunity of clearing considerable areas of the wood of old and poor trees, so as to be able to replant during the next autumn. These operations which were only commenced at the end of the year will be detailed in the Report for 1882.

The Pinetum.—The collection of Cypresses, Arbor Vita, Retinosporas, &c., which were planted in long beds along the walk extending along the Queen's College ground in 1872, and which were all replanted at greater intervals in 1879, and supplied with better soil, have

grown so rapidly that it became necessary greatly to enlarge their boundaries, and, in fact, to place them where they will remain for as long as most of them may live. For this purpose semicircular hoop-beds 15 to 50 feet in diameter have been made on either side the path, with the concavities towards the path; into them almost the whole collection has now been transplanted without loss, and in them they both look well and are well displayed for study and comparison. Of these (the Cupressineæ, &c.) there are about 150 reputed species and varieties, represented by about 500 species in 17 beds, and three more of them will be required to complete the arrangements. The collection of Yews, Podocarpi, &c., have still to be treated in a similar manner.

The Pines proper, Larches, Spruces, and Silver-firs, all want more room and better soil, and these will be attended to in the coming spring.

The Lake.—Large quantities of good loam are being removed from the north bank of the Lake to improve the beds in various parts of the Garden and Arboretum, especially the Herbaceous ground, the Pinetum, the Leguminosæ and Rosacæ. The effect of this will be to bring the Lake and its islands more into view, and take away from the formal stiffness of the northern bank, which in this respect contrasts most unfavourably with the southern. Many of the Deodars which blocked the spaces between the Limes on the verge of the Lake have been removed. This work will be proceeded with, and, if possible, the north-shore line will be varied and made more picturesque.

Preparations are made for replacing the broad gravel-walk on the Sion vista with grass. This walk has been an eyesore ever since it was made; and covered as it is

with loose shingle, it has always been avoided by visitors.

The following is a statement of

the plants, &c., sent out during the past year, and included in 355 consignments :—

—	Ward's Cases.	Packets of Seeds.	Stove and Greenhouse Plants.	Herbaceous Plants.	Trees and Shrubs.	Number of Recipients.
Britain - -	—	661	2,740	925	4,981	120
Continent - -	—	275	214	21	122	24
Asia - -	17	339	789	—	—	11
Africa - -	1	640	129	10	—	9
America - -	13	83	1,145	100	—	13
Australia and New Zealand.	4	2	183	—	—	9
Total -	35	2,000	5,200	1,056	5,103	186

Cinchona Ledgeriana.—Mr. Morris writes, September 7 :—“ We are now layering Mr. Howard's plants [sent from Kew], and hope to get about 50 strong plants by the end of this month. We obtained about half an ounce of fresh seed direct from Mr. Moens, in Java, in May last. We have succeeded in potting off 15,000 seedlings from it, and have every hope of saving them all. This will do a good deal with the plants sent by you in establishing this valuable plant in Jamaica. The demand, however, for seed and plants is so great that we cannot have too much of it. I have also raised some plants from seed sent by Dr. King, but I doubt whether his plants are so true as those sent from Java. That is judging by the appearance of the plants in the young state.”

Cocoa plants for eastern colonies.—In the Kew Report for 1880 (pp. 13, 14) the steps were recorded which had been taken to transmit from Trinidad through Kew to Ceylon, Singapore, and Fiji, plants of the best known cultivated varieties of the Cocoa plant. The seven Wardian cases despatched from Kew in the Autumn of 1879

reached Ceylon in good order. Out of 182 plants sent, 127 were alive, 24 in a doubtful state and 31 dead on their arrival at Peradeniya, November 5, 1880; none of the 11 varieties sent wholly failed.

The plants for Singapore were despatched from Ceylon March 9, 1881. The Hon. Cecil C. Smith wrote August 25 respecting them :—

“ They are doing fairly well now, but it took some little time to recover the effects of their removal. The cultivation of Cacao is becoming important here and in our neighbourhood it promises to be a decided success. The same too as to coffee. The accounts from the Johore plantation and from Sungly Ujong (next to Malacca) are very satisfactory, and it was only last night that I was told that in the latter place Cinchona is doing admirably. Unfortunately we cannot, nor can our planters, get the Ledgeriana, but we shall make a further attempt to induce the Dutch authorities to give us some.”

The plants for Fiji were despatched from Ceylon in April and reached their destination in the following July. Unfortunately they had all perished in transit.

In the same month, however, Mr. Prestoe despatched from Trinidad a supplementary case containing the plants required to make up the full number of 20 of each variety which he had been requested to procure. These reached Kew in good condition, and were immediately forwarded to Ceylon. Out of 30 plants 27 arrived in October living, while three were dead or nearly so. Dr. Trimen retained nine of the plants, and despatched the remaining 18 to Fiji which they reached on December 23. Mr. Thurston, the Colonial Secretary reports as follows:—"With the exception of two plants the contents of the case on landing at Suva appeared all that could be desired, and the weather being warm and moist, the others were at once planted out in the ground prepared for them. Since planting, the Cacao plants as well as several cuttings of the *Erythrina umbrosa* (Madre del Cacao) which accompanied them, have budded freely, and appear in a fair way to establish themselves rapidly. While writing this letter I have received a note from a planter to whom I gave a few plants of Cacao (Java) less than three years ago, to the effect that it is bearing, one tree having over 20 pods upon it, and 'an immense quantity of blossom.'"

The plants which reached Fiji ultimately, fortunately represented no less than seven distinct varieties, including Criollo, red and yellow; Cundeamar; Forastero, red; Sangre Toro, yellow; and Verdilico.

Cola nut.—The distribution of plants of this plant (see Kew Report, 1880, pp. 14-15) has been continued. It has been sent to the botanical establishments at the following places:—Cambridge (United States), Calcutta, Ceylon, Dominica, Java, Singapore, Toronto.

Columbian barks.—With respect to the remaining plants of Calisaya of Santa Fé, which as stated in the last Kew Report (p. 15) were taken out to the Nilgiris in September 1880, I have received the following official information from Mr. Cross through the India Office:—"I arrived on the 8th of October with all the Santa Fé plants (also the Carthagenas) in fairly good condition, considering the excessive heat experienced during the voyage. . . . All are now going on well, and four cutting plants obtained from the Santa Fé are now rooting. I had to keep the plants for some time in the open air, the propagating houses were in such bad condition, in fact they had never been in a good state."

Mr. Cross gave some further information in a private communication:—"All the Santa Fé plants taken out by me were planted out and established, together with a few cutting plants and a couple of grafts, one of which was put on a Condaminea tree six or eight years old at a height of about seven feet up the trunk. The object in this case was to bring the full vigour of the trunk to bear on the graft so as to produce early flowers and seeds."

Cow tree.—The Palo de Vaca or Cow tree of South America (*Brosimum Galactodendron*) grows in large forests in the mountains near Cumana, and in other parts of the sea coast of Venezuela. It forms a tree frequently over 100 feet high, and often running to a height of 60 or 70 feet before branching. The milk which is obtained by making incisions in the trunk is said to have an agreeable taste like that of sweet cream with a slightly balsamic odour; it is somewhat glutinous, but said to be nourishing and perfectly wholesome.

According to Boussingault the constitution of the "milk" of the Cow tree approaches very closely that of the genuine milk of the cow.

At the request of the India Office we obtained from Venezuela a supply of the seeds (through the kind assistance of Dr. Ernst, Professor of Natural History in the University of Caracas).

A case of germinating seeds was duly despatched in October 1880 to the Superintendent of the Victoria Gardens, Bombay. No information of any kind has since reached Kew officially as to the result of the experiment. I extract, however, the following account from Mr. Stomont's report on the Khandesh Government Farm for 1881:—

"Six small healthy-looking plants of the Cow tree (*Brosimum Galac-todendron*) were received from the Superintendent of the Victoria Gardens, Bombay, in July; of these, two were sent for trial in Dhulia, three others planted out in ordinary garden soil, and one merely shifted into a larger pot. The latter is doing well; but those planted out have made no progress, have even lost most of the leaves they had. What they may do in the hot weather remains to be seen."

The home of the Cow tree in Venezuela is in 10° N. lat., and in a doubtless very damp climate. How it will fare 11° further north with a rainfall of under 40 inches is a not perhaps very hopeful prospect. A portion of the seeds retained at Kew germinated, and plants were sent during the past year to the Botanic Gardens of the following places:—Adelaide, Brisbane, Calcutta, Ceylon, Fiji, Java, and Singapore. In Ceylon the plants are reported as doing well, though slow in their growth.

Elephant sugar-cane.—Plants of this variety originally obtained

from Cochin China (*see* Kew Report, 1876, p. 25) were sent to Demerara and Dominica.

Eucalyptus.—*Sind.*—Major McRae reports, September 6, 1881:—"Most of the plants of *Eucalyptus cornuta*, *E. rostrata*, and *E. latifolia* are doing so well that I feel certain they could be grown for road-side trees and may pay the cost of cultivation on a large scale for timber."

West tropical Africa.—For several years past a correspondence has from time to time been carried on with the Colonial Office in reference to the introduction of various species of *Eucalyptus* into the British settlements in the West Coast of Africa. Seeds have been repeatedly procured from various parts of Australia and sent out to meet the wishes of the several Governments. As might have been expected those from the temperate parts of Australia (such as *Eucalyptus Globulus*) have proved quite unfitted for growth in a tropical climate. Out of a mass of documents I quote the following report from Mr. J. W. Rowland, Assistant Colonial Surgeon at Lagos. He writes, July 27, 1881:—"I find that the *E. Globulus* is the least likely to succeed as it requires too much care. But the *E. Bai-teyana* thrives wonderfully well, also the *E. acmenoides* and *E. resinifera*. When I left Lagos I had 65 plants growing on a swamp near the town, and I have no doubt they will turn out a great success."

It cannot be doubted that apart from their hygienic qualities these species (which are all natives of the hot parts of Australia) will be found valuable introductions into West Africa if only for their accommodating disposition in respect to the conditions of growth and for the value of their timber.

Fodder plants.—Mesquit bean.

—Major McRae reports from Sind, September 6, 1881 :—"Some 200 plants, *Prosopis glandulosa*, were raised from seed sown during the inundation season; these were about 4 feet high in March, and coming into blossom. Experience has already shown this to be a most valuable fodder tree. It yields two crops of pods yearly, and yields its first crop in a year. It grows rapidly, yielding large crops yearly."

Tagasaste (*Cytisus proliferus*, var.)—Mr. A. Jamieson, Superintendent of the Botanical Garden, Ootacamund, reports, July 7, 1881 :—"Nothing could be more satisfactory than the growth this plant has made during the past year. Several dozens of plants put out in a bed of still rather poor soil, have made a wonderfully rapid growth, many of them being 15 feet in height, and are well furnished with branches, which are covered with succulent healthy foliage. I have tried milch cattle, sheep, goats, &c., with it; sheep and goats eat it greedily; cattle eat it, but do not seem to care for it much. I have no doubt, however, if they were persistently tried with it they would partake of it freely. The plant is perfectly hardy, and is not affected by frost or drought, and I feel certain would thrive in many parts of these hills, where nothing else of any value as a fodder could succeed. The plants are coming into flower, and will probably yield a quantity of seed by the autumn."

Garcinia indica.—This little known plant yields the kokum oil of Western India. Deputy Inspector-General Balfour gives the following account of it :—"This tree grows on the western coast of peninsular India, and in ravines of the Konkan.

"Its fruit yields a solid vegetable oil, which melts at a temperature of 95°. It now forms an article of export. The seeds are first sun-dried, and then pounded and boiled in water; the oil collects on the surface, and on cooling concretes into a solid cake. When purified from extraneous matter, the product is of a rather brittle quality, of a pale yellowish hue, inclining to greenish, and mild to the taste."

Plants have been sent from Kew to Dominica, Jamaica, and Trinidad.

India-rubbers. — CASTILLOA.

—**Ceylon.**—Dr. Trimen reports :—"The Castilloa, both at Peradeniya and Heneratgoda, produced flowers during the dry weather of April; on examination, however, these were all male. This species is said not to produce seed till eight years old. The finest tree at Heneratgoda has now a stem of 22½ inches in circumference at about a yard from the ground."

Madras.—Mr. Cross writes, March 6, 1881 :—"Castilloa elastica, of which there are only three plants, has evidently found a home on the banks of the Nilambur river . . . A Castilloa tree, if carefully and judiciously tapped, with a diameter of 1½ to 2 feet, may be expected to yield about 12 pounds of rubber per annum. Of all the different species of rubber producing trees, the *Castilloa* should prove, under cultivation, the most remunerative."

CEARA.—**Ceylon.**—Dr. Trimen reports :—"Ceara continues to interest planters by its rapid growth, ready propagation, tenacity of life, and early production of seed. From this latter quality chiefly it has resulted that the loud and urgent demand for seed has almost ceased in Ceylon in the course of one year. We have distributed it to several planters in India and

“ to the Government establishments
 “ there; also some to Singapore for
 “ a further trial, as well as to
 “ Jamaica and other colonies. * *

“ During the early part of the year
 “ I made a preliminary and tentative
 “ investigation to ascertain the con-
 “ dition of the milk in our Ceara
 “ trees at Péradeniya, and the best
 “ means of obtaining it. The prin-
 “ cipal conclusion I arrived at was
 “ that the trees had not their milk
 “ in a sufficiently concentrated state
 “ to invite tapping. I was quickly
 “ led to the opinion that the method
 “ of paring the stem, as practised by
 “ the natives in Brazil (according
 “ to Mr. Cross), would not be found
 “ either convenient or economical.
 “ The milk-vessels occur in two
 “ layers, the richer one is in the
 “ innermost stratum of the bark,
 “ just outside the cambium, but
 “ there is a smaller one immediately
 “ beneath the thin green layer; this
 “ latter is sacrificed by the slicing
 “ process, which also causes loss
 “ from the milk adhering to the
 “ shavings. In the culture of this
 “ kind of rubber the principal dif-
 “ ficulty will, I think, be the *extrac-*
 “ *tion* of the milk. It appears to
 “ be present in good quantity, but
 “ a very small amount flows from
 “ each cut, and it is difficult to avoid
 “ drip and loss if the stems are not
 “ perpendicular. It is not possible
 “ at present to make any estimate
 “ of the slightest value as to the
 “ probable average yield of a tree.
 “ The plant is evidently very hardy,
 “ and rapidly recovers from bark
 “ injury. I think I should repeat
 “ here what I said two years ago,
 “ that the yield of a few trees can-
 “ not be remunerative, and only
 “ large plantations can hope to re-
 “ pay the cost of collection. The
 “ quality of the *dry* rubber (result-
 “ ing from milk laboriously obtained
 “ from one tree by small incisions)
 “ appears identical with the Ceara

“ scrap of commerce, in spite of the
 “ extremely watery character of the
 “ milk. Further experiments will
 “ be shortly made.”

Madras.—The india-rubber trees
 at Nilambur have been planted in
 an open space of teak forest land,
 on the bank of the Nilambur river.
 “ The plants,” writes Mr. Cross,
 March 6, 1881, “ have in the brief
 “ space of two years shot up in the
 “ most surprising manner, the
 “ highest upwards of 30 feet in
 “ height, and are now yielding an
 “ abundant crop of seeds. I was
 “ shown one strong rank sapling,
 “ which in five months from the
 “ time of planting had grown up
 “ and produced flowers. This region
 “ is without doubt admirably adapted
 “ for the growth of the tree. . . .
 “ At the same time, I would confine
 “ the general planting of the Ceara
 “ rubber to rather dry arid situa-
 “ tion and poor soils. . . .
 “ Mr. Ferguson was desirous of
 “ proof of the actual existence of
 “ rubber in his Ceara saplings, and
 “ although these were too young to
 “ yield this product, I resolved to
 “ make an attempt to satisfy him.
 “ The natives at Ceara in bleeding
 “ this sort simply slice off the outer
 “ portion of the bark on one side of
 “ the tree from the base to a height
 “ of 4 or 5 feet. The milk exudes
 “ from the pared portions of the
 “ trunk and runs down in little
 “ courses. By the following morn-
 “ ing the milky juice of these courses
 “ is sufficiently solidified to be pulled
 “ from the trees in strings, which
 “ are rolled up into balls as the work
 “ of collection proceeds. When
 “ this process was tried on one tree
 “ the milk exuded freely, but next
 “ day on examination it was found
 “ that the greater portion had eva-
 “ porated, showing the watery and
 “ immature state in which the milk
 “ exists in young growing plants.
 “ However, on making incisions on

"the collar and largest roots of the plants milk of good quality was obtained, which next day was found coagulated. From the collars of five saplings about an ounce of rubber was obtained, which, in appearance, elasticity, and odour, could not have been distinguished from Ceara scrap as seen in commerce. But it is manifest that the trees ought to be allowed to attain some size before being wrought."

Mr. Jamieson reports from Ootacamund, October 25, 1880 :—"Ceara rubber is going to be a decided success at Barliyar; the largest tree has now attained a height of 17 feet, having made a growth of over 14 feet in 12 months. After several unsuccessful attempts to propagate this plant from cuttings, I have succeeded in rooting three plants, which will be grown in the hothouse in the Ootacamund Gardens as stock plants, as I have found that the young tender shoots grown under glass propagate more readily than cuttings from trees grown in the open. The largest tree flowered at Barliyar in May last, and I hope to get a quantity of seed from it for distribution. I sent five healthy Ceara rubber plants to the Agri-Horticultural Society's Gardens, Madras, and they arrived in good order."

Mauritius.—Mr. Horne writes, October 3, 1881 :—"Manihot Glaziovii grows remarkably well here, and we propagate it by cuttings when it is leafless. These strike like willows in the open ground, but they must not be disturbed until the next season, when they are at rest, as otherwise the cut rootlets bleed the plant to death. From letters in some of the papers the writers do not seem to be aware of this, or they would not wait for their trees seedling to increase their stock of them."

HEVEA.—*Ceylon*.—Dr. Trimen reports :—"A single tree of Hevea flowered at Heneratgoda and produced a few capsules in April. The growth of Para rubber is not rapid; our largest is now 21 inches in circumference at a yard from the ground, an increase of 5 inches in the year. New plantations of Hevea have been formed, and some trees at Peradeniya have been planted in a position in the new garden where they are flooded when the river is high, with a view to an imitation of their native habitat."

Madras.—Mr. Cross writes, March 6, 1881 :—"The Para rubber has seemingly not found its proper habitat at Nilambur. The young plants have shot up like long whip handles, with a bunch of leaves on the top. There is not, however, the slightest reason to despair of success."

LANDOLPHIAS.—A considerable distribution was made of East African rubber-vines from the stock which had been gradually worked up at Kew. The species sent out were the four discussed in the Kew report for last year (pp. 39-43), 1, *L. Kirkii*; 2, *L. florida*; 3, *L. Petersiana*; 4, *L. sp.* The botanical institutions of the following places were the recipients :—

	Total No. of Plants.
Adelaide -	1, 3, 4 - 14
Brisbane -	1, 3, 4 - 30
Cambridge (United States) -	1, 3, 4 - 6
Ceylon -	1, 2, 3, 4 - 58
Fiji -	1, 2, 3, 4 - 10
Jamaica -	1, 3, 4 - 36
Singapore -	1, 3, 4 - 4
Toronto -	1, 3, 4 - 3
Total -	161

Fiji.—Mr. Thurston writes :—"The Landolphas have been planted

" on the land which, with the Governor's permission, I have selected
 " for the botanic gardens at Suva,
 " and are at this date doing well."

Liberian coffee.—In continuation of previous notices I record some further details as to the progress of this valuable plant in parts of the world where it has been introduced from Kew. The remarks made by Mr. Jamieson are interesting. Although not botanically definable it was suspected (*see* Kew Reports, 1873, p. 5; 1874, p. 5) that the Cape coast and Liberian coffee might be two distinguishable forms of the species.

Dominica.—Dr. Nicholls writes (September 27, 1881):—"My Liberian coffee plantation is getting on capitally, and the old trees are loaded with berries. The first flowering this year commenced on Feb. 25th, and lasted for several days; and the second flowering, which also lasted for several days, began on April 18th. Since then I have noticed some of the trees bearing flowers on the following dates, May 23rd, August 1st, August 10th, and September 5th and 10th. I find that the branches of *C. liberica* have a different habit from those of *C. arabica*, for whilst the branches of the latter trees are pendulous; most of those of *C. liberica* have an upward tendency, and the younger primary branches make a very acute angle with the stem. I have been experimenting in topping the trees, but only with partial success, in consequence of this erect habit of growth. When a tree is topped, secondary buds form *below* the last pair of auxiliary branches, and very shortly they will develop into upright stems. If these be removed, the last pair of auxiliary branches frequently take

" an upward direction and in time
 " form a bifurcated continuance of
 " the main stem. These interesting
 " facts point to the inadvisability of
 " trying to dwarf the trees, and
 " they show that the trees themselves struggle to overcome the
 " interference with their natural
 " mode of growth."

Dr. Nicholls has published (S. W. Silver & Co.) a useful little work "on the cultivation of Liberian coffee in the West Indies," in which he has embodied the results of the observations of the late Dr. Inray and himself.

The progress which the new staple has made owes everything to the exertions of these gentlemen. The plant was introduced into Dominica in 1874 from the Royal Gardens, Kew. "At the present time large supplies of berries for seed purposes are exported from Dominica to Martinique, Guadeloupe, Jamaica, St. Kitts, and Trinidad."

Jamaica.—The Government has published a pamphlet by Mr. Morris, entitled "Notes on Liberian coffee, its history and cultivation," which gives an elaborate account of everything known about the plant.

Nilgiris.—I extract the following from the report of Mr. Jamieson, superintendent Government Botanic Gardens, dated October 25, 1880, but which has only recently come into my hands:—"I consider the progress made and the present condition of the plants eminently satisfactory, and it is now beyond doubt that this variety of coffee when grown under conditions analogous to those at Barliyar is vastly superior to the ordinary *Coffea Arabica*. Another interesting fact with regard to this coffee has been determined during the past year. Having had opportunities of examining the flowers and fruit of the plants introduced and

"planted at Barliyar in 1877 as 'true 'Liberian coffee,' I am now quite satisfied that it is a distinct variety from the plants received in 1874-75 as 'West African 'coffee.' There is no distinguishable difference between the leaves and habit of growth of the two varieties. The flowers of the 'West African are not so large and the berries are borne in larger whorls, and are more spherical in shape than that of the true Liberian variety; but the most important difference in a commercial point of view is that the West African is a much freer and more abundant cropper than the other; it is also harder and ripens its fruit about two months earlier than the latter, and it has never produced any abortive berries, which is frequently the case with the Liberian variety. Several hundred seeds were sold and 5,925 plants raised from last year's crop of West African coffee, and orders have been received for 500 plants. With a view to encourage planters to take up the cultivation of this valuable coffee in suitable localities, I intend advertising plants for sale at greatly reduced prices. Our trees have not been topped or pruned, but allowed to grow in their natural form, and promise to yield a good crop this year; but no doubt the yield of fruit will be greatly increased as more care and knowledge are brought to bear on their cultivation."

Queensland.—Mr. James Pink, Curator of the Brisbane Botanic Gardens, writes October 10, 1881:—"Queensland grown coffee is being sold in the Brisbane market this year, for the first time; the green berry at 8d. per lb. We are also raising large quantities of Liberian coffee from seed sent from Ceylon. It is doubtful whether it will succeed near Bris-

bane, but it will doubtless thrive well further north."

Seychelles.—Mr. Cockburn Stewart, Civil Commissioner of the Seychelles, writes May 22, 1881:—"You will be interested to hear that the Liberian coffee which was sent originally to Mauritius by you in 1877 or 1878, has succeeded here in a marvellous manner. The soil and climate of these islands appear to be just what is required for the cultivation of Liberian coffee. Cacao planting is beginning to make great progress here, and it is impossible to imagine anything finer than the produce of this tree in Seychelles. Vanilla grows abundantly, and is of a magnificent kind. It is a pity that these islands are not better known in England, for they doubtless present a great field, and will in a short time, if properly managed, become one of the most important spice-producing countries in the east."

"There is no money in the place, unfortunately, and it is by far behind hand; but I feel convinced that a great future is in store for Seychelles."

Mahogany.—*Bombay.*—Mr. Shuttleworth reports, September 14, 1881, that in the northern division of the Bombay Presidency:—"The mahogany trees, if carefully looked after, thrive, and have a quick growth."

In the southern division, Lieut.-Colonel Peyton reports, October 1, 1881:—"The mahogany, of which there are many plants, is attacked by a grub which destroys the young terminal shoots and distorts the trees; otherwise, the plants are green, and appear fairly healthy."

Medicinal plants for Saharunpore.—A correspondence has been in progress with Mr. Duthie, F.L.S., Superintendent of the Go-

vernment Botanical Gardens, Sabarunpore, on the cultivation of various medicinal plants in that establishment, and the preparation of extracts from them, for the use of the Indian medical department. Roots and seeds of English *Taraxacum* have been despatched to Mr. Duthie, and samples of the extract prepared under his supervision have been reported upon.

Trees for London parks, &c.—During the past year, under the direction of the Board, 874 trees and shrubs have been supplied to

Battersea Park, 1,687 to the Regent's Park, and 500 to the Royal Artillery Barracks, Sheerness. This nearly exhausts the nurseries which were originally formed at Kew, and which, by the instruction of the Board in 1861, were stocked with "a variety of deciduous trees."

The receipts have been during the past year 3,671 living plants of all kinds, and 2,106 packets, bags, and boxes of seeds from 218 contributors. They are classified as follows:—

—	Ward's Cases.	Packets of Seeds.	Stove and Greenhouse Plants.	Herbaceous Plants.	Trees and Shrubs.	Number of Contributors.
Britain - -	—	398	1,036	881	227	116
Continent - -	—	448	58	123	218	23
Asia - -	8	456	353	3	—	29
Africa - -	3	71	155	—	—	21
America - -	13	442	310	3	183	17
Anstralia and New Zealand.	4	291	118	4	—	12
Total -	28	2,106	2,030	1,014	628	218

Mr. Watson, foreman of the Propagating Department, visited under Board's authority in the autumn the principal botanical establishments of Belgium and Germany with the result of obtaining many valuable additions to the Kew collections.

During the past year the following plants among others of less importance were added to the cultivated collection and are now become established.

Adiantum Bausci.
Acerides Lecanum.
Aglanema pictum.
Alocasia Thibautiana.
Angracum citratum.
Areca Alicia.
Bismarckia nobilis.
Clerodendrum Rumphianum.

Colocasia neoguineensis.
Crinum Bainsii (?).
Cycas undulata.
Cymbidium Lowii.
Dendrobium Treacherianum.
 " *Vetichianum.*
Dioscorea pyrenaica.
Dracaena Lindenii.
Duboisia Hopwoodii.
 " *myoporoides.*
Encephalartos latifrons (large).
Grammatophyllum Ellisii.
Hevea Spruceana.
Jasminum gracillimum.
Kentia divaricata.
 " *gracilis.*
 " *Van Houtteana.*
Macrozamia Moorei.
Manicaria saccifera.
Masdevallia triangularis.

Masdevallia Wageneriana.

Microstylis metallica.

" *chlorophrys.*

Musa coccinea.

Myosotidium nobile.

Nepenthes Rajah.

Pescatorea cerina.

Phalanopsis violacea.

Philodendron Wallisii.

Pinguicula candata.

Pitcairnia corallina.

Pleione Hookeriana.

Pritchardia aurea.

" *Gaudichaudii.*

Pseudodracontium Lacourii.

Sarcochilus Fitzgeraldii.

" *Hartmanni.*

Sagus amicarum.

Schismatoglottis crispata.

Streptocarpus parviflorus.

Strychnos Ignatii.

Tabernaemontana crassa.

Teymannia altifrons.

Utricularia Endressii.

Vanda Hookeri.

Warszewiczella discolor.

Zamia prasina.

" *Van Houtteana.*

" *Wallisii.*

" *"Katzeri."*

The following is a list of the principal contributors to the living collections during 1881 :—

Britain.

Exchanges have been made with the following Botanic Gardens, viz. :—Cambridge, Chelsea, Dublin, Edinburgh, and Glasnevin; with the Royal Horticultural Society, Chiswick, and also with the following nurserymen, viz. :—Messrs. Backhouse of York, Bull of Chelsea, Dickson and Co. of Edinburgh, Henderson of St. John's Wood, Ker of Liverpool, Low of Clapton, Rodger, MacLelland and Co. of Newry, Smith of Worcester, Sander of St. Albans, Shuttleworth and Carder of Clapham, Thompson of Ipswich, Veitch of Chelsea, Williams of Holloway, and Wills of South Kensington.

Contributions have been received from over 200 sources; of these the principal have been :—

Aitchison, Surgeon-Major, various seeds from Afghanistan.

Bailey, Rev. —, seeds from New Zealand.

Balfour, Prof. Bayley, seeds from Socotra.

Boscawen, Hon. and Rev. T. S.; *Nymphaea Daubenyana.*

Bowman, W.; *Dendrobium undulatum* and herbaceous plants.

Bowring, J. C.; Orchids.

Christy, T.; seeds of *Tabernaemontana crassa*, *Polystachya hypocrita*.

Clapham, A.; *Viola Munbyana* and ferns.

Clarke, Col. Trevor; *Crinum Moorei*.

Cole, J.; *Streptocarpus pauciflorus*, &c.

Cordery, O.; succulents.

Crewe, Rev. Harpur; *Salvia*, three species.

Croucher, J.; various succulents.

Currie, Sir Donald, M.P.; seeds of Cyprian cedar (*C. Libani* var. *brevifolia*).

Ellacombe, Rev. H.; herbaceous plants.

Elwes, H. J.; four cases of plants from India, including *Crawfordia trinervis*, *Paris polyphylla*, *Lilium oxypetalum*, *Pleione Hookeriana*, *P. humilis*, and others, *Dendrobiums*, *Erias*, *Thunias*, *Aroids*, &c., also various seeds from India.

Foster, Dr. M.; Irids.

Fraser, N.; filmy ferns and seeds.

Frere, Sir Bartle; valuable collection of Cape bulbs.

Gillespie, Dr.; seeds of *Psiadia rotundifolia*.

Gumbleton, W. E.; herbaceous plants.

Henry, I. Anderson; herbaceous plants.

Horner, J. F.; *Abies* sp.

Howard, J. E.; *Cinchonas*.

Joad, the late G., (bequest of) ; selections of the rich collection of herbaceous plants, &c., cultivated in his garden at Wimbledon, including many rare stove, greenhouse, and herbaceous plants, terrestrial orchids, and bulbs.

Lawrence, Sir T., Bart. ; *Mesospinidium incantans*.

Lawson, Rev. W. L. ; set of ferns from Algeria.

Lennox, Lord H. ; *Bignonia, flava*.

Lombe, Dr. ; seeds from New Zealand.

Lyall, C. ; orchids from Assam.

Maclear, Mrs. ; Australian orchids.

MacLeay, Sir G. ; *Pitcairnea corallina, Canna iridiflora*.

Magnay, C. ; seeds of "Talipot palm."

Marriott, Sir W. ; several orchids.

Mateer, Rev. S. ; Indian plants, including tubers of *Gloriosa*, terrestrial orchids, &c., various seeds.

Maw, G. ; *Colchicum sp. Croci*, Corinthian and Finger grape vines.

Miles, F. ; *Nymphaeas*, shrubs, seeds from Merv.

Nevett, W. ; *Cattleya Mossiae*.

North, Miss ; seeds from Australia.

Perry, W. W. ; African seeds.

Perez, G. V. ; succulents from Canary Islands.

Sherring, R. V. ; ferns.

Smith, D. ; *Fouquieria longava*.

Smith, Mrs. ; Iridaceous plants.

Speed, T. ; *Musa coccinea*.

Stokes, B. ; seeds from Manitoba.

Truran, J. ; box of anemone roots.

Walker, Col. ; several orchids.

Wills, A. ; ferns.

Continent.

Exchanges have been made with MM. Haage and Schmidt of Erfurt, Van Houtte of Ghent, Linden of Ghent, and De Smet of Ghent.

Contributions were received from :—

Corsi-Salviati, Marquis, Italy ; *Orchis pseudosambucina*.

Decaisne, Prof., Paris ; *Dioscorea pyrenaica*.

Forbes, H. O., Sumatra ; tubers *Conophallus Titanum*.

Hanbury, T., Mentone ; various seeds.

Kreuter, F., Vienna ; seeds from Japan.

Lange, Prof., Copenhagen ; seeds of roses, *Crataegus*, &c.

Lavallée, M., Paris ; rare trees and shrubs, *Begonia sp.*, Anonas, *Melastoma spp.* &c.

Leichtlin, Max, Baden - Baden ; rare herbaceous plants and bulbs, *Kniphofia Saundersii*, Tritomas, *Agave protuberans*, &c. ; various seeds.

Paris, H.R.H. the Comte de ; tubers *Ophrys bombylifera*.

Regel, Dr. E., St. Petersburg ; many herbaceous and bulbous plants, collection of seeds from Pekin, *Conifera*, &c.

Schlegelmilch, Dr. F., Coburg ; *Sempervivums*.

Wendland, G. F., Hanover ; *Bismarekia nobilis*, orchids, palms, shrubs and herbaceous plants.

Asia.

Beddome, Col., Madras ; seeds of *Cycas sp. Bentinekia Coddapanna*, &c.

Berkeley, Col., Andamans ; seeds of *Cucurbitaceae*.

Brooke, Mrs., (the Rancee), Borneo ; seeds of *Pinanga sp.*

Cameron, J., Bangalore ; stems of *Cycas Boddami* ; seeds.

Cyprus, High Commissioner of ; seeds *Cedrus Libani*, var. *brevifolia*. Duthie, J., Saharunpore ; various seeds.

Ellis, R., Pangi Valley ; many packets of seeds and bulbs.

Ford, C., Hong Kong ; *Phania sp.* tubers of *Zingiberaceae* ; various seeds.

Gammie, J., Darjeeling ; seeds of *Cinchona Ledgeriana*, and palms.

Gilbert, J. H., Rangoon; *Ipomœa campanulata*.

Hance, Dr., Canton; seeds of the "Star-anise."

Johnston, Dr., Bengal; bulbs from Afghanistan.

Kinch, E., Japan; collection of Japanese seeds.

King, Dr., Calcutta; two Wardian cases containing *Magnolia Campbellii*, *Wallichia disticha*, *Cycas pectinata*, &c.; also seeds of *Borassus*, *Egle Marmelos*, *Hodgsonia*, &c.

MacNair, Major, Singapore; Wardian case of plants.

Peché, G., Moulmieu; valuable set of orchids, including *Vanda cœrulea*, *Acridas*, *Dendrobium*, *Saccolabium*, &c., large bulb of *Crinum* sp.

Prisdang, Prince, Siam; seeds and tubers of *Curcuma*, &c.

Rama-Varma, Prince, Travancore; seeds of *Bentinckia Coddapanna*, *Musa superba*, &c.

Ridley, Mrs., Lucknow; bulbs of *Hippeastrum*.

Steavenson, J., Madras; seeds of *Phœnia pedunculata*, &c.

Thomas, E. B., Nilgherries; box of *Gloriosa superba*.

Thurston, J. B., Fiji; Pritchardias and Ptychospermas.

Treub, Dr., Java; seeds of *Gnetum Gneumon*, rare palms, &c., Wardian case of palms, ferns, &c. including *Teymannia altifrons*, *Bromheadia palustris*, *Acrostichum trinerve*, &c.

Trimen, Dr., Ceylon; two Wardian cases containing various orchids, Arisemas, Cycads, *Shorea Dyeri*, *Teymannia altifrons*, and economic plants, also various seeds.

Watt, Dr. G., Kishnagar; seeds of Primulas.

Africa.

Ayres, C., Cape Town; case of *Disa grandiflora*, seeds of *Welwitschia*.

Bowker, Col., Natal; seeds of *Gardenia globosa*.

Calvert, H. H., Alexandria; seeds of *Melia* and *Schinus*.

Hutton, H., Beaumont, Cape of Good Hope; various seeds.

Kirk, Sir J., Zanzibar; bulbs of *Crinum Bainsii*? *C. Kirkii*, and other spp., *Brunsvigia*, *Haemanthus*, &c.; tubers of *Dioscorea* sp., *Zingiberaceæ*, *Lissochilus*, &c., Wardian case of *Angraecums*, &c.

King William's Town Bot. Garden; South African orchids, including *Polystachyas*, &c.

MacOwan, Prof., Cape Town; various seeds.

Parker, Dr., Madagascar; bulbs and tubers.

Saunders, Mrs., Natal; *Haemanthus Catherinae*, *Crinums*, &c.

Schenfeld, Rev. C., Gold Coast; tubers and seeds.

Seychelles, Civil Comm. of; Wardian case of *Nepenthes*.

Stewart, H. C., Seychelles; nuts of *Lodoicea seychellarum*.

Tidmarsh, E., Grahamstown; large stocks of *Testudinaria elephantipes*, and *T. sylvatica*.

Wilson, J., Port Elizabeth; seeds of *Encephalartos*.

Wildpret, H., Oratava; seeds of *Lotus Bertheloti*, &c.

New World.

Austin, Mrs., California; seeds of *Conifera*, &c.

Briggs, Sir T. G., Barbadoes; Wardian case of *Melocactus communis*, &c.; seeds of *Thrinax*, sp.

Engelmann, Dr., St. Louis; seeds of succulents, &c.

Ernst, Dr., Caracas; box of *Schœnocaulon officinale*, seeds of *Ceroxylon andicola*.

Espeut, W. B., Jamaica; tubers of Arracacha.

Fletcher, J., Ottawa; tubers of *Nymphaea*, &c., and seeds of herbaceous plants.

Forbes, W. A., Pernambuco; seeds of *Hancornia speciosa*.

Glaziou, A., Rio Janeiro; very fine set of tree-ferns.

Hay, J. Drummond, Valparaiso; seeds of *Jubaea spectabilis*.

Jenman, G. S., Demerara; Wardian case containing *Hevea Spruceana*, *Nectandra Rodinei*, *Caryocar nucifera*, *Manicaria saccifera*, &c.; various seeds.

Kellog, A., San Francisco; seeds of *Eucharidium Breweri*.

Lemmon, J. G., California; seeds of Agaves, *Dasyllirion Wheeleri*, *Fraseria*, &c.

Morris, D., Jamaica; box of orchids, including *Pleurothallis* spp., Mesospinidioms, Epidendrums, &c.; Wardian case of rare ferns; seeds of *Pinanga Kuhlii*, and other palms.

Nicholls, Dr., Dominica; Wardian case of ferns, palms, &c.

Prestoe, H., Trinidad; three Wardian cases containing *Cyrtopodium Woodfordii*, *Danaea elliptica*, *Cyathaea ferox*, *Trichomanes crispum*, Theobromas, and other economic plants, palms, &c.; seeds of palms, &c.

Ravenal, H. W., South Carolina; seeds of *Carya myristicæformis*.

Sargent, Prof., Harvard; seeds of trees and shrubs.

Sturtevant, E. J., New Jersey; *Nymphaeas*, &c.

Washington Bot. Garden; various seeds and plants.

Wright, W. G., California; seeds of *Washingtonia filifera*, *Fremontia californica*, &c.

Australia and New Zealand.

Cheeseman, J. F., New Zealand; tubers of seven vars. of the cultivated sweet potatoe (*Convolvulus chrysorrhæus*) with native names.

Enys, J. D., New Zealand; seeds of *Ranunculus Lyallii*.

Guilfoyle, W., Melbourne; Wardian case of Australian plants, including Boronias, *Eucalypti*, &c.

Hector, Dr., Wellington; various seeds.

Hill, W., Brisbane; Wardian case containing seedling palms Cycads, *Sagus amicarum*, orchids, &c.; four large stems of *Catakhodzamia Macleayi*, &c.

Kirk, T., Wellington; seeds of *Cordyline australis*, true and cultivated vars.; *Myosotidium nobile*, &c.

Mueller, Sir F., Melbourne; large stem of *Macrozamia Moorei*; various seeds, including those of *Duboisia Hopwoodii* ("Pituri"), *Eucalypti*, &c. &c.

Oliver, J., New Zealand; seeds of trees and shrubs.

Schomburgk, Dr., Adelaide; Wardian case of *Eucalyptus*, *Boronia*, *Musa coccinea*, &c.; many packets of seeds.

SUPPLY OF SPECIMENS FOR SCIENCE AND ART DEPARTMENT, &c.

A supply of cut plants for the Art schools and of specimens for the examinations in botany of the Science and Art Department, have been regularly furnished. A large number of specimens of flowering plants, as well as other botanical materials, have been supplied for the various examinations of the University of London as well as for some of those of the Civil Service Commission.

COLONIAL BOTANIC GARDENS.

Brisbane.—Mr. Walter Hill having attained the age of sixty years, has been retired from the appointment of Director of the Botanic Gardens and Government Botanist. Mr. James Pink has been appointed to the position of head gardener of the Botanic Gardens.

Since 1874, Mr. F. M. Bailey, F.L.S., has been keeper of the Herbarium of the Queensland Museum. The upper floor is devoted to products of the vegetable king-

dom. To this building, I am informed, the library from the Botanic Gardens has also lately been removed. The formation of the herbarium appears to have been wholly the work of Mr. Bailey. It contains a fair collection of Queensland, American, and European specimens, arranged according to the Kew Genera Plantarum, and therefore readily comparable with the National Central Herbarium. The Flora of Queensland is one of peculiar interest to the scientific botanist, owing to the tendency which it shows to blend with that of Indo-Malaya. Mr. Bailey is occupied at present with the preparation of a synopsis of the Queensland Flora. I do not doubt that in the elaboration of this work he will meet with much that is of great interest. The son of the late Botanist to South Australia, Mr. Bailey has, in the course of a long residence in the southern hemisphere, acquired by travel and study an intimate acquaintance with the Floras of Australia and New Zealand, second, perhaps, only to that of the head of Australian botany—Sir Ferdinand Mueller, K.C.M.G. In response to an application from the Queensland Government, a large and varied collection of duplicate specimens of vegetable products has been forwarded to the museum. Mr. Bailey has informed me that this "will form a most attractive and instructive feature in our herbarium department." From time to time duplicate specimens of a suitable character will also be forwarded from the Kew herbarium, and a beginning has already been made.

Demerara.—I have received a copy of the report of the Government Botanist and Superintendent of the Botanic Gardens, for the half-year ended December 1880. Astonishing progress seems to have been made in creating a Botanic

Garden of great beauty in perhaps one of the most unpromising sites in which such an undertaking has ever been attempted. 7,768 individual plants representative of every type of the vegetable kingdom have been planted out, "and 912 which are not of a character to bear full exposure, either to sun or wind, have been established in the Propagating House." Governor Kortright has reported to the Secretary of State for the Colonies: "Considering the short time since the land was an undrained wilderness, I think great credit is due to the Directors and to Mr. Jenman for the progress that has been made in the Botanic Gardens, which are even now assuming a pleasing aspect, and which can already boast of a valuable collection of plants."

Mr. Jenman at the end of the year made a very important journey for the purpose of collecting. His destination was the high sandstone savannah, above the Kaieteur falls. His collections, which are at the moment undergoing examination at Kew, comprise numerous plants of entire novelty and of the highest scientific interest.

Dominica.—This island has no Botanic Garden. But as a reference to preceding Kew, reports will show the functions of such an institution were virtually fulfilled by the late Dr. Inrray, who was an assiduous correspondent of the Royal Gardens, and who spared no pains either in the interests of scientific botany or in the introduction of new vegetable products into the island which he had made his home. A reference to the loss which both Kew and Dominica have suffered by his death (August 22, 1880), is an omission in my last report which I deplore. He bequeathed his St. Arment Estate to Dr. Nicholls, who is animated with

the same enthusiasm as his friend. In several points in the pages of this report I have gladly availed myself of the careful information which his correspondence has placed at my disposal.

Jamaica.—Mr. Morris, the Director of Public Gardens and Plantations, continues with unremitting vigour to develop the resources of his department in promoting new cultures in the island. I have referred below to various points in which he has obligingly furnished me with information. The following extract from a letter dated October 24, 1881, will give some idea of the activity with which botanical enterprise is being pushed in Jamaica:—

“As the Atlas Steamship Company has consented to carry all our plants free from Kingston to the outports, and the railway will probably do the same, our distribution will greatly increase. Last year we distributed nearly 100,000 plants, and most were paid for. Independent of Cinchona sales, we cleared last year about 800*l.* for plants which were formerly given away. The change has been effected, fortunately, without any grumbling, and as our distributions are four times what they were, the plan evidently pays commercially.”

New Zealand.—The reports of the Colonial Botanic Garden, Wellington, are of the most formal description and are entirely destitute of any information of either scientific or general importance. I fear that the interest taken in the colony in the institution is far below what might be justly expected from the prosperity and energy of the residents. During 13 years the total expenditure seems to have been little over 5,000*l.*, and the Government vote in 1880-81 was reduced

from 300*l.* to 100*l.* Dr. Hector, the manager, reports that during the year 1880-81 “the work done in the gardens has been only conservative.” In 1879-80 the keeper reported “that he was unable to preserve order in the gardens, and that his duties as special constable greatly interfered with his ordinary work.” The gardens are described as “surrounded only by an open fence.” Wages have been kept below an average of 19*l.* a month on account of the precarious nature of the revenue.”

Looking at the interest and beauty of the New Zealand Flora, and the advantage which might accrue to the colony from the correspondence with kindred botanical institutions of a vigorously administered and adequately supported botanical garden, the condition of things disclosed by the reports, meagre as they are, is simply deplorable, and in melancholy contrast to the magnificence with which the Botanic Gardens of the neighbouring Australian colonies are sustained.

Trinidad.—I have received a copy of Mr. Prestoe's very important report on the Botanic Gardens, Trinidad, for 1880 (laid before Legislative Council, October 1, 1881). This, which is the first document of the kind submitted by the Government Botanist since his appointment in 1864, is replete with the most interesting and instructive information both as to the work of his department and as to the planting industries of the colony, more especially cocoa, to which I have alluded below (pp. 10, 11). I trust that, now the Colonial Government has broken the ice, Mr. Prestoe will regularly furnish his fellow-workers in botanical enterprise in other parts of the empire with successive reports, giving the valuable results of his experience in the detailed business of his department.

The following **botanical appointments** have been made by the Colonial Office on the recommendation of the Director :—

W. Elliott, in the employ of the Royal Gardens, to be Superintendent of the Parade Garden, Kingston, Jamaica.

W. Harris, in the employ of the Royal Gardens, to be Superintendent of the King's House Gardens and Grounds, Jamaica.

W. Scott, in the employ of the Royal Gardens, to be Assistant to the Director of Forests and Botanical Gardens, Mauritius, *vice* N. Cantley, appointed Superintendent, Botanical Gardens, Singapore.

The following appointment was also made by the India Office on the recommendation of the Director :—

L. J. K. Brace. New Providence Asylum, Bahamas, to be Curator of the Herbarium, Royal Botanical Gardens, Calcutta. Mr. Brace had been previously employed (*see* Kew Report, 1880, p. 30) in the investigation of the flora of the islands on behalf of the Bahamas Government.

SELECT NOTES FROM OFFICIAL CORRESPONDENCE.

Boxwood, Indian.—The possible supply of this important commodity from India was adverted to in the Kew Report for 1877, p. 27. Messrs. Joseph Gardner and Sons, the well-known timber merchants, wrote to Dr. Brandis, the Inspector-General of Forests in India, April 29, 1881, on the subject: "We bought the parcel (about 5 tons), landed ex Strathmore in London at the high price of 30*l.* per ton. At these high prices the consumption will be very limited indeed. Can you kindly inform us what the prospects are of securing any large quantities of this wood, say 5,000 to 10,000 tons, at about 10*l.* per ton, in Liverpool or London. We are drawing our present supplies

"from Russia and Persia principally; but there are so many fiscal restrictions, and the wood is also inferior to your Indian shipments, that we should prefer drawing all our supplies from India. At anything like 30*l.* per ton, only very small quantities can be used; at 10*l.*, however, it would probably be used very extensively for various purposes for which cheaper woods than boxwood are now used."

To this communication Dr. Brandis replied, July 6:—"The boxwood resources of the country are very limited There is no chance of such large supplies as from 5,000 to 10,000 tons being available from India."

It is evident, therefore, that we cannot look to India to remedy the increasing dearth of boxwood. It would be obviously much to the advantage of any of our colonies that could send into the timber trade in quantity any wood which would be acceptable as a boxwood substitute. 10*l.* a ton is calculated by the Indian Forester to equal about four shillings the cubic foot. A further consideration is that the expense of conveying boxwood from the forests in India is very great, and unless a high price were reached its exportation would be impossible. The logs composing the parcel already referred to had to be carried partly on men's backs and partly by carts from the forests to Saharunpur, and thence by rail to Bombay. A price of 30*l.* a ton gave a profit of about 73 per cent.; 17*l.* 10*s.* was consumed in expenses, and any price which did not cover this would of course involve loss.

Cinchona.—*Hybrid variety.*—A good deal of attention has been attracted in India and Ceylon to a *Cinchona*, which there is little doubt is a hybrid between *C. officinalis* and *C. succirubra*. I shall

have occasion to deal more in detail with it in a succeeding report. Dr. King reports from Darjeeling, May 28, 1881:—"Mr. Wood's analysis showed that this variety yields a bark rich in quinine, and steady efforts have been made to increase it. During the year 85,000 plants of this hybrid were put out at Mungpoo and 5,000 at Sittong, bringing up the full number now on the plantation to close on two hundred thousand." Dr. King further writes to me, October 8:—"Next to *Ledgeriana* our most promising bark is what we call our 'hybrid.' The first plants of this hybrid appeared amongst some seedlings raised from Ceylon grown seed sent to us by Dr. Thwaites. The plants look as if they were a hybrid between *succirubra* and *officinalis*. In habit of growth it resembles the former, but the leaves differ, and at a distance a patch of it looks more like *officinalis* than *succirubra*, having the dull heavy green colour of the former. Chemically the bark resembles that of *officinalis*. With us this 'hybrid' offers to do splendidly at an elevation where *succirubra* won't grow well. *officinalis* never has thriven here. I believe our plant to be a hybrid, because it never comes true to seed. Seedlings come out nearly pure *officinalis*."

Jamaica.—There is every reason to hope that *Cinchona* planting in Jamaica, which has hitherto been an almost exclusively government enterprise, will, now that it has been shown to admit of commercial success, receive a large development at the hands of private individuals. "The Government being desirous of encouraging the cultivation of *Cinchona*, is prepared to grant a limited extent of land at a nominal price, to any person who may

"be prepared to embark in such an undertaking, on terms that are likely to insure that the lands shall be used for the purpose intended." The 'Kingston Gleaner,' commenting on this, August 27, 1881, remarks:—"We hope to witness an early extension of *Cinchona* cultivation by men who have capital, and can await the first yield in the fourth or fifth year. It is possible that a market for the Jamaica bark will be found some day in the United States, which consumes vast quantities of quinine, but for the present England takes all that can be shipped and at remunerative prices. The time cannot be far off when the masses of Jamaica will be provided by Government with a cheap effective febrifuge, now so greatly needed."

Ledgeriana.—In an article in the Journal of Botany for 1881 (pp. 321-325), Dr. Trimen has defined this form of *Cinchona* *Calisaya* as a distinct species. Its history has been already given in the Kew Report for 1880 (pp. 32-33). I am indebted to the courtesy of Dr. Trimen for the opportunity of reproducing here the figure he has given of a flowering specimen of Ceylon growth.

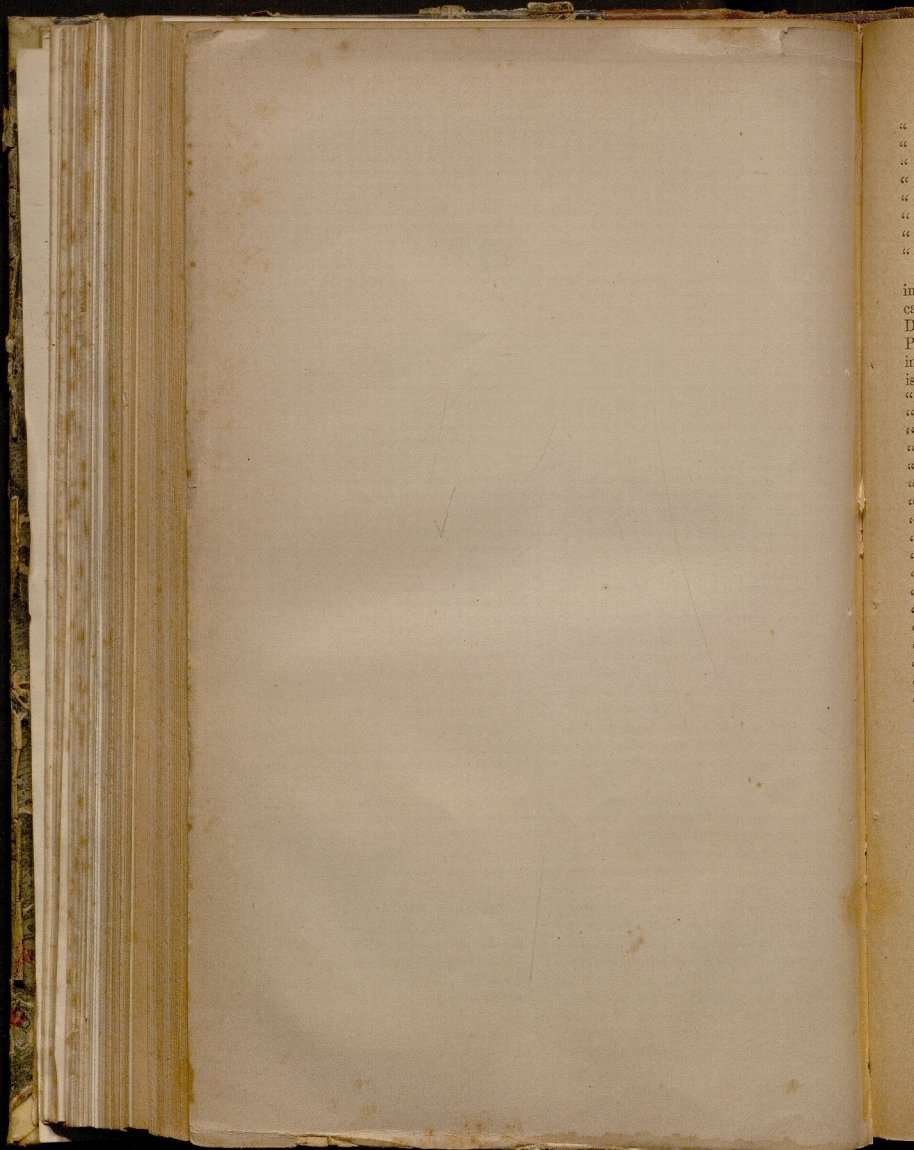
Dr. King reports from Darjeeling, May 28, 1881:—"My recent visit to the Dutch plantations in Java confirmed the belief that our best trees of *Calisaya* are veritable *Ledgerianas*. Every effort has therefore been made to increase our stock of *Ledgeriana*, and during the year 99,415 plants of that variety of *Calisaya* were added to the permanent plantation. The difficulties of propagating this sort make progress rather slow, and the total number of *Calisaya* trees on the plantation still reaches only 412,000.



W. de Alwis del.

W. de Alwis sculp.

Cinchona Ledgeriana Moens



" There was, however, at the end of the year, a considerable nursery stock of young plants (namely 380,000), and during the year we have now entered upon, the *Ledgeriana* plantation (saving blight and bad weather) should be considerably increased."

In Jamaica the cultivation of this important kind is being energetically pushed by Mr. Morris, the Director of Public Gardens and Plantations. I extract the following from a circular which has been issued from his department:—*Cinchona Ledgeriana*, although a delicate plant at first, is likely to prove a free robust grower in Jamaica, provided it is planted in rich free soil at an elevation between 2,500 ft. and 5,000 ft., and well sheltered from prevailing winds. The plants now distributed free of cost by the Government of Jamaica, are intended to form nuclei for the establishment of this valuable *Cinchona* on private plantations. They should be planted if possible near residences, or in easily accessible places, kept away from all other *Cinchonas* to prevent hybridization, and if desired to produce seed at an early period, they should receive throughout special and careful treatment."

Sikkim febrifuge.—The febrifuge manufactured by the Bengal Government at Darjeeling, from the bark of *Cinchona succirubra*, grown on its plantations there, appears to be making steady progress in public esteem in India. The financial success of the operations superintended by Dr. King, must exceed the most sanguine hopes of the statesmen who originally projected and carried out the introduction of *Cinchonas* into India.

I quote the following from Dr. King's report, May 28, 1881:—"During the year 5,500 pounds of

febrifuge were used in Government hospitals and dispensaries in substitution of quinine. Quinine during the whole year ruled at a high rate, and in a trustworthy London trade circular, the average wholesale price for the year is given at 12 shillings per ounce. Calculated at a rate of exchange equal to 1s. 8½d. per rupee (and including nothing for the cost of transit to India), this is equal to Rs. 112 per pound. But even taking Rs. 100 as the price which Government would have had to pay for quinine, the cost of 5,500 pounds of it would have been Rs. 5,50,000, whereas an equal quantity of febrifuge was used at a nominal cost of Rs. 90,880. There was thus effected a clear saving of more than four and a half lakhs of rupees, a sum pretty nearly equal to half the total expenditure on the plantations (including compound interest at 4 per cent.) since their commencement. The savings effected by similar substitutions of febrifuge for quinine in former years amounted to eleven and three quarter lakhs, the total saving now therefore stands at sixteen and a quarter lakhs of rupees. As the object of Government is not to make money by its plantation, but to provide the masses of the people with a good remedy for fever, cheap enough to be within reach even of the poorest, it may soon become a question whether the selling price of the febrifuge might not be reduced."

Cocoa.—The cultivation of the Cocoa or Chocolate tree (*Theobroma Cacao*) has been eagerly adopted by planters in different tropical colonies. I have given an account (pp. 10, 11) of the result of the steps which have been taken to introduce the best strains from Trinidad into our eastern possessions. I

quote the following account from the transactions of the Massachusetts Horticultural Society (1881, pp. 32-33) of the mode of cultivation in central America as likely to be interesting to our colonial correspondents:—

“The Cacao trees grow about as large as a moderate sized plum-tree, and are exceedingly beautiful. They are raised in nurseries, and afterwards planted in orchards, and by the side of each a banana is set to shade the young cacao tree until it is five or six feet high. At intervals in the orchards is planted a tree called ‘madre de cacao,’ a species of *Erythrina* or Coral tree. It sheds its leaves towards the end of the dry season, and during the wet season flames out into crimson flowers, resembling those of the gladiolus, and in such numbers as to completely cover the tree. It thus affords abundant shade during the whole year; and to give this shade to the cacao tree is the object of planting it. On the plantation of ‘the Lacayo family,’ ‘Las Malaccas,’ the mother trees are old, and more than 70 feet high, and in May, the first rainy month, are all in gorgeous blossom. When these trees are seen from an elevated position, mixed with the green of the banana, a cacao orchard affords a sight not merely of beauty but of wealth. The flowers of the cacao tree are borne in bunches, and are of a delicate pinkish white. The trees are very infertile, producing only from twenty-five to thirty ounces of seed in a year.”

Jamaica.—The cultivation of Cocoa is being actively pushed by Mr. Morris, Director of Public Gardens and Plantations. Mr. Bancroft Espeut writes Nov. 3, 1881:—

“The manihot (Ceara rubber) has done splendidly, and one is near

“20 feet high. You are no doubt aware that in planting cacao it is requisite to plant some shade tree. In Trinidad, &c. the *Erythrina umbrosa* is chiefly used. We have only *E. Corallodendron* here, and I had intended using it and the *Pithecolobium* in my new cacao plantations. But the *Manihot* seems to me far preferable as a tree, while it will be also a source of profit.”

Madras.—Mr. Jamieson reports:—

“The cocoa trees continue to thrive, and yield remarkably well; orders have already been registered for upwards of 1,200 plants. I anticipate no difficulty in being able to dispose of the entire stock of plants at good prices before the end of the planting season.”

Trinidad.—Mr. Prestoe’s valuable report on the Botanic Gardens for 1880 contains an elaborate account of the method of curing adopted in the colony, with suggestions for its improvement.

Surinam.—Mr. Hensen states that “In Surinam the cocoa with yellow pods, called ‘Creole coca,’ is generally planted. Another sort with red pods, named ‘Caracas cocoa,’ is also at present planted by everyone who can get the seeds. Where both are grown in the same field the red degenerates before the Creole. Planters there assert that the Caracas grows more quickly and strongly, and that it bears more and better than the Creole. The beans are lighter than those of the Creole variety, so that on an average the kernels of 10 to 12 Creole fruits will yield one half kilogram (1.1 lbs.) of cocoa, while for the same quantity 14 to 16 fruits of Caracas are wanted. The Caracas has more spongy beans than the Creole, but the flavour of the former is superior.”

Coffee-disease.—*Ceylon.*—Mr. Marshall Ward, who was appointed in 1879 for two years to investigate the coffee disease of the island (Kew Reports, 1879, p. 30; 1880, pp. 34, 35) has made his third and final report the Ceylon Government. He has also given an account of the purely scientific aspects of his researches upon the fungus (*Hemileia vastatrix*), which produces the disease, in a paper published in the "Quarterly Journal of Microscopical Science" for January 1882 (pp. 1-11, with 2 plates). I quote from Mr. Marshall Ward's final report the following summary of his conclusions:—

1. "*Hemileia vastatrix* is a parasitic fungus, the spores of which are capable of rapid germination on the moist surface of a coffee leaf. The short tubes thus produced enter the breathing pores of the leaf, and in less than a week, in favourable circumstances, begin to form a mycelium, which at the end of another week or so have done sufficient damage to the leaf to produce yellow spots. During the third week the spores are usually produced, each to act as before, if sown.

2. A leaf of the coffee attacked at numerous points by such germinating spores rapidly succumbs to the ravages of the mycelium, and falls long before it would normally have done so. Not only by directly robbing the tree of food prepared by the labours of the leaf, but, further, by occupying space and shortening the period of usefulness of the leaf, is the tree injured.

3. The loss of food material and functional disturbance brought about by these continual and periodical ravages have for effect a diminished power to mature crop on the part of the coffee. And flower-buds, flowers, and berries fall

because the nutritive relations between the shoots, leaves, and flowers have become overthrown. More crop is borne as a rule, however, where the trees contain more food material to support it.

4. The spores of *Hemileia* are carried by wind. Whether a spore travels a long distance in one journey, or whether it is swept along in successive leaps, it may be carried from one estate or district to another. The shaking of the trees also disseminates spores, and they are driven from fallen leaves to the trees. These spores, scattered on the foliage, become washed down to the lower surface of the leaves and germinate as before, provided the atmosphere be sufficiently moist.

5. No special predisposition on the part of the coffee is required for its infection, and no other conditions are necessary to the spore than moisture, and the presence of air, &c., as with any germinating seed.

6. The spores are in such countless numbers, germinate so rapidly, and some of them so easily escape the action of even the most efficacious remedies, that no good and lasting results can be obtained from external applications unless the sources of re-infection be removed. No attempts to combat the disease by passing ingredients into the tree have shown any trace of success; the mycelium cannot be attacked after it has entered the leaf.

7. Diseased leaves should be collected and destroyed, and every means possible be employed to prevent the ingress of winds. Cultivation should be directed to these ends, and the pruning and manuring, as far as possible, arranged so that large masses of young foliage are as seldom as possible exposed as a surface of

“ food material for the spores at those times when they are most blown about, as at the bursts of the monsoons. In cases where the disease is threatening to denude the trees of leaves at the critical period when crop is ripening up, there can be little question of the use of lime, unless weightier considerations based on the results of experience with that particular soil, forbid it.

“ 8. Manure can in no sense be properly looked upon as a cure for the disease. In so far as it enables a tree to clothe itself with dense foliage, the tree may be able to afford the sacrifice of a number of its leaves to the fungus ; but the well fed mycelium will in such cases produce more spores in proportion, and these may be the more readily distributed, and germinate on other leaves, and so the stock of fungus be actually increased. Nevertheless, careful manuring is necessary for the production of crop without damage to the tree.

“ 9. The burning of fallen leaves is almost universally condemned by planters as too dangerous. In cases where this cannot be done, it is better to bury the leaves and prunings than to leave them tossing about. In doing this, the layers of leaves and prunings (which may be mixed with weeds) should be carefully covered with caustic lime and earth and not disturbed for several months. The suggestion that the leaves might be placed under pigs and cattle affords a less safe alternative ; but even this plan is much better than leaving them to be blown about the estates. The sooner the leaves are gathered after falling, the more spores are destroyed with them.

“ 10. The origin of leaf disease cannot be traced with certainty,

“ but the evidence is so strong in favour of its having arisen from an invasion of spores out of the jungle, that this view may be considered highly probable. Once on the coffee its spread would be very rapid, where such large unbroken areas extend. No trace of valid evidence exists for the views that the disease has been ‘induced by artificial manuring’ or ‘caused by alterations in the ‘sap of the tree’; it is, beyond all doubt, the results of the action of a fungus derived from without, the spores of which were either imported into Ceylon (an improbable event) or came from the native jungles.”

The most practical outcome of Mr. Marshall Ward's investigation would be apparently to suggest the importance of dividing large areas of land in coffee plantations by means of screens or belts of trees which would not so much break the force of the wind as filter out from it the spores with which it was laden.

The following passage from the report may be quoted as bearing more particularly on this point:—
“ There can be no question that coffee under artificial shade is spared a large infliction of wind-blown spores, and although such sheltered trees often tend to form foliage in excess of crop, unless the season be hot and dry, it becomes an important question how far the visitations of *Hemileia* could be checked by belts of trees or other shelter. It is matter for regret that such immense, unbroken areas of coffee exist without break of any kind, and one can trace the swaying backwards and forwards of the spore-laden winds in consequence. A subject of some importance in this connection is the planting of other trees among the coffee; this is of course done to some

" extent in the case of Ceara-rubber
 " and Cinchonas, and although the
 " success of the experiment is not
 " established in these cases, I would
 " call attention to its general im-
 " portance from the above point of
 " view. The value of a broad
 " acreage of patana or chena land
 " to the windward side of an estate
 " is another illustration of the im-
 " portance of any break in the
 " onward career of wind-blown
 " spores. Many planters have re-
 " cognized that they do not get
 " leaf disease from the low-country
 " patanas to windward, a fact worthy
 " of remark in this connection."

I understand that in Southern India where the Government policy precludes coffee estates being continuous, the injury which might be done by the *Hemileia* is much mitigated by the effect of the intervening woodland.

Mauritius.—I regret to record that Mr. Horne, Director of the Botanic Garden, Mauritius, informs me in a letter, dated October 3:—
 " We have got the *Hemileia vasta-*
trix on nearly all the coffee trees
 " in the island."

Fibres.—*Jute cultivation in America*.—Mr. Victor Drummond in a commercial report to the Foreign Office, April 7, 1881, draws attention to "the great progress that has been made in jute cultivation in the State of Louisiana, as it is possible that, owing to the attention given to this fibre, . . . the interests of our Dundee manu- facturers and Indian cultivators may be curtailed before long." . . .
 "It is now about 10 years since the American Department of Agriculture became at all interested in the subject of growing Indian jute upon American soil. Seed was distributed in 1870, and experiments conducted in the

" Southern States. The result has
 " shown that the plant can be pro-
 " fitably grown 'wherever in the
 " Southern States there is a hot,
 " damp climate, and a moist soil
 " of sandy clay or alluvial mould.'
 " The yield was in some cases at
 " the rate of 3,500 pounds to the
 " acre, some of the stalks reaching
 " to the height of 15 feet. It is
 " stated that jute butts can be pro-
 " duced in the United States at
 " 3 cents. per pound, and the fibre
 " for 8 cents. Imported jute costs
 " from (for butts) 3 cents to 5 cents
 " per pound, and the fibre 8 cents to
 " 12½ cents per pound."

The subject is one of such im- mense importance to Indian trade that I do not hesitate to quote, as throwing some further light on the subject, the following extract from an American paper, printed in the Paper Makers' Monthly Journal for December 15, 1881:—"John Sloan, a New York jute manufacturer, says there is no difficulty in raising as good jute in Louisiana as in India. Some six or seven years ago I entered into correspondence with the agent of the Southern Jute Planting Association, who sent me two bales of the first jute grown there. I found that, while the jute had been just as good as that from India, it had been spoiled in manipulation after being cut. Jute grows six or eight feet high before it is ready to cut. Then, after cutting, it is soaked, passed between iron rollers to soften and crush it, and then carded or combed out into thread. All this requires a certain amount of manual labour, and, as it happens that the sugar-cane crop ripens just when the jute is ready to cut, the jute is allowed to stand and harden, instead of being treated at once. At least this was the case with the two bales sent to us, and since then

“ we have never seen any more of the American product. The fact is that some one must do for the jute plant what Whitney did for the cotton plant—invent a machine which shall replace manual labour. In the jute districts of India the labourers get 12 cents a day for harder work than we could get out of men here for 10 times that sum. Unless we can find some means of manipulating jute by machinery, I am afraid that India will undersell us. Inventors are at work at the problem, and its solution is merely a matter of time. That it is well worth trying to raise our own jute is shown by the statistics of consumption here and in England. From January 1, 1880, to January 1, 1881, this country imported 56,606 bales of jute, worth from \$18 to \$20 a bale, or more than \$1,000,000. In England the yearly consumption amounts to more than 1,000,000 bales. One reason for this vast difference is that our absurd tariff gives Dundee, where all jute is manufactured, an overwhelming advantage over us. The duty on jute amounts to 15*l.* a ton, or from 25 to 35 per cent. of its value, while jute manufactured into yarn pays only a duty of 25 per cent. ad valorem. The cost of manufacturing jute into yarn, in which shape it is sold to carpet and bagging manufacturers, is not large; and the result is that we who try to import our own jute have to pay as large a duty as the importer pays on the manufactured article; besides which, labour is cheaper in Dundee than here. How this policy has retarded the growth of the jute industry in this country may be seen at a glance by referring to the jute importations of the last 10 years, which show that 10

“ years ago we were importing more jute than now.—”

Muddar cotton.—I extract the following from the “Memorandum on materials in India suitable for the manufacture of paper,” by B. L. Liotard. The muddar plant (*Calotropis gigantea*) is referred to below as a source of a substance resembling gutta percha (p. 45):—

“ Some of the floss or muddar cotton (as we might call it) was sent from India to Messrs. Thresher and Glenny, who had for a long time been devoting attention to the subject. These gentlemen, after experiencing some difficulty, owing to the want of machinery suited to it (cotton machinery literally blew it away), were at length able to report their ability to turn it to account. They produced with it some articles of clothing and some other articles, having used muddar floss and cotton in equal parts, and they also made a flannel from muddar in one part, and wool in two parts. Encouraged by these results Messrs. Thresher and Glenny expressed their readiness to take quantities of the floss, if obtainable in England, in a good clean condition at 35*l.* a ton (3¼*d.* a lb.). Dr. Walker, of the Agra Jail, reported that it might be collected at about 1*l.* 10*s.* per maund, that is about 1¾*d.* per lb. The results of these trials and enquiries do not appear in any of the sources of information to which I have access.

“ In India the muddar cotton is made use of to a certain extent but only in a few places. Unlike other fibres it does not require any preparation; it has only to be collected free of dirt, to be separated from the seed by aid of the usual bow, and then to be packed. Before weaving with muddar thread it is necessary to

" steep the thread for four or five days in water; it is then steeped in flour mixed with water, with the addition of a little methi seed (*Trigonella*) and the gum of the babool tree; the last two substances in the proportion of one and a half rupee weight to each seer of thread. But this steeping is also done by the native weavers with the common English thread before weaving, so that the only difference is the addition of the methi and babool gum, that cost about a pice or two." (p. 41.)

Being anxious to obtain for the Museum of the Royal Gardens articles manufactured from muddar cotton I applied to Messrs. Thresher and Glenný. They replied to me, January 21, 1881, as follows:—

" We made a number of experiments with muddar floss, but owing to the shortness of the fibre they were all unsuccessful. We then tried to mix it with American cotton, but in consequence of the failing we have named and its extreme lightness the muddar floss was blown away in the operation, and we were forced to the conclusion that for our purpose it was practically useless."

Food products.—*Coquito*.—*Jubaea spectabilis*, the Coquito palm of Chile, is very abundant in that country between the latitudes of 33° and 35°. It is therefore well adapted for cultivation in warm temperate climates in the old world. A sweet syrup called 'Miel de Palma' or palm honey, is made by boiling the sap to the consistency of treacle, and forms an article of trade. The nuts were also formerly made into a sweetmeat. I am indebted to J. de V. Drummond-Hay, Her Majesty's Consul at Valparaiso, for specimens for the Kew Museum of the manufactured products. He writes to me, July 21,

1881:—"I send you a small box containing a small parcel of the seed of the Chilian Palm Tree, also a tin of the honey made at the celebrated estate called Cocalaw in the south of Chile, where the decoction is supposed to be manufactured better than in other places, and another tin containing the same honey but mixed with the nuts. Formerly the nuts were made into dry sweetmeat; I have not been able to get any, and am told it is no longer made."

The addition of the nuts in the honey is supposed to be an improvement to the honey. All the honey produced finds ready consumers, but the quantity cannot be much, as an ordinary tree yields only 25 lbs. of sap, which when boiled down in the shape taken as honey becomes considerably reduced. I am informed a tree has to get to the respectable age of 100 years before it bears the nuts or 'Coquito.'

Creole Spinach.—Dr. Nicholls, of Dominica, communicates to me the following:—"I have sent specimens of two of the common weeds of the island for the reason that they are of considerable economic value. One, the scientific name of which I do not know, is called 'spinach,' or by the Creoles 'épinards.' When boiled, and eaten with vinegar, it is really a most excellent vegetable, and scarcely distinguishable from its better known namesake. The plant is a valuable one to all Dominica housekeepers, for when green vegetables are scarce, an inexhaustible supply of spinach is to be found at all seasons of the year in the gardens, along the roadsides, and on waste lands. I believe the plant will thrive in all tropical and sub-tropical climates, and in places where green vegetables are unobtainable this hardy

"weed may be of inestimable value both as an anti-scorbutic and as a palatable food plant. The 'spinach' is simply boiled, as cabbages, and served up plain; the stems and leaves are the parts used. I have lately been reading Mr. Gill's interesting book on Ascension, and considering the dearth of vegetables in the island, I would suggest that some of the seeds (I will send you a supply by next mail) be forwarded to the naval officer in charge, I find there are two kinds of 'épinards' one (*Amarantus tristis*) 'É. rouge,' which is the vegetable, and another 'É. blanc'; the latter (*Amarantus spinosus*) has prickles, and is not eaten. I send dried specimens by this mail."

Laver Bread.—I am indebted to Miss Caroline M. Maw for specimens for the Kew Museum of this curious product, the preparation of which appears to be a considerable local industry in some maritime parts of south-west England. Miss Maw has obligingly favoured me with the following account of the method of preparation:—

"Laver bread is made of a seaweed (*Porphyra laciniata*) which is found growing on the low rocks. The women gather it in large baskets and carefully pick it over, wash it, and take out any other sort of seaweed that gets in with it. It is then thoroughly washed again to remove all the sand, after which it is boiled for about two hours, then chopped up with a knife, rolled into lumps and sprinkled with oatmeal to keep it together and make it look clean.

"It is only made along the Gower and Devonshire coasts, where a great many women earn their living by making it. After it is cooked it will keep for about three or four days in summer and for

"about a week in winter. Most of it is taken to the Swansea market, for which a great deal is sent from Devonshire, where the seaweed grows more abundantly than about Gower.

"It is sold at 3d., 4d., and 5d. per lb. The poor people are very fond of it, and eat it either fried with bacon grease, or else cooked like a vegetable with meat. It has not very much flavour, and looks and tastes rather like 'spinach.'

Negro Coffee.—In the Kew Report for 1877 (pp. 39-40) I gave some particulars of the use of the seeds of *Cassia occidentalis* in Tropical Africa as a coffee substitute. These seeds occasionally find their way into the European market. The following extract from a letter from Dr. Nicholls of Dominica, dated September 27, 1881, shows that their use is well known amongst the negro inhabitants of that island:—

"*Cassia occidentalis* is, I find, an excellent coffee substitute, it is called in Dominica by the following names 'Herbe puante,' 'café marron,' and 'wild coffee.' I have often heard of the negroes using the seeds of a native plant as coffee, but it is only lately that I have enquired into the subject, with results that will I believe be of interest to you.

"I collected some seeds and directed my cook to roast and grind them, so that I might taste the 'coffee.' Other matters engaging my attention I forgot the circumstance until several days afterwards, when one evening my wife enquired how I liked my after-dinner cup of coffee. I turned to her enquiringly, when she laughingly said 'that is your wild coffee.' I was indeed surprised, for the coffee was indistinguishable from that made of

"the best Arabian beans, and we
"in Dominica are celebrated for
"our good coffee. Afterwards some
"of the seeds roasted and ground
"were brought to me, and the aroma
"was equal to that of the coffee
"ordinarily used in the island.

"I intend to send you a good
"quantity of the 'café marron' in
"its stages of preparation, in order
"that you may have an opportunity
"of undergoing my experience, and
"afterwards, you will, I think, be
"willing to raise *Cassia occidentalis*
"above the rank of a weed. I may
"inform you that the plant itself is
"used by the native 'doctors'
"medicinally in the form of a de-
"coction, and it has the reputation
"of being a good diaphoretic. I
"will enquire into the matter, ex-
"periment physiologically on my-
"self, and report the result to you.
"The weed is very common, indeed
"troublesome to the sugar planters,
"so if it turns out to be valuable
"it can be obtained in large
"quantities."

Rice Corn.—Mr. Victor Drum-
mond, Her Majesty's Secretary of
Legation at Washington, drew atten-
tion in his report for 1880 to a
species of *Sorghum*, which, under the
name of *Sorghum cernuum* or Rice
corn, had attracted a good deal of
attention in Western Kansas and
New Mexico.

Mr. Drummond states that "this
"corn will grow on the arid plains
"of the west; it is proof against
"drought, worms, grasshoppers, and
"other evils, and can be cultivated
"with less care and expense than
"wheat, corn, or oats. The stalk
"makes as good fodder as corn
"does, and a few acres will furnish
"a family with fuel for the winter,
"an all-important consideration in
"a treeless country. It stands the
"rain equally well with the drought.
"The seed is supposed to have been
"brought to the United States from

"Southern Russia by the Memnonite
"emigrants."

Paragraphs to the same effect
having gone the round of the
American newspapers and found
their way to this country, a good
deal of interest, official and private,
was excited in the matter. Samples
of the seed sent to the Royal Gardens
by the Foreign Office and the Board
of Trade, were distributed to Bris-
bane, Grahamstown, and the Trans-
vaal. Arrangements were also made
for the supply of seed which had
been asked for by Ceylon and
India.

Sir Edward Thornton, Her Ma-
jesty's Minister at Washington, sub-
sequently transmitted further in-
formation on the subject, including
a report by the United States Com-
missioner of Agriculture, who rather
cast doubt on the supposed Russian
origin of Rice corn. The plant
known to botanists under the name
of *Sorghum cernuum* is undoubtedly
a native of India. It is however
worth noticing that in the "Bulletin
"de la Société d'acclimatation de
"Paris" (July 1880, p. 325), men-
tion is made of 'Dschugara' a grain
cultivated in Russia "originaire de
"l'Asie Centrale, c'est à dire du
"Turkestan, où elle est cultivée en
"grand." On enquiry, Dr. Regel
the Director of the Imperial Botanic
Garden, St. Petersburg, informed
me that this was also *Sorghum*
cernuum. There may after all, there-
fore, be something in the supposed
Russian origin of the Rice corn.

I am indebted to Mr. Tidmarsh,
Superintendent of the Botanic Gar-
den, Grahamstown, South Africa,
for the following report, dated
January 20, 1881, on the seed sent
to him:—

"I am now growing the so-called
"Rice corn' sent to me. The
"grain is not quite identical with
"that grown about here and known
"as 'Kafir corn,' but is very near

" it. As to the plant thriving in
 " the absence of moisture, that is
 " not so by any means. Two or
 " three rows of it growing where
 " water could be given it in reason-
 " able quantity are four feet in
 " height; but in a piece of newly
 " trenched land on the slope some
 " of the plants are not four inches
 " above ground, except where the
 " rows run down to a bank, and
 " thus get most of the water from
 " rain falling. These plants are
 " about 15 inches high, and this is
 " on good soil, dry, about 14 inches
 " in depth, and a good season in
 " addition."

Vegetable substitute for rennet in India.—Mr. Stormont, Superintendent of the Government Farm, Khandesh, reported, May 10, 1880 :
 "—Cheese-making is a branch of
 " agricultural industry, altogether
 " unknown in this district, and but
 " imperfectly understood in any part
 " of India; yet there seems no
 " reason why it should not be suc-
 " cessfully practised."

Commissioner E. P. Robertson, minuted upon this, June 10. "Cheese
 " to be saleable amongst the natives
 " of this country should be made
 " with some vegetable rennet. Na-
 " tives would not touch cheese made
 " with ordinary rennet, and I am
 " convinced that good cheese cannot
 " be made without the use of some
 " rennet. If a good vegetable
 " rennet could be procured the curd
 " cheeses could be made; they
 " would be cheap, and ryots would
 " soon find a ready sale for them."

These facts having attracted my attention I consulted Mr. A. H. Church, formerly Professor of Chemistry in the Royal Agricultural College, Cirencester, but who has taken up his residence at Kew, and is now Professor of Chemistry to the Royal Academy. This gentleman very kindly made some

experiments on curdling milk, with calcium chloride and with vegetable acids. He arrived at the conclusion, however, that though in the laboratory good results could be obtained they depended too closely on careful attention to the conditions of the process to afford a workable method for every day use in India. Meanwhile, I had turned my attention to some suitable vegetable "rennet." Surgeon-Major Aitchison, while engaged at Kew, in working up his Afghan collections, under instructions from the Government of India, suggested a well-known North-West Indian plant (*Puneceria coagulans*), as possessing the desired qualities.

The plant in question is one of the best-known plants in Scinde, Beluchistan, and Afghanistan. "It bears the name of Puneer-band (cheese-maker), from its being used by the Beloochies and Afghans in making cheese (puneer) as a substitute for rennet."

I communicated this information to the India Office. As will be seen from the following extract from Mr. Stormont's report for 1881: the suggestion was immediately acted upon with very gratifying success.

"During the year a good deal of attention has been devoted to dairy experiments, especially the making of cheese after the practice of Italy and Switzerland. The Commissioner, C. D., pointed out that, before cheese-making can ever become an industry of the ryots, some vegetable substance must necessarily be found to take the place of the animal rennet used in European countries.

"In connection with this difficulty, Surgeon-Major Aitchison brought to the notice of the authorities at Kew that the fruit of *Puneceria coagulans*, a shrub common in Afghanistan and

"Northern India, possesses the property of coagulating milk.

"A quantity of the dried capsules of this plant was accordingly obtained, and part of it tried here, and found to be most suitable for the purpose. Being a member of the poisonous night-shade family, its safety was in the first place carefully and gradually tested. It has been ascertained that an ounce of the pounded capsules in a quart of water is a very suitable strength for use; a table-spoonful of this decoction coagulates a gallon of warm milk in about half an hour. Seeds of the plant sown have germinated freely, and their further progress will be specially reported upon."

The anxiety as to the botanical position of *Punceria* amongst the *Solanaceæ* has, I think, no solid foundation. The genus *Punceria* is now reduced by botanists to *Withania*. This is a member of the tribe *Solanææ*, which appears to be generally free from the poisonous principles so characteristic of *Atropeæ* and *Hyoscyamææ*. It abounds, in fact, in plants producing fruits which daily experience shows to be innocuous, such as the Tomato, Aubergine, Capsicum, *Cyphomandra*, and Cape Gooseberry.

I think I am justified in remarking that an instance of this kind brings into prominence the utility of submitting such a botanical problem to a central institution where all available information can be brought to bear upon it.

West Indian Oranges.—It can hardly be doubted that one of the most important industries of the West Indian islands in the future will be the fruit trade. With regard to the export of oranges from Jamaica, Mr. Morris, in his report (issued Feb. 24, 1881), make the following judicious remarks:—"To maintain and improve this trade,

"no doubt much might be done, The due selection of seed trees; their more careful management; the thinning of the oranges when too crowded, in order to encourage the development of large and handsome fruits; greater care in packing, are all questions which would well repay attention and promote an industry which has already assumed considerable proportions."

With regard to packing, there is evident room for improvement. In Mr. Drummond's Commercial report to the Foreign Office, dated March 19, 1881, he quotes figures, supplied by Mr. J. H. Bostwick, Inspector of Customs, showing that of 7,450,100 oranges imported into New York during 1879 from Jamaica 3,352,545 perished on the voyage. This represents an enormous loss. I may take the opportunity of quoting the following remarks made by Mr. Bostwick, regarding oranges from Mediterranean countries. The matter deserves the careful attention of all who grow the trees for fruit.

"The trade in Mediterranean fruit during the past year has been disastrous to the parties engaged in it, especially to the producers. The price of box fruit was, as a rule, very low, particularly in the case of oranges imported from Catania and Palermo. These were seriously affected by a parasite, which greatly impaired their value. A large portion of the fruit arrived in bad order. The writer, who has had large experience in the successful cultivation and management of all varieties of fruit trees, suggests to the producers of oranges and lemons a very simple remedy to insure speedy extermination of this destructive insect. This remedy consists in thoroughly scouring the bodies and large

“limbs of the trees with common
“hard soap and sharp sand. One
“or two applications will entirely
“eradicate the parasites, and render
“the bark of the trees perfectly
“smooth and healthy. Had this
“simple process been applied to
“the orange trees of Matanzas,
“West Indies, many years ago, they
“would not have been destroyed by
“this dreadful pest. The writer
“would simply add that he has suc-
“cessfully destroyed untold millions
“of parasites by the application of
“the remedy above suggested.”

Gutta percha.—The natural sources of supply of this important substance and the possibility of their exhaustion were referred to in the Kew Reports for 1876 (p. 23) and 1877 (pp. 30, 31). In 1878, Dr. Dennys Assistant Curator of the Raffles Museum, Singapore, made an important report to the Government of the Straits Settlements on the subject. But this document, though an exceedingly careful *résumé* of the present state of our knowledge, did little more than formally record its defectiveness, as regards many of the subsidiary resources of supply. It brought, however, into prominence the rapidity with which the Gutta trees are disappearing in the Straits Settlements. Commerce will for a time have its wants supplied by collection made farther a-field. But the time cannot be far distant when the natural sources of gutta-percha will be definitely used up.

Gutta-percha, although similar in chemical properties to caoutchouc, is tough and inelastic, in which respects it is strikingly different. It “slowly absorbs oxygen when ex-
“exposed to the combined influence
“of light and air, and is gradually
“converted into a brittle resin
“freely soluble in hot alcohol.
“After having undergone this
“change it entirely loses its plastic

“character, and this is one of its
“principal defects; it may, how-
“ever, be preserved in the dark, or
“under water, for an indefinite
“period, without change.”

Unlike caoutchouc which is derived from plants of groups belonging to widely different parts of the vegetable kingdom, typical gutta-percha appears to be only yielded by members of the *Sapotaceæ*.

MALAY PENINSULA.—1. *Dichopsis Gutta*.—There can be no doubt from the examination of copious specimens that this is the source of the principal kind of gutta-percha of commerce. The plant was originally determined and described by Sir W. Hooker in 1847 (*Journal of Botany*, Vol. VI., pp. 463-5). M. Pierre, Director of the Botanic Garden, Saigon, is disposed to cast some doubts upon the determination, but as I think, without valid reason. *Dichopsis Gutta* formerly existed in abundance in the southern part of the Malay Peninsula; it extends to Sumatra, Borneo, and probably other islands of the Malay Archipelago.

The gutta-percha yielded by this species is known in the Straits Settlements as *Gutta-Taban*. Two varieties are distinguished, Gutta taban putih (white) and Gutta taban merah (red). The tree producing the former is said by Dr. Dennys only to differ from the latter “in the
“fact that its flowers are white
“instead of red. Gutta taban, of
“whichever variety, produces the
“standard gutta-percha of com-
“merce, and is therefore of most
“importance.”

“All accounts agree in the
“general features of the localities
“in which gutta-percha producing
“trees are found to thrive. Mr.
“Low describes them as growing
“in the forests on the side of every
“hill and mountain in Perak;
“adding, that they do not flourish

" in the plains. Mr. Murton states that the tree producing Gutta taban is most abundant on Gunongs Meeru and Sayong, and Bujong Malacca. A few large trees still exist on Gunong Bubo and the Thaipeng range, while small plants from 1 to 8 feet are abundant on the granite formations in Perak, up to 3,500 feet elevation.

" In Selangor, Captain Douglas describes the trees as growing to a large size on the slopes of low hills in dense primitive forests. They prefer a rich yellowish loamy strong soil, and aspect appears to be of little or no consequence. The young trees require shade and good drainage, the one being afforded by the tree from which they spring, and the other by the sloping nature of the ground in which they grow.

" It does not appear that the juice is collected at any special period. Mr. Low states, however, that there is a very marked difference in the yield of the wet and dry seasons; at the former period an average tree will yield some five catties (a catty = $1\frac{1}{3}$ lb.), while in the dry season it will only yield one. Considerable difficulty, by the way, appears to exist in ascertaining the actual yield per tree, and the difficulty will, owing to native habits of exaggeration, continue until some trustworthy European himself watches the operation. Mr. Murton states that a native gutta-percha merchant mentioned 40 catties as the yield of a single tree, while he himself, from other information, puts down the yield at from 5 to 15 catties per tree, and never exceeding 20.

" In view of the enormous number of trees which must have been destroyed, if even 10 catties be taken as an average, I should

" be inclined to accept the higher estimate. In order to procure the juice, the Taban tree is felled and the bark is then ringed in spaces a foot wide and about 15 to 18 inches apart. The upper end of the tree is usually cut off, as this is said to cause it to bleed more freely. Buckets made of wood, cocoa-nut shells, or leaves stitched together, are used to collect the juice, which is then poured into a hollow bamboo. Thus far the process for all varieties is the same; but in Perak, while the Taban merah is simply boiled until it solidifies, the Taban puteh is boiled with water, salt, and Samak bark, the ingredients named being, it is alleged, necessary to cause solidification. In Selangor, where possibly the second variety is not found, the juice is said to be poured into an iron pan over a very slow fire until it assumes the consistence of a very stiff paste, when it is moulded into convenient shapes for transport.

" The destruction of trees involved in this process is so enormous that it seems impossible for the supply to long continue. It is computed that over 7,000 trees were cut down during 1877 in the neighbourhood of Klang, while 4,000 must have perished near Selangor in a single month to furnish the 270 piculs (a picul = $133\frac{1}{2}$ lbs.) returned as exported. The estimated annual export from the Straits Settlements and the Peninsula was given as 10 millions of pounds in 1875, which at the high average of 15 lbs. to a single tree, would give 600,000 trees. The demand seems always to exceed the supply.

" The principal adulterant made use of seems to be *Gutta jelutong*.

" Singapore and Penang are the

"chief collecting dépôts for gutta-percha, and a failure in the supply might seriously injure the trade of either port."

2. *Gutta Sundek*.—Although I have constantly urged my correspondents in the Malay Peninsula to send me specimens of the now well known tree producing this kind of gutta, no material for its adequate botanical determination has hitherto reached Kew.

Dr. Beauvisage, of Paris, obtained fruiting specimens from Mr. Low, British Resident at Perak, and has identified the species. (*Contributions à l'étude des origines botaniques de la Gutta-percha; thèse pour le doctorat en médecine*) with *Payena* (*Keratephorus*) *Leerii*, Hassk.

Mr. C. B. Clarke having, however, examined similar specimens from Perak (communicated by Mr. Cantley, Superintendent of the Botanic Garden, Singapore) while elaborating the *Sapotaceae* for the Flora of British India, is of opinion that the identification of Beauvisage is erroneous, and that "without fuller material, this tree cannot be safely referred to any genus." It does not, however, seem to belong to *Isonandra* or *Dichopsis*.

Dr. Trimen, Director of the Royal Botanic Gardens, Peradenaya, states in his report for 1880, "I have during the year, through the kind exertions of Mr. Low, our Resident at Perak, received a consignment of germinating seeds of the second best variety of that country. This is called 'Gatah sundek,' and Mr. Low informs me that it forms a very large tree 120 feet high, but quick growing. From specimens of the foliage and fruit sent with the seeds, it would appear (so far as can be identified without flowers) to be a species of *Payena*. This is a valuable gift, as 'the Gatah trees

"in Perak sufficiently large to produce the gum are now very rare, and very great difficulty arises in procuring seeds or specimens.' The young plants are growing vigorously in Peradeniya and Heneratgodā."

With regard to *Gutta Sundek* or *Puteh Sundek*, Dr. Dennys's report merely contains the following remarks:—"It is stated by Captain Murray to be identical with *Gutta Taban*. Mr. Murton, however, describes it as the product of a tree differing from *Dichopsis* *Gutta* in having leaves 'much shorter and broader,' more ovate in general outline, and the pilose hairs on the under surface not so fulvous as in that species. Captain Murray's remark, however, points to the fact that commercially *Gutta Sundek* and *Gutta Taban* are deemed much the same, the former being only an inferior variety."

It is evident from the facts stated above, that the running out of existing natural sources of gutta-percha is an event within measurable distance. The preservation of the supply is peculiarly a case for Government and not for individual enterprise. I reproduce here the concluding passages of the convincing report of Dr. Dennys, in the hope that before it may be too late the policy suggested may seriously engage the attention of the Governments of some of our Eastern possessions. "Comparatively scanty as are the details as yet to hand regarding both gutta-percha and caoutchouc, two facts may be considered ascertained. (1.) That the demand is increasing and is likely to increase for some time to come, and (2) that the supply threatens to become exhausted within a very short period. As regards Singapore, there is ample evidence that both *Ficus elastica*

“ and *Dichopsis Gutta* at one time
 “ abounded on the island, and that
 “ their disappearance is entirely
 “ owing to the want of foresight of
 “ those who reaped the first harvest
 “ of their yield. In view therefore
 “ of the very large amount of suit-
 “ able unoccupied ground at Go-
 “ vernment disposal, and which is
 “ not likely to be wanted for build-
 “ ing or other planting purposes, I
 “ would respectfully suggest that
 “ measures be taken to ascertain
 “ whether an appreciable increase
 “ to the future revenue of the
 “ colony might not be ensured by
 “ selecting and planting suitable
 “ localities.

“ It may be difficult for the Co-
 “ lonial Government to exercise a
 “ direct influence in favour of care
 “ and prudence on the part of the
 “ native administrations, but much
 “ might be done to encourage enter-
 “ prise in the formation of new
 “ Gutta plantations. It may also
 “ be worth while to ascertain
 “ whether the appointment of Eu-
 “ ropean conservators under the
 “ control of the residents, would
 “ not achieve the end of preserving
 “ a most valuable monopoly to the
 “ different governments, as it may
 “ be assumed that the expenses
 “ thus incurred would be amply
 “ justified by the commercial re-
 “ sults both to Singapore and
 “ Penang as depôts, as well as
 “ to the original collectors and
 “ vendors of such important ar-
 “ ticles of trade. It is not im-
 “ possible also that fresh discoveries
 “ might be made if not of new trees
 “ yielding similar products, of sub-
 “ varieties which might furnish a
 “ commercially valuable substitute
 “ while it is more than probable
 “ that vast areas of virgin growth
 “ might be discovered in the inter-
 “ ior portions of the Peninsula by
 “ an explorer under Government
 “ auspices.

“ The principal obstacles in the
 “ way of individual enterprise lie
 “ in the time necessary to mature
 “ the tree, said to be about 15 or
 “ perhaps 20 years at least, and the
 “ difficulty of obtaining seeds, sap-
 “ lings, or cuttings wherewith to
 “ commence plantations. These
 “ can only be met by the cordial
 “ co-operation of the residents and
 “ native authorities, the latter
 “ especially needing to be convinced
 “ that by aiding the movement they
 “ will not be depriving themselves
 “ of a valuable monopoly. As re-
 “ gards the former it is probable
 “ that but very few Europeans would
 “ embark capital which would not
 “ yield an outturn for 15 or 20 years,
 “ which I am informed on botanical
 “ authority is the average time re-
 “ quired before a tree is ready for
 “ tapping; many trees indeed are
 “ reputed to be 30 years old when
 “ tapped, and it would therefore
 “ seem that the Government alone
 “ could afford to undertake the esta-
 “ blishment of plantations. At
 “ present we are without data as to
 “ probable expense, but, as the trees
 “ are essentially jungle trees, and
 “ require no care when once fairly
 “ started, this may be taken as very
 “ low. Assuming each picul of
 “ 133½ lbs. of the best qualities to
 “ represent the yield of 10 trees,
 “ and to be worth \$45, 10,000 trees
 “ would give a gross return of
 “ \$45,000. The available Crown
 “ lands in Singapore could probably
 “ grow 100,000 trees at the lowest
 “ estimate giving \$450,000 in the
 “ gross outturn, though this esti-
 “ mate must be mere guesswork
 “ until a proper survey be made.
 “ But assuming that the annual in-
 “ come of the colony could be in-
 “ creased by \$200,000, or less than
 “ half the sum named, the matter
 “ seems worth attention; while there
 “ is reason to believe that even if
 “ the yield from the native states

" continued at its present figure the
 " additional supply would soon find
 " a market without materially lower-
 " ing the price."

3. *Gutta-jelutong*.—A product bearing this name is used both in the Malay Peninsula and Borneo for adulterating gutta-percha. In the Kew Reports for 1880 (p. 47), I have referred foliage specimens of the Perak gutta-jelutong tree to *Alstonia*? *costulata*. The examination of the *Apocynaceæ* for the flora of British India has led me to regard this as the type of a new genus to which I have given the name of *Dyera*. Further specimens in a flowering state of the Gutta-jelutong tree of the Straits Settlements show that though closely resembling in habit *Dyera costulata* (which Main-guy describes as "abounding in pure caoutchouc"), it is a distinct species, which will be described in the flora of British India as *Dyera laxiflora*.

According to Mr. Treacher (Journal of the Straits Branch of the Royal Asiatic Society, July 1879, p. 57), the Bornean Gutta-jelutong is "the product of a lofty tree, taller than any of those yielding the true gutta (*i.e.*, over 100 feet in height). Growing on both hills and in swampy land, with dark coloured bark, leaves 5 inches long, 3 inches broad, green above and light below, seeds in black pods, like those of a bean, 9 to 10 inches in length, each pod containing 8 to 10 seeds." Pods of this kind differ strikingly from the slender follicles characteristic of *Alstonia*, and afford one of the distinctive marks of the new genus *Dyera*. The Kew Herbarium contains specimens of a Bornean tree collected by Mr. Lowe, who has marked it "Kayu jelutong." It will form a third species of *Dyera*.

4. *Gutta Pulei*.—Mr. Cantley sends specimens of a tree rather abundant at Singapore under this name. It appears to be one of the forms of the polymorphic *Alstonia scholaris*, which is known to yield caoutchouc (see Kew Report, 1878, p. 39).

5. Several other trees are known to produce substances analogous to gutta percha in the Malayan-Peninsula. The following may be mentioned:—

Dichopsis obovata occurs in the tropical forests of Tenasserim and at Malacca and Singapore. Kurz says, "yields a fair sort of gutta-percha." Mr. Collins collected gutta from this species at Singapore.

Bassia Motleyana occurs at Malacca; it yields an inferior gutta in Borneo; see below (p. 43).

Payena Maingayi, found at Malacca by Maingay, who says it "abounds in gutta-percha."

BORNEO.—It has long been known that besides *Dichopsis gutta* other sapotaceous trees yield part of the gutta-percha, which finds its way into commerce from Borneo. As, however, in the case of the Bornean caoutchouc-producing plants discussed in the Kew Report for 1880, the exact identification of those yielding gutta-percha in the island is involved in the greatest perplexity. Dr. Beauvisage has effected little more than to bring the literature together. Memoranda on the subject have been communicated to the Colonial Office both by Mr. W. H. Treacher, the Colonial Secretary at Labuan, and by Mr. F. W. Burbidge. Beyond establishing the fact that the Bornean product is derived from more than one species they do not carry our knowledge much further. Mr. Treacher says:—"Gutta-percha (Gutta Cras) is the product of lofty forest trees. They are thus

" named in order of value of their products by Bruni collectors :—

" 1. Gutta or Gniato Elong, Gutta Puteh.

" 2. Gutta or Gniato Maresah.

" 3. Gutta or Gniato Durian.

" The Gutta Cras (both *gniato* and *cras* appear to mean hard, in contradistinction to *lechak*, soft, which is applied to caoutchouc)

" imported into Labuan is the unadulterated product of both the Gutta Elong and Gutta Puteh.

" The Gutta Merah is Gutta Cras adulterated with filings of the

" bark of the tree from which it is obtained in the proportion of

" 20 catties of filings to 10 catties of the pure gutta. This adulterated gutta is said to be preferred

" by the Chinese traders, who are supposed to be unaware of the

" deception. My informant denies the existence of a distinct Gutta

" Merah tree, and asserts that the gutta of all trees is naturally of

" a white colour.

" Gutta Maresah yields an inferior Gutta Cras.

" The product of the Gutta Durian is not imported in a pure state,

" being inferior to that of other guttas, inasmuch as it is less

" elastic. It is frequently mixed with the Gutta Cras.

" The gutta is obtained in the following manner. The tree

" selected is felled near the root; it is then ringed, the bark being

" taken off all round to the breadth of an inch or more, at distances

" of about $2\frac{1}{2}$ feet, or half a Malay dupah or fathom, care being taken

" to commence at the top end and to proceed towards the root, otherwise it is said the gutta exudes

" from the opposite end. The gutta is allowed to drop into leaves or

" any convenient vessel, and if Gutta Merah is required the bark

" filings are mixed with it in the proportion mentioned above. The

"

" gutta is then collected and boiled in a little water for half an hour

" or so, until it becomes hard, in quantities of 50 catties weight or

" under at a time, and is brought over to Labuan.

" After a trunk has been ringed, it takes some couple of days before

" all the gutta has been obtained from it."

The botanical identification of the gutta-percha tree enumerated by

Mr. Treacher is, in the absence of authentic specimens, impossible.

1. *Gutta Elong* is very probably yielded by *Dichopsis Gutta*, of which

the Kew Herbarium possesses characteristic specimens (foliage only) from North-west Borneo, collected

by Mr. Burbidge, and from South-east Borneo, collected by

Mr. Carl Bock.

2. *Gutta Puteh*. Specimens of the tree stated by Mr. Burbidge to produce this in North-west Borneo

exactly agree with others also stated by Mr. Murton to yield it in Perak.

They consist of foliage only, and closely resemble *Dichopsis Gutta*.

They differ, however, so far as to make it possible that if the tree were

represented by more ample material, it might prove to be a distinct species.

De Vriese described under the name of *Dichopsis (Isonandra) macrophylla*, a tree of which specimens

were collected by Motley, who noted that it was called Ngaiato puteh, and

that it was a large tree with greenish white flowers. Motley seems to have supposed this to be one of the

sources of the gutta-percha of commerce. "It is said to be common

" in the Dyak country."

3. The only other tree about which anything is accurately known is

Bussia Motleyana (Isonandra Motleyana), vernacular name Kotian.

Motley says of this:—"A very tall and straight tree, with smooth

" reddish grey bark, reddish within, yielding when wounded a copious

"

" flow of milky juice, which hardens to a white waxy resin, brittle when old, but readily softened by heat. " Wood reddish white, woolley in texture, soon decaying in the weather, but good for housework. " The gum is said to be used to adulterate the inferior kinds of gutta-percha; it is certainly unsaleable alone. From the seed is expressed an oil used for lamps, and when fresh for cooking. " Grows in deep bogs where its roots are under water five months of the year."

There are specimens of this tree in the Kew Herbarium, collected by Maingay at Malacca.

4. That there are several other trees which contribute more or less to the Bornean supply of gutta-percha is certain. But in the present state of our knowledge it is impossible to say anything definite about them. It is much to be hoped that the British North Borneo Company will employ some competent botanist to investigate the whole subject of the plants in the island which yield both gutta-percha and caoutchouc (Gutta-lechak). Neither question has ever yet been adequately dealt with. What is wanted is that some person should systematically set to work to collect good specimens in flower and fruit of every tree yielding any product of the kind of commercial value. Such specimens should be accompanied by notes giving all the local information procurable as to vernacular names, habit of growth, and methods of collection. Samples of the produce fit for commercial tests should be secured at the same time and carefully labelled. Such an investigation would be of great scientific and commercial interest. Many of the gutta trees are known to be very local, and it is quite conceivable that as matters at present stand they may disappear from the face of the earth without

botanical science even ascertaining anything about them. Moreover, it is to the distinct interest of a body like the British North Borneo Company to ascertain definitely what is the extent of the present gutta-percha and india-rubber resources of the island, and how, as far as at any rate as the territories under its own jurisdiction are concerned, the existing supplies may be best developed and husbanded.

5. I am indebted to Mr. Carl Bock for a leaf "of one of the " plants yielding Mallan or gutta-percha, interior of Koti, Borneo." This seems to belong to *Coccoloba fenestratum*, and there must have been some error regarding it. Mr. Bock, however, as stated above, brought back leaves of undoubted *Dichopsis Gutta*.

INDIAN PENINSULA. — Although Malaya is the head-quarters of the commercial gutta-percha supply, India itself is not destitute of trees yielding substances more or less similar, which may deserve attention.

1. *Dichopsis elliptica* (= *Bassia elliptica*, *Isonandra acuminata*). Inspector-General Balfour gives the following account of this tree, which appears to be common on the Malabar coast, the forests of Coorg, the Wynad, Travancore, &c. It grows to a height of 80 or 90 feet. A substance similar to the Gutta-percha of commerce is procured by tapping, but the tree requires an interval of rest of some hours or even of days after frequent incision. In five or six hours upwards of 1½ lbs. was collected from four or five incisions. The gum is hard and brittle at the ordinary temperature, but becomes sticky and viscid on the increase of heat. It is not found applicable to all the purposes for which gutta-percha is used, but 20 or 30 per cent. of it may be

mixed with gutta-percha without destroying its qualities.

2. *Dichopsis polyantha* (= *Isonandra polyantha*).—A tree 30 or 40 feet high, occurring in Silhet, Chittagong, and Pega, produces, according to Kurz, "a good quality of gutta-percha in large quantity, probably not inferior to that of Singapore."

3. *Achras Sapota* (= *Mimusops Manilkara*). This is cultivated in India for its fruit. It produces a substance resembling gutta-percha, which is apparently the Chicle Gum of Mexico. With respect to this, Messrs. Siemens Brothers reported (see Kew Report, 1876, p. 18), "in mixing with india rubber it made the latter too brittle."

4. *Calotropis gigantea*.—Attention should be drawn to the remarks made on a substance "apparently precisely analogous to gutta-percha," obtained from the common Indian plant *Calotropis gigantea*. This, however, belongs to *Asclepiadaceae*, and not to *Sapotaceae*, in which family are included all the other plants mentioned in this notice. An account of this product will be found in the last place where it would probably be looked for, Memorandum on Materials in India suitable for the Manufacture of Paper, by L. Liotard (Calcutta, 1880, pp. 37-39). The substance was examined by Professor Redwood, who reported, "The substance resembling gutta-percha, obtained from the 'muddar, I find possesses several properties in common with gutta-percha, while in other respects it differs."

COCHIN CHINA. — *Dichopsis Krantziana*.—M. L. Pierre, Director of the Botanic Garden, Saigon, gives in the *Excursions et Reconnaissances*, No. 11., published by the French Colonial Government at Saigon, an interesting account of

the gutta-percha derived from this plant, which appears to be a source of one of the inferior qualities met with in commerce. As the publication appears difficult of access in Europe, I quote his remarks:—

"This tree furnishes a large quantity of a milky juice, which yields a gutta of inferior quality, judging from experiments made by experts in Paris. It must be remarked, however, that the sample experimented on was obtained by the defective method used by the Cambodians in the manufacture of torches and had become resinous. The Cambodians sell it to the Chinese, who export it to Singapore, where it is sold as an inferior kind of gutta. The product, in fact, altogether varies in its texture according to its mode of preparation. The milky juice left to itself and coagulated yields a whitish substance which is not resinous nor glutinous. The absence of the last character is an essential property of good gutta. When on the contrary the milk is coagulated with hot water, it has a glutinous texture highly injurious to its commercial value. In this state it is useless, except to mix with gutta of better quality. To prepare it properly it should be poured into earthen vessels and allowed to slowly evaporate without the application of any artificial heat. The process is slow, but it is that which is employed in Malaya in the preparation of the best sorts of gutta" (p. 227).

M. Pierre very obligingly communicated a specimen of his Cochin China plant to the Kew Herbarium. Mr. C. B. Clarke remarks upon it:—"Seems very near a species I have made *Dichopsis Helferii* on a Tenasserim tree, of which the fruit is not known. The leaves do not quite match either in

" shape or in number of nerves, nor
 " are the sepals exactly the same.
 " They may be one tree neverthe-
 " less."

AFRICA.—The curious points of affinity of the flora of tropical Africa to that of Malaya, finds a striking illustration in the nearly related sources of caoutchouc of the two areas. A similar parallelism might have been expected to extend to gutta-percha. But though *Sapotaceæ* are not wanting in tropical Africa, the expectation has not hitherto been fulfilled. The indications of possible African sources of this product are of the slenderest.

1. *Chrysophyllum africanum*.—A note in the Kew Herbarium, appended to specimens of this species, which is a native of Upper Guinea, states that the trees are "*valde lactescentes*."

2. *Gutta-shea*.—This curious substance, which is a bye-product of *Butyrospermum Parkii*, is doubtless closely allied to gutta-percha. It has already been described in the Kew Report for 1878 (p. 38).

SOUTH AMERICA.—1. *Mimusops globosa* (= *Sapota Mulleri*).—Gum Balata has been more than once referred to in these reports (1873, p. 6; 1877, p. 31). It is a substance which hitherto on some technical grounds has made but little way in the European market, although it appears to have the advantage over gutta-percha that it does not become slowly resinous. The trade in it appears to have taken a fresh start, as appears from the following extract from a valuable paper by Mr. G. S. Jenman, F.L.S., Government Botanist of British Guiana:—"The Balata or 'bully tree' is found in British, French, and Dutch Guiana, and also in Venezuela, Trinidad, and Jamaica. On points of the Berbice, Canje, and Mahaicony rivers

" of Guiana, it is particularly plenti-
 " ful. It is one of the finest forest
 " trees of the country, eighty feet
 " high or more, having a trunk two
 " feet in diameter. The wood is
 " hard and very durable. Two
 " kinds are recognised by the balata
 " collectors and woodcutters, which,
 " from their description, are either
 " well marked varieties or distinct
 " species, a question it would be
 " very interesting to determine.
 " The first exportation of balata
 " gum took place more than 20
 " years ago, when a small sample
 " was sent home for experiment.
 " The quantity increased yearly,
 " and in 1865 reached 20,000 lbs.
 " In 1874 it fell to 1,669 lbs.,
 " which fetched 111*l.* in the market.
 " The next year the figures were
 " 10,134 lbs., realising only
 " 114*l.* 10*s.* The following year's
 " export was worth 145*l.* 16*s.* 8*d.*
 " In 1877 the business sprang up to
 " 20,812 lbs., which sold for 1,040*l.*,
 " and last year it reached the un-
 " precedented quantity of 47,483 lbs.,
 " which sold for 2,543*l.* 5*s.* 10*d.*
 " This was more than double the
 " largest previous exportation in a
 " single year."

I extract the following additional information from the report of the Crown Surveyor, British Guiana, for the year 1880:—"Some years ago the extraction of the balata from the bullet tree was carried on on a large scale. The process adopted, at first, was by tapping the trees, but the late Sir William Holmes, who obtained bullet tree grants from the Crown in Mahaicony creek, thought this rather a slow method of obtaining the balata, and, consequently, imported a small steam engine and crushing mill (the latter, though smaller, being precisely similar to the rollers used on sugar estates) for the purpose of grinding the bark, and thus obtaining the

" balata more rapidly and in larger quantities.

" I was present with Sir William Holmes when the mill was first set to work, and he perceived that instead of the pure cream-like substance that had flowed from the tree when tapped, a dirty reddish brown substance dropped from the crushed bark, filled with impurities, and consequently of much less marketable value than what was obtained by the tapping process. I believe, however, that the tapping of the tree is the method at present pursued in the county of Berbice, whence comes all the balata which is now exported. Irrespective of the inferior quality of the balata obtained by the crushing process, a great destruction of valuable wood was the inevitable consequence, because these magnificent trees, when cut down and denuded of their bark, were allowed to lie and rot.

" I have seen sheets of balata so prepared as to be apparently almost quite as durable and useful, as parchment, and which could be used for draining plans, licences of occupancy, deeds, &c."

2. *Massaranduba*. — The Cow tree of Para is a lofty tree attaining a height of 100 feet. It belongs to *Sapotaceæ* and probably like the Balata to the genus *Mimusops*. It has been described as *Mimusops elata* though, as the flowers are apparently unknown its exact systematic position is somewhat uncertain. "On incisions being made in the bark, a milky juice flows most copiously; it is about the consistency of thick cream, from which, but for a slightly peculiar flavour, it can scarcely be distinguished. By exposure to the air it thickens, and forms adhesive glue something like gutta-percha."

The specimens of the milk and resulting product collected by the traveller, Spruce, and still preserved in the Kew Museum.

India-rubber.—COCHIN CHINA.

—Chinese collections of *Materia Medica* often contain specimens of a drug consisting of blackened fragments of bark and small pieces of twigs. These when broken across are seen to contain an abundance of caoutchouc which can be drawn out in fine elastic threads as in the East African *Landolphia*s. Specimens have reached the Kew Museum from the Paris Exhibition of 1878 (with the Chinese name *tu chung*), and from the Smithsonian Institution, Washington. The botanical origin has been hitherto altogether uncertain. It seems, however, probable from a notice by M. L. Pierre, Director of the Botanic Gardens, Saigon (*Excursions et Reconnaissances*, No. 11, Saigon) that this drug is the produce of *Parameria glandulifera*. This is an apocynaceous climber ascending to the summits of the highest trees; it is common in the forests of Cochin China. Specimens which M. Pierre has obligingly communicated to Kew prove that the plant is identical with a species which abounds in Southern India. M. Pierre states "that the sap which flows from the stem has exactly the appearance of milk, and may even be used as a substitute for it, it has a slight nutty flavour. In the liquid state it is often employed in medicine by the Annamites and the Cambodians. The bark after being dried ordinarily in smoke is sold at 20 to 25 francs the picul (= 133½ lbs.) and exported to China. The bark is a medicinal product esteemed by the Chinese."

The method of extracting the caoutchouc is exceedingly simple. The liquid obtained from the laticifer either from incisions or by cutting

it into short lengths (if it is wished to obtain at once a larger quantity) is poured into a basin filled with water at a temperature of 104° — 122° F. On agitating the mixture with a stick, the milk immediately coagulates into pure caoutchouc of excellent quality. The plant may be propagated by cuttings with great facility, and M. Pierre suggests that it may be planted in forest reserves where the trees are not less than 10 years old. If this method were thought practicable by the Indian Forest Department it might be extended to the African Landolphias and in this way a forest product of great importance might be secured.

MALACCA.—The first definite attempt to cultivate the Malayan rubber vines has, as far as I know, been made by the Hon. Martin Lister, of the Lewisholme Estate, Sunjje - Ujong, Malacca. I am indebted to Clements Markham, C.B., F.R.S., (whose interest in the cultivation of rubber plants in our Eastern possessions is only second to that which he takes in Cinchona planting) for the opportunity of reading a private letter on the subject. The example set by Mr. Lister is so praiseworthy that I hope I shall be excused in holding it up for imitation:—

"You will be glad to hear that I have got five different kinds of rubber bearing creepers growing here besides gutta-percha (Gutta Taban)
"I was able to get distinct samples priced approximately.
"Balam, good gutta susu, about \$42 per picul (= $133\frac{1}{2}$ lbs.)
"Kappor, best gutta susu, about \$46.
"Etam, inferior in colour, \$38/
"\$39/
"From what Malays tell me the creepers will give about one catty

" (= $1\frac{1}{2}$ lb.) at six years old, and I am going to measure off an acre when I return from China, clear up the undergrowth, leaving large trees standing, plant two or three of the creepers to each large tree and train them along large hard wood poles fixed from tree to tree at an elevation from the ground of about 5 feet. In this way the coolie has facility in extracting the milk, and is also under the eye of the superintendent. Each coolie will be provided with a certain number of small tin pots with a hook to them and when he has gashed the creeper (running horizontally) he hangs the tin to the creeper and so on, at 11 o'clock collecting the tins and taking them to the store. This is the way in which I have worked it out in my mind, and I really believe it will be a profitable affair, though it would be a folly to attempt it on anything but a small scale at first. The creeper heals quickly and will in a year's time give as much if not more than the first, and so on."

SINGAPORE.—The careful investigation of the *Apocynaceae* for the Flora of British India, has necessitated the revision of the names of two of the species mentioned in last year's report (pp. 44-47).

1. *Chilocarpus flavescens* appears to be a true *Willughbeia*, and will find its place in the Flora as *Willughbeia flavescens*.

2. *Willughbeia Burbidgei* turns out, after comparison with authentic specimens of *Willughbeia firma* Bl. obligingly lent to Kew from the herbaria of Leyden and Utrecht, to be identical with that species. Blume's plant was represented in the Kew Herbarium by specimens communicated by Miquel, and apparently referable to a quite distinct species *Willughbeia coriacea*.

Medicinal products.—Jalap.
—Amongst minor planting industries, the cultivation of Jalap tubers has excited some interest.

MADRAS.—As I have received enquiries upon the subject, I quote the following account of the method worked out by Mr. Jamieson, and described by him in the report on the Madras Botanical Gardens and Parks for the year 1879-80.

"The propagation of jalap was commenced in the Ootacamund Gardens to 1877. Our stock then consisted of 100 plants that had "been "grown in the gardens for ornament. "Although the tubers increase "to a large size and the stems grow "luxuriantly and flower profusely, "the flowers do not fertilize freely "and produce but few seeds in the "climate of Ootacamund; consequently the increase of the plant "has been confined almost entirely "to propagation from root and stem "cuttings. This work has been "carried on steadily until there are "now upwards of 25,000 plants "and root cuttings permanently "planted out. The tubers were at "first planted 4 x 4 feet apart, "but it was found that they did "not exhaust the land, and thrive "equally well when planted closer. "They are therefore now planted "in rows 3 feet apart, and the "distance between each plant in "the row does not exceed 2 feet, "so that 25,000 plants give a total "area planted of 5 acres. The "cost of cultivation, weeding, &c., "is also much reduced by close "planting.

(a.) *Method of Cultivation.*—

"Having no data to guide me "regarding the climate and soil "which are natural to the jalap "plant, I tried it in a variety of "situations and now find that it "thrives best in a tolerably rich, "dry, and friable, loamy soil; in "fact conditions of soil that are

"indispensable to the production of "good potatoes seem equally necessary to the growth of jalap; "good grass land is preferable to "open rich forest land; when "planted in the latter it has a "greater tendency to produce a "mass of succulent roots than to "form tubers. In opening land "for the cultivation of jalap several "acres of well drained grass land "sheltered from the south-west "winds and with a stream of water "on or near it should be laid out "in terraces 10 feet wide. The "terracing should be completed by "the end of January and the "ground dug over to the depth "of 2 feet and left exposed to the "action of the sun until the "beginning of April, when it "should be drilled, manured, and "planted with potatoes (an early "ripening variety of kidney would "be the best variety to plant). "The potatoes should be lifted "in June, the land cleared of "weeds, and forked over in order "that the manure (not taken up "by the potatoes) may be thoroughly "incorporated with the soil. The "ground is now ready to receive "the jalap plants, which should "be planted when the tubers are "about the size of pigeon eggs in "rows (across the terraces) on "ridges a few inches higher than "general level of the ground, in "order that they may be raised "sufficiently high to prevent water "from lodging immediately around "them. If the weather be dry, "the plants should be watered "occasionally until they have "begun to grow; when once established ordinary garden culture "as to weeding, &c., is all that is "necessary.

"(b.) Jalap is a herbaceous "plant throwing out twining stems, "which should be supported by "stakes or wire trellises in the

" same manner as ordinary garden peas are. The stems die down annually and the tubers remain dormant for two or three months. In addition to the aerial stems, jalap throws out a mass of underground shoots, which emit roots and form tubers at intervals of from 6 to 9 inches. It is from these underground shoots that the greater proportion of our plants have been raised; when cut about 3 inches long and planted they root freely and gradually enlarge into tubers; by this means the plants can be multiplied to any extent."

" One acre of land planted, as I have described, should at the end of three years produce 5,000 lb. of green tubers, which will yield, when thoroughly dried, 1,000 lb. of jalap powder; the cost of cultivation, collection, and drying of the root for the same period will not exceed Rs. 300. I therefore estimate that dried jalap tuber can be produced in Ootacamund at a cost of 4 annas and 10 pies per lb."

JAMAICA. — Mr. Morris writes September 7: " We are shipping another lot of jalap, which will complete the crop for this year—about 1,200 pounds. As jalap loses fully two-thirds of its weight in drying, this will represent over a ton weight of green jalap yielded by our small plantation."

Waras.—A drug known under this name appears to be exported in considerable quantity from Aden. It is used as a substitute for kamala, a well-known Indian product of *Mallotus philippinensis* (*Rottlera tinctoria*, Roxb.). Its origin is quite unknown (see Flückiger and Hanbury, *Pharmacographia*, pp. 575, 576). At the suggestion of the former, Captain Hunter, Assistant

Resident at Aden, obtained specimens of the plant stated to yield *Waras* in Arabia. He has also sent one to Kew with a note stating that it was gathered "at an elevation of 6,000 feet on Jebel Dhubarah, 60 miles due north of Aden." The plant sent was immediately identified with a leguminous species, *Flemingia congesta*, Roxb., having of course no affinity with *Mallotus philippinensis*.

True kamala consists of the epidermal glands detached by brushing from the fruits of the *Mallotus*. Alcohol extracts from it a splendid red colour. The name "*waras*" means saffron, and it may be mentioned in support of the notion that a similar substance is yielded in Arabia by perhaps one or more species of *Flemingia*, that dried specimens belonging to this genus stain paper in the herbarium a bright yellow colour when washed over with the alcoholic solution of corrosive sublimate used to protect them from the attacks of insects. *Flemingia rhodocarpa*, Bak., from the Mozambique district has its pods covered with a bright red resinous pubescence.

In the *Pharmacographia* (2nd ed., p. 372), Flückiger and Hanbury state that *Mallotus philippinensis* grows in Abyssinia and Southern Arabia. In a letter Professor Flückiger doubts whether he and Mr. Hanbury were not mistaken in regard to this. The evidence of specimens in the Kew Herbarium only carries the distribution to the West as far as Scinde. There is nothing improbable in its extending to Arabia, the flora of which is still so imperfectly known.

Oil Stuffs. — New vegetable sources of oil are still eagerly in request amongst commercial men, and are a frequent subject of correspondence. I add the following

notes to what has already appeared in previous reports on the subject.

African nuts.—Samples of an oil seed bearing the name of "African nuts" have been sent to Kew from more than one source. On careful examination they proved to be kernels of a wild nutmeg nearly allied to *Myristica surinamensis*. Further enquiry proved that, though imported as African nuts, they were really grown on the banks of the Amazons, the port of shipment being Para. I am indebted to Mr. J. A. Voelcker for the following analysis of these nuts :—

Moisture	-	-	4.74
Oil	-	-	60.55
Albuminous compounds (containing .92 nitro- gen) -	-	-	5.75
Mucilage, sugar, and digestible fibre -	-	-	20.14
Woody fibre (cellulose)	-	-	7.13
Mineral matter (ash)	-	-	1.69
			100.00

Copra.—Mr. Morris writes, September 7 :—We are shipping by this mail one and a half tons of "copra" (see Kew Report, 1877, p. 34); the produce of nuts from the Palisadoes plantations. This is purely for the sake of testing the value of the material as compared with the fresh nuts. Nearly everything in the nature of experimental work must be done here by Government. Few people have capital, except those engaged in sugar and coffee, and thus Government is obliged to pioneer everything in the shape of minor products.

Niko nuts.—Fruits and kernels belonging to the West African *Parinarium*, already referred to in the Kew Report for 1877 (p. 35) under this head, have been repeatedly sent to Kew for identification. I am also indebted to

Mr. J. A. Voelcker for the following analysis :—

Moisture	-	-	1.59
Oil (of a yellow colour, readily drying into a thick varnish-like mass)	-	-	59.43
Albuminous compounds (containing .75 nitro- gen) -	-	-	4.69
Sugar, gum, mucilage, &c.	-	-	29.75
Woody fibre (cellulose)	-	-	3.60
Mineral matter (ash)	-	-	.94

100.00

Phylloxera Congress at Bordeaux.

A Congress was held at Bordeaux to consider the present position of the phylloxera question in Europe. It was attended, at the request of the Governments of Victoria, South Australia, and New South Wales, by the Assistant-Director of the Royal Gardens on their behalf, and by Mr. Roland Trimen, F.L.S., F.Z.S., Director of the South African Museum, on behalf of the Government of the Cape.

Plantain - stems for paper-making.—Some inquiry has been made as to the utilisation of plantain-fibre for paper-making. As to its suitability, if procurable, there can be no manner of doubt, as there was at one time a keen demand from America for old Manila rope for the purpose. The paper made from this material, of which there are specimens in the Kew Museum, is of quite exceptional toughness. From time to time plantain-stems have been supplied to paper-makers from the Royal Gardens for experimental purposes. The only drawback to the collection of the fibre in plantain-growing countries is the practical difficulty of dealing with the 90 per cent. of water which the stems contain. In India it is found that by opening out the stems they can be dried in the sun in about a fortnight, but the fibre becomes discoloured and otherwise deteriorated

in the process. Mr. G. W. Strettell has pointed out that by the employment of machinery an absolutely dry fibre can be produced within eight hours of treatment. He has further pointed out that plantains in a wild state form a very large percentage of the sub-arborescent vegetation of the Chittagong Hill tracts, Burmah, and other places. He suggests that a considerable revenue might be derived from establishing machinery for extracting the fibre in the neighbourhood of Government forests.

Dr. King reported: "In my opinion this proposed plantain industry has a good deal of promise about it, and I think it might be well worth while for Government to spend a little money in sending a sufficiently large shipment to the London market, and to allow it to be sold for what it will fetch in small lots, so that the new material may become generally known to the paper-making interest. If the fibre answers for paper, Government need do no more; the matter will no doubt be taken up by private enterprise."

The Bengal Government "will be prepared to give all reasonable assistance to any mercantile firm or individual wishing to try experiments in the Chittagong Hill tracts or elsewhere in Bengal. It will supply plantain-stems free of cost on the spot for a reasonable time at the outset of the experiment, and will arrange for future supplies at reasonable rates. It will also give such other assistance as may be deemed necessary and proper."

Whatever the success of the enterprise in India, I think the matter is well worth attention in the West Indies. The cultivation of Bananas for export is assuming a constantly increasing magnitude. Each Banana

stem is useless after it has borne fruit, as it does not do this more than once. To work up the decaying stems into paper-pulp, if it could be done inexpensively, would be a desirable addition to the profit of Banana-growing, and would get rid of the evils incident to the decomposing of the useless stems.

MUSEUMS.

The expenditure of the grant of 2,000*l.* provided by the India Office for the extension of Museum No. 1, in order to accommodate the series of specimens selected from the economic-botanical collections forming part of the India Museum at South Kensington, has supplied, besides the additional space, an increase of accommodation for the better circulation of visitors, which has long been needed. A wing about 50 feet long by 28 wide has been thrown out from the back of the Museum at right angles. The old inadequate staircase has been removed, and a new one with double flights of stairs (4 feet 6 inches wide) for ascent and descent, has been erected. The framework of the staircase is of iron, the treads of the stairs are of teak, and are so fixed as to be reversible when worn on one surface. Besides the staircase the wing also contains three new rooms each containing two blocks of cases forming three bays on each side.

On the staircase at the first landing has been placed the stained glass window in four lights removed from the Guildhall, and presented to the Royal Gardens in 1878 by Alderman W. J. R. Cotton, M.P. It represents the growth and manufacture of cotton, and pending the erection of the new staircase it had been deposited for safety in the South Kensington Museum.

The intercalation of the Indian specimens, and the expansion of the general collection into the new rooms

necessitated the entire re-arrangement of the contents of the Museum. This was accomplished during the early part of the year, the Museum being closed for the purpose. It was re-opened to the public on Easter Monday.

No. 2 Museum has also been enlarged by an extension at the west end, about 30 feet long by 25 feet wide. This contains on the ground floor a corridor with new entrance, and a new staircase. It is now possible to arrange on crowded days for the circulation of visitors on both floors of this Museum. The extension also contains on the ground floor a convenient room which will be occupied by part of the collection of Palm specimens now most inconveniently crowded. At present it awaits the cases with which it is to be fitted. The upper floor forms one large room, which has been fitted with cases removed from the India Museum. This has been devoted to the exhibition of the collection of specimens of cryptogamic plants, which had previously been much scattered, and are now for the first time brought together and arranged in proper sequence. The space vacated by the cryptogamic plants in different parts of the building have been devoted to the better display of Palm specimens.

The necessity of more adequate accommodation for the cryptogamic collections was urged in the Kew Report for 1875 (p. 12) and 1876 (pp. 26-27).

The principal contributions received during the last year have been:—

Aitchison, Surgeon-Major; numerous specimens of economic interest from the Kuram Valley, including fibre prepared from leaves of *Chamarops Ritchiana*, club used for beating the leaves into fibre, shoes made of it, and iron needle

used in their manufacture; a branching trunk of *Chamarops Ritchiana*.

America, U. S. National Museum; a collection of food products of N. America.

Bidie, Dr.; collection of mats, baskets, &c., made of leaves of *Borassus flabelliformis*, *Phœnix sylvestris*, *Cocos nucifera*, *Bambusa arundinacea*, *Andropogon muricatus*, *Pandanus odoratissimus*, and *Cyperus*.

Boughton, Sir Charles Rouse, Bart.; portrait in oil of Thos. Andrew Knight, Esq., F.R.S.

Burgoyne, Burbidges, Cyriax, and Farries, Messrs.; copper such as is used to import Balsam of Peru from Central America; artificial vanilline and vanilla sugar.

Chantre, C.; Natal pod pepper (*Capsicum*), Zanzibar Anime, Fiji Copal (*Dammara vitensis?*), and three samples of opium.

Collier, Peter (U.S. Depart. of Agric.); fruit spikes of several varieties of *Sorghum*, and samples of sorghum sugar and glucose from *Zea Mays*.

Corsi, Marchese; painting on canvas of *Amorphophallus Titanum* from W. Sumatra.

De Candolle, Alphonse; bust of Augustin Pyrame De Candolle.

Eastman, Mrs.; Adie's sympleometer, which belonged to the late Mr. H. C. Watson, and which was used by him for the purpose of determining the range in altitude of the British Flora.

Fritzoe, Treschow; series illustrating the manufacture of paper from pine wood (*Pinus Abies*) and aspen (*Populus tremula*).

Gardner, Messrs. Joseph and Sons; gun-stock made of walnut wood, and two flutes made of cocus wood and African black wood.

Hanbury, Thos.; fruits of *Pyrus Sorbus*, *Crataegus Azarolus*, *Diospyros Kaki*, *Psidium pomiferum*, *Zizyphus vulgaris*.

Hay, J. D. V. Drummond; fruits of *Jubaea spectabilis*, and honey obtained from the tree.

Heldreich, Von, Dr. Theodore; bundle of leaves of *Salvia triloba* var. *typica*, as sold in the streets of Athens for use as tea; gall-bearing branch of *S. triloba* var. from the Isle of Syros.

Henriques, Senor J.; paper made of fibre of *Agave Americana* and cotton.

Hollande, Jules, per Col. Pearson: veneers of sycamore, oak, wild cherry, pear, hornbeam; a series of wood implements; and 21 specimens of foreign woods.

King, Dr.; collection of mats and matting made of *Cyperus procerus*, *C. Pangorei*, *Cocos mucifera*, *Borassus flabelliformis*, *Arundo Karka*, *Bambusa arundinacea*, *Phrynium dichotomum*, *Typha elephantina*, *Phoenix sylvestris*, and *Saccharum officinarum*.

Macfarlan, J. F. & Co.; very fine sample of aloin.

Mackey, Mackey, & Co.; specimen of Quinquinum, and fine sample of myrrh.

Madras Government, Revenue Department; collection of gums, resins, &c.

Maw, Caroline M.; specimens of Laver, *Porphyræ laciniata* from the Mumbles; also specimens of Laver bread made in large quantities and sold in the markets at Swansea.

Moseley, Prof. H. N.; tinder of *Echinops strigosus* used in the neighbourhood of Granada, Spain, by the mule drivers.

Nicholls, Dr.; large series of hats, mats, baskets, and other articles made of leaves of palms, bamboos, &c.; also other economic products of Dominica.

New Zealand Commission, International Exhibition, Melbourne, 1880-81; collection of New Zealand timbers.

Parke, Davis & Co.; collection of North American drugs.

Payne, Dr.; portraits of Sir John Hill, Dr. Withering, John Tradescant, and William Curtis.

Parker, Dr. G. W.; specimens of *Hydrostachys imbricata* and other Madagascar products.

Pearson, Col.; large collection of tool handles and other articles made of ash, hornbeam, cornel, beech, box, and other woods.

Peckover, A.; ball of woad, woad plants, handspade used in weeding the plants, and drawings of woad mill.

Pharmaceutical Society of Great Britain; bark of *Illicium Griffithii*, roots of *Naregamia alata*, and other pharmaceutical products.

Phillips, Messrs., & Co.; eight samples of rare teas.

Ribbentrop, B.; specimens of Burmese woods.

Ringer, Dr. Sydney; arrow poison from *Strophanthus*; specimens of woods used as antidotes, and gourd for holding charcoal, also used as an antidote.

Sargent, Prof. C. S.; collection of 60 specimens of North American woods.

Schwartz, John; 12 specimens of refined and highly crystallized sugar.

Smith, Messrs. T. & H., & Co.; samples of mono-bromide of camphor and cubebene.

Smith, W. G.; portraits of Charles Darwin, Esq., and Dr. Masters.

Sutton & Sons, Messrs.; a large series of models of vegetables, fruits, seeds, pasture grasses, &c.

Terry, Messrs. Joseph, & Co.; series illustrating the applications of Liquorice *Glycyrrhiza glabra*.

Wallace, A. R.; leaf of *Teymannia* from N. Celebes; sleeping mat made of leaves of *Pandanus* from New Guinea; and piece of cloth made from bark of *Broussonetia papyrifera*.

Welch, Margetson & Co.; specimens of yarn and flannel made of a mixture of pine-leaf wool and animal wool.

Whiffen, Thos.; samples of Jamaica crown bark, yellow and red barks, and "Cinchona cuprea."

JODRELL LABORATORY.

The principal researches conducted in the Laboratory during the past year have been those of F. O. Bower, Assistant to the Professor of Botany, University College, "on the further development of "*Welwitschia mirabilis*," published in the Quarterly Journal of Microscopical Science for October 1881 (pp. 571-594, with plates xxxii and xxxiii), and "on the germination "and embryology of *Gnetum "Gnemon."*

The Laboratory has also been used for the examination of the University of London for the degree of Doctor of Science in the subject of Physiological Botany.

NORTH GALLERY.

The contractors completed the structural work of the gallery and adjoining care-taker's house and studio, and Miss North was occupied up to the end of the year in the work of internal decoration and the arrangement and hanging of her pictures.

Mrs. Badderley, wife of George Badderley, the museum preparateur, has been appointed caretaker.

HERBARIUM.

Steudel's Nomenclator.—The appeal which I made in the last Kew Report (p. 62) for aid in keeping the interleaved copy of Steudel's Nomenclator posted up to date met with a more ready response than I anticipated.

Mr. Darwin having had occasion to appreciate the usefulness of such a work in the botanical investiga-

tions which of late years engaged his attention, determined to supply the funds for preparing a new edition of "Steudel's Nomenclator" brought up to date. The work, which it is estimated will extend over about six years, will be carried on at Kew, and will be based on the limitations of genera laid down in Bentham and Hooker's "Genera Plantarum," to which it will, in fact, form a kind of complement. The editorial work has been entrusted to Mr. Daydon Jackson, Secretary of the Linnean Society. Mr. Darwin's munificent aid does not extend beyond supplying the means for preparing the work. The form and manner of publication will be reserved for consideration on its completion.

Principal additions.—Under this head three gifts of great interest and value require prominent mention.

1. The collection of dried fungi belonging to the late Frederick Curry, M.A., F.R.S., Treasurer of the Linnean Society presented by his executors in accordance with his wish. This collection, although not very large, is of great value, as it contains the types of many species described by Mr. Curry.

2. The European herbarium of the late George Curling Joad, F.L.S., of Oakfield, Wimbledon Park, presented by his widow in accordance with his wish. This was a very splendid and munificent gift. The herbarium consisted of two parts, 1, the personal herbarium of Mr. Joad, consisting of plants collected by himself for the most part in Southern and Central Europe; 2, a general European herbarium, formed of published sets of dried plants. The whole collection was of very considerable extent, and as Mr. Joad spared neither expense nor trouble upon it, the specimens were mostly of great

beauty, and in the best possible state of preservation.

3. The British herbarium of the late H. C. Watson, of Thames Ditton, presented by his executor, J. G. Baker, Esq., F.R.S., first assistant in the herbarium of the Royal Gardens. Mr. Watson was the well known author of the *Cybele Britannica*, and many other works on the geographical distribution of British plants. His herbarium, which will always have a classical interest to students of British botany, will, like that of Mr. Borrer, be kept as a separate collection apart from the general herbarium. Besides his dried plants, Mr. Baker also presented to Kew a selection from Mr. Watson's books and the beautifully kept manuscript collections for his various published works, which have since been carefully bound for the library.

A very valuable collection of N. Chinese plants (540 species), collected and presented by Dr. Bretschneider, of the Russian Embassy, Peking, was received in 1880, but accidentally omitted to be recorded in the Report for that year. This is the most extensive collection ever received in England from that interesting country. The specimens were examined and named by Dr. Maximowicz, of the Imperial Botanic Gardens, St. Petersburg, through whom they were transmitted to Kew.

The following is a list of the names of the **other Principal Contributors** to the herbarium during 1881.

Europe.

- Arnold, Dr. F.; lichens (147).
 Berkeley, Rev. M. J.; 63 drawings of *Agaricinee*, &c.
 Buda-Pesth, Herbarium of Hungarian Museum of; Austrian, &c., plants (82).
 Cooke, Dr. M. C.; miscellaneous fungi (281).

Fraser, J., M.D., England; *Salices* (2).

Furtado, F. d'Arruda; Azores (54).

Husnot, T.; French mosses (25).
 Kunze; miscellaneous fungi (204, purchased).

Lacaita, C. C.; Italy (10).

Larbaletstier, C.; lichens (80, purchased).

Massalongo, Dr. C.; Italian *Hepaticae* (22, purchased).

Oliver, Prof. D.; British (8).

Phillips, Wm.; British *Eleutheriaceae* (50, purchased).

Thuemen, Baron von; "*Myotheca universalis*" (200, purchased).

Asia and Indian Archipelago.

Aitchison, Surgeon-Major; Afghan and sundry (7).

Baber, E. C.; (of H.M. Legation, Peking,) China (1).

Beddome, Col.; S. India (54); cultivated *Cinchona* (18).

Brandis, Dr.; Indian Bamboos (2).

Cantley, N.; Malaya (17).

Clarke, C. B.; Sikkim ferns (40).

Dickins, F. V.; Japan (395).

Duthie, J. F.; Saharanpore Botanic Garden plants (36).

Ellis, Robert; Pangli plants (249), and 2 drawings.

Forbes, H. O.; Java (106, purchased).

Ford, Chas.; Hongkong and China plants (66), also plants collected in Szechuen by Col. Mesny (22).

Hance, Dr.; China, &c. (3).

Johnston, Surgeon-Major J. W.; Afghan (41).

King, G.; Indian (8).

Maximowicz, C. J. de; China, &c. (2).

Murray, Jas. A.; *Algæ* from Kurrahee (80).

Perry, W. Wykeham, R.N.; China (7).

Puckle, Major-General J.; 90 drawings Indian *Glumales*, &c.

Regel, Dr.; Central Asia (1).

Sander, Messrs.; Philippines (1).
Schweinfurth, Dr. G.; South Arabia (82).

Sintenis and Rigo, Messrs.; Cyprus (986, purchased).

Smith, Hon. C.; Perak (5) and *Antiaris*.

Trimen, Dr. H.; Ceylon (1).

Veitch, Messrs.; Curtis's Archipelago plants (111).

Veitch, Messrs.; Wallis's Philippines (and N. Granada) plants (110).

Watt, Dr. G.; India (33).

Zohrab, James; Arabia (357).

Africa.

Ascherson, Dr. P. (1).

Bolus, Harry; Cape of Good Hope.

Bowker, Col.; Natal (2).

Cosson, Dr. E.; Algeria (196), Morocco (82).

Edinburgh, Royal Botanic Garden; Shire Highlands collected by J. Buchanan (638).

Floyer, E. A.; Egypt (15).

Hurst, H. A.; Egypt and Nubia (10).

Kirk, Sir John; East Tropical Africa, and Johanna (23).

Portuguese (Government) Polytechnic School, Lisbon, continuation of Welwitsch's Angola collection (416).

Saunders, Katherine; Natal (375).

Schweinfurth, Dr. G.; Socotra.

Tyson, W.; Cape of Good Hope (8).

Wood, J. M.; Natal phanerogams (463), fungi (23).

Mauritius and Madagascar.

Baron, Rev. R.; Madagascar (633).

Bewster, C. E.; Bourbon (1).

Hildebrandt, J. M.; Madagascar (42, purchased).

Horne, J.; Mauritius (2).

Parker, Dr. G. W.; Madagascar (420, purchased).

Veitch, Messrs.; Curtis's Madagascar plants (20).

North America.

Allen, T. F.; (10).

Bennett, A.; (5).

Curtiss, A. H.; South United States (200, purchased).

Davenport, G. E.; United States Filices (8).

Farlow, Dr.; *Algæ* (50).

Fletcher, J.; Canada (2).

Gray, Prof. Asa; N. American (28), and Schaffner's Mexican collection (719).

Greene, E. L.; New Mexico (201, purchased).

Haydon, Walter; Hudson's Bay (128).

Hemsley, W. B.; Mexico (10).

Jones, M. E.; Utah (6).

Lemmon, J. G.; Arizona (26).

Markham, Capt.; Vancouver's Island.

Mott, F. T.; Oregon (7).

Palmer, Dr. Edward; Mexico and Texas (1,442, purchased; 151, presented).

Ravenel; American fungi (200, purchased).

Sargent, C. S.; N. American (3).

Watson, Sereno; Florida (2).

West Indies and Guiana.

Eaton, Prof.; Bermuda ferns (10).

Eggers, Baron; St. Thomas, Dominica, &c. (200, purchased; 510, presented).

Farlow, Dr. G.; Bermuda *Algæ* (19).

Fendler, A.; Trinidad (807, purchased).

Jenman, G. S.; Jamaica (5).

Morris, D.; Jamaica (105).

Nicholls, Dr. H. A.; Dominica (2).

Noek, W.; Jamaica (7).

Prestoe, H.; Trinidad (9).

South America.

Foreign Office ; Paragnay, *Pilocarpus* sp.

Geheeb, A. ; Brazil mosses (10).

Glaziou, A. ; Brazil (620).

Kalbreyer, — ; New Granada (93).

Lorentz, Dr. P. G. ; Uruguay (50, purchased).

Sander, Messrs. ; Columbia, &c. (17).

Schrader, August ; Venezuela, *Musci* (145, purchased).

Australia.

Hartman, C. H. ; sundry cryptogamia (20).

Merrifield, Mrs. Mary P. ; *Algae* (5).

Mueller, Sir F. ; 8 phanerogams and 101 fungi.

New Zealand.

Cheeseman, T. F. (44).

Hector, Dr. (10).

Polynesia.

Department Agriculture, U. S. A., Wilkes' Grasses (95).

Storck, J. P. ; Fiji (9).

The following persons have, amongst others, prosecuted **studies in the Herbarium** during the past year :—

Aitchison, Surgeon-Major ; determination of second collection made as botanist attached to the Kuram Valley Field Force.

Balfour, Professor J. Bayley ; preparation for publication of the results of his expedition to Socotra.

Ball, John ; Morocco and Syrian plants.

Bentham, George ; Genera plantarum.

Bolus, Harry ; Cape plants.

Brace, L. J. K. ; preparing for his appointment as Curator of the Herbarium of the Royal Botanic Gardens, Calcutta.

Braithwaite, Dr. ; British musci.

Burck, Dr. S. W. ; (Buitenzorg) Javan ferns, &c.

Cantley, N. ; Singapore and Malayan plants.

Clarke, C. B. ; Flora Indica ; monographs of *Cyrtandraceae* and *Commelynaceae*.

DeCandolle, Casimir ; *Piperaceae*.

Dickins, F. V. ; Japanese collections.

Ettingshausen, Baron von ; fossil plants.

Gray, Dr. Asa ; North American *Compositae*.

Groves, H. L. J. ; *Characeae*.

Hemsley, W. B. ; Mexican and Central American Flora for the "Biologia Centrali-Americana."

Herschell, Major ; Indian ferns.

Hiern, W. P. ; Major Pinto's tropical African plants.

Lacaita, C. C. ; Italian plants.

McNab, Professor W. R. ; *Selaginaceae*.

Mangles, J. H. ; Indian Rhododendrons.

Masters, Dr. M. T. ; *Nepenthaceae*, *Sarracenia*, &c.

Solms-Laubach, Count ; *Pontederiaceae* and origin of cultivated fig.

BOTANICAL PUBLICATIONS prepared in connexion with the work of the Herbarium.

Mr. J. G. Baker, F.R.S., First Assistant in the Herbarium, has contributed to the Linnean Society notes on a collection of flowering plants made by L. Kitching, Esq., in Madagascar (Journal, vol. xviii., pp. 264–281, with two plates) ; also a synopsis of *Pitcairnia*, and papers on Kalbreyer's new Granada ferns and Curtis's Malay and Madagascar ferns contributed to the Journal of Botany.

Mr. Bentham, F.R.S., has contributed to the Linnean Society in anticipation of the forthcoming concluding part of the Genera Plantarum :—

Notes on *Orchideæ* (Journal, vol. xviii, pp. 281-360).

Notes on *Cyperaceæ* (Journal, vol. xviii, pp. 361-367).

Notes on *Gramineæ* (Journal, vol. xix., pp. 14-134).

Mr. N. E. Brown, A.L.S., Senior Second Assistant in the Herbarium, has contributed to the Gardeners' Chronicle notices of several new and interesting plants in cultivation in the Royal Gardens.

Mr. C. B. Clarke, M.A., F.L.S., Bengal Educational Service, on special duty at Kew in the preparation of the Florain British India, has contributed to the Journal of Botany a revision of the Indian specie of *Leuca*.

The Director has edited the

107th volume of the Botanical Magazine, containing illustrations and descriptions chiefly of plants which have flowered in the Royal Gardens; also *Icones Plantarum*, vol. xiv., Parts ii. and iii.

Mr. W. B. Hemsley has continued the preparation of the Botany of the Biologia Centrali-Americana, of which parts 7-10 have been published.

Dr. George Watt, F.L.S., Professor of Botany, Bengal Educational Service, has contributed to the Linnean Society, Notes on the vegetation of Chumba State and British Lahore, with description of new species (Journal, vol. xviii., pp. 368-382, with six plates).

I have, &c.

(Signed) JOS. D. HOOKER, *Director*.

To the Right Honourable

The First Commissioner of Her Majesty's Works and Buildings.

APPENDIX I.

Number of Visitors in the Year 1881, as compared with 1880.

			1880.	1881.
Total number on Sundays	-	-	315,629	411,512
Total number on weekdays	-	-	408,052	425,164
			<u>723,681</u>	<u>836,676</u>
Greatest monthly attendance (June) -	-	-	-	182,404
Smallest monthly attendance (January)	-	-	-	5,634
Greatest weekday attendance (June 6th)	-	-	-	50,683
Smallest weekday attendance (January 18th)	-	-	-	2
Greatest Sunday attendance (June 19th)	-	-	-	27,711
Smallest Sunday attendance (January 23rd)	-	-	-	281

Number of Visitors in each month.

			1880.	1881.
January	-	-	8,170	5,634
February	-	-	15,331	9,687
March	-	-	48,307	26,510
April	-	-	35,399	90,032
May	-	-	172,263	104,608
June	-	-	106,469	182,404
July	-	-	95,169	145,730
August	-	-	142,395	149,459
September	-	-	60,095	73,545
October	-	-	20,430	27,527
November	-	-	10,451	13,076
December	-	-	9,202	8,464

APPENDIX II.

List of Exotic Economic and Medicinal Plants, cultivated under glass in the Royal Gardens, Kew.

- Abrus precatorius, *L.*, Crabs Eyes; India.
 Acacia arabica, *Willd.*, Gum Arabic; Arabia, &c.
 " Catechu, *Willd.*, Catechu; India.
 " Farnesiana, *Willd.*, Cassie; West Indies.
 Achras Sapota, *L.*, Sapodilla Plum; Trop. America.
 Adansonia digitata, *L.*, Baobab; W. Africa.
 Adenanthera pavonina, *L.*, Barricari Seeds; India.
 Egle Marmelos, *Corr.*, Bael of India; E. Indies.
 Agave americana, *L.*, American Aloe; Trop. America.
 Aleurites triloba, *Forst.*, Candle Nut; Polynesia.
 Alocasia indica, *Schott.*, "Taro;" India.
 Aloe ferox, *Mill.*, Cape Aloes; Cape.
 " succotrina, Cape Aloes; *Lam.*; Cape.
 " Perryi, *Baker*, Socotra Aloes; Socotra.
 " vulgaris, *Lam.*, Barbadoes Aloes; Medit. and Trop. Asia.
 Alpinia officinarum, *Hance.*, Galangal; China.
 Alstonia scholaris, *R. Br.*, Dita bark; E. Indies.
 Amomum masticatorum, *Thuc.*; Ceylon.
 " Melegueta, *Roxb.*, Grains of Paradise; Trop. Africa.
 Anacardium occidentale, *L.*, Cashew Nut; India.
 Anamirta paniculata, *Colebr.*, Cocculus Indiens; India.
 Andira inermis, *Kth.*, Bastard Cabbage Bark; T. America and Africa.
 Andropogon citratus, *D.C.*, Indian Lemon Grass.
 " Nardus, *L.*, Citronella; India.
 " muricatus, *Retz.*, Cuscut; India.
 " Schœnanthus, *L.*, Rusa oil; India.
 Anona Cherimolia, *Mill.*, Cherimoyer; Bolivia, Peru.
 " muricata, *L.*, Soursoop; Trop. America.
 " palustris, *L.*, Alligator Apple; Trop. America.
 " reticulata, *L.*, Custard Apple; Tropics, cult.
 Antiaris sacchora, *Dalz.*, Sack Tree; India.
 " toxicaria, *Lesch.*, Upas tree; Java.
 Arracacha esculenta, *D.C.*, Arracacha; Trop. America.
 Arachis hypogæa, *L.*, Ground Nut; Tropics.
 Araucaria Bidwillii, *Hk.*, Bunya-Bunya; Queensland.
 Areca Catechu, *L.*, Betel Nut; E. Indies.
 Arenga saccharifera, *Lab.*, Sugar Palm; Ind. Arch.
 Argania Sideroxylon, *R. and S.*, Argan Oil; Morocco.
 Artanthe elongata, *Miq.*, Matico; S. America.
 Artocarpus incisa, *L.*, Bread Fruit; Polynesia.
 " integrifolia, *L.*, Jack Fruit; Trop. Asia.
 Asclepias Curassavica, *L.*, False Ipecacuanha; W. Indies.
 Attalea Cohune, *Mart.*, Cohune Nut; Honduras.
 Averrhoa, Bilimbi, *L.*, Blimbing; India.
 " Carambola, *L.*, Carambola; India.
 Balsamodendron Opobalsamum, *Kth.*, Balm of Gilead; Trop. E. Africa.
 Bassia butyracea, *Roxb.*, Vegetable Butter; N. India.
 " latifolia, *Roxb.*, Mahwa Tree; India.
 Batatas edulis, *Chy.*, Sweet Potato; Tropics.
 Benincasa cerifera, *Savi.*, White Gourd; Tropics of Old World.
 Berrya Ammonilla, *Roxb.*, Trincomalee Wood; India.
 Bixa Orellana, *L.*, Arnatto; Tropics, cult.
 Blighia sapida, *Ky.*, Akee Tree; W. Africa.

- Bæhmeria nivea*, *Hk.*, China Grass ; Trop. Asia.
 „ *Puya*, *Hk.* Nepal.
Boldoa fragrans, *Juss.*, Boldo ; Chili.
Bombax Ceiba, *L.*, Silk Cotton Tree ; Trop. America.
 „ *malabaricum*, *D. C.*, Cotton Tree ; India.
Boussingaultia baselloides, *Kth.* ; Ecuador.
Bromelia Ananas, *L.*, Pine Apple ; Tropics.
Brosimum Alicastrum, *Sw.*, Bread Nut ; Trop. America.
Buphane toxicaria, *Herb.*, Poison Bulb ; Cape.
Butea frondosa, *Kantig.*, Dhak or Pulas ; India.
Cæsalpinia Bonduc, *L.* ; Tropics.
 „ *coriaria*, *Willd.*, Divi-Divi ; S. America.
 „ *Sappan*, *L.*, Sappan Wood ; India.
Cajanus indicus, *Spr.*, Pigeon Pea, Dhal ; E. Indies.
Callitris quadrivalvis, *Vent.*, Sandarach ; N. Africa.
Calophyllum Calaba, *Jacq.*, Calaba Oil ; Trop. America.
 „ *inophyllum*, *L.* ; Trop. Asia.
Calotropis gigantea, *Br.*, Muddar ; India.
Canavalia obtusifolia, *D. C.* ; Trop. Africa.
Canella alba, *Murr.*, Canella Bark ; W. Indies.
Canna edulis, *Ker.*, Tous-les-mois ; W. Indies.
Capparis spinosa, *L.*, Capers ; Mediterranean region.
Capsicum annuum, *L.*, Red Pepper ; Trop. America.
Carica candamarcensis, *Hk. f.* ; Columbia.
 „ *Papaya*, *L.*, Papaw ; Tropics.
Carissa Carandas, *L.*, India.
Carludovicia palmata, *R. and P.* ; Peru and New Grenada.
Caryophyllus aromaticus, *L.*, Cloves ; Moluccas.
Casimiroa edulis, *Llav. and Lex.*, Mexican Apple ; Mexico.
Cassine Maurocenia, *L.*, Hottentot Cherry ; Cape.
Castanospermum australe, *A. Cunn.*, Moreton Bay Chestnut ; Australia.
Castilleja elastica, *Cerv.*, Panama India-rubber ; Cent. America.
Catha edulis, *Forsk.*, Arabian Tea ; Arabia.
Cedrela odorata, *L.*, W. Indian Cedar ; W. Indies.
Cephaelis Ipecacuanha, *Rich.*, Ipecacuanha ; Brazil.
Ceratonia siliqua, *L.*, Carob Tree ; Levant, S. Europe.
Ceroxylon andicola, *H and B.*, Wax Palm ; S. America.
Chamærops humilis, *L.* ; S. Europe, N. Africa.
Chloranthus inconspicuus, *Sw.*, Chu-lan ; China.
 „ *officinalis*, *Bl.* ; India.
Chlorocodon Whitei, *Hk. f.*, Mundi root ; Natal.
Chloroxylon Swietenia, *L.*, Satin wood ; Ceylon and India.
Chondrodendron tomentosum, *R. and P.*, Pareira Brava ; Brazil.
Chrysobalanus Icaco, *L.*, Cocoa Plum ; Trop. Africa and America.
Chrysophyllum Cainito, *L.*, Star Apple ; W. Indies.
Cicer arietinum, *L.*, Gram ; S. Europe and India.
Cinchona Calisaya, *Wedd.*, Yellow Bark ; Peru and Bolivia.
 „ *var. Verde.*
 „ *condaminea*, *B. and B.* ; Peru.
 „ *cordifolia*, *Mutis.* ; Colombia.
 „ *var. ?* Colombian Bark ; Colombia.
 „ *glandulifera*, *R. and P.*
 „ *Ledgeriana*, *How.* ; Bolivia.
 „ *micrantha*, *R. and P.*, Lima Bark ; Peru.
 „ *officinalis*, *L.*, Crown Bark ; Peru.
 „ *var.*
 „ *crispa*, Quina fina de Loxa ; Peru.
 „ *Pahudiana*, *How.* ; Trop. America.
 „ *Peruviana*, *How.*, Grey Bark ; Peru.
 „ *robusta*, *Trimen* ; Ceylon Hybrid.
 „ *succirubra*, *Pav.*, Red Bark ; Ecuador.
Cinnamodendron corticosum, *Miers.*, Mountain Cinnamon ; W. Indies.

- Cinnamomum Camphora, *Nees*, Camphor; Japan and Formosa.
 " Cassia, *Bl.*, Cassia lignea; Java, cult.
 " zeylanicum, *Nees*, Ceylon Cinnamon; Ceylon.
 Cissampelos Pareira, *L.*, Pareira brava; Tropics.
 Citrus Aurantium, *L.*, Sweet Orange; India.
 " " var. Bergamia, Bergamot Orange.
 " " " Bigaradia, Bitter or Seville Orange.
 " " " japonica, Kumquat.
 " " " myrtifolia.
 " " " melitense, Blood Orange.
 " decumana, *Willd.*, Shaddock; Tropics, cult.
 " Limetta, *Risso.*, Sweet Lime.
 " Limonum, *L.*, Lemon; cultivated.
 " medica, *L.*, Citron; cultivated.
 " nobilis, *Lour.*, var. Tangerina, Tangerine Orange.
 " " " major, Mandarin Orange.
 Cocos nucifera, *L.*, Cocoa-nut; Tropics.
 Coffea arabica, *L.*, Coffee; Tropics, cult.
 " " var. Mocha.
 " liberica, *Hiern*, Liberian Coffee; Liberia.
 Coix Lachryma, *L.*, Job's Tears; Tropics.
 Cola acuminata, *R. Br.*, Cola Nut; W. Trop. Africa.
 Colocasia antiquorum, *Schott*, Coco; Tropics.
 Convolvulus Scammonia, *L.*, Scammony; Levant.
 Cookia punctata, *Retz.*, Wampee; China.
 Copaifera officinalis, *L.*; Colombia.
 " Lansdorfii, *Desf.*, Balsam of Copaiba; Brazil.
 Corchorus capsularis, *L.*, Jute; India.
 " olitorius, *L.*, Jews' Mallow; India.
 Cordia Myxa, *L.*, Sebestens; India.
 Cordyline sp., cultivated "Ti" of New Zealanders.
 Couroupita guianensis, *Aubl.*, Cannon Ball Tree; Guiana.
 Cratæva gynandra, *L.*, Garlic Pear; Trop. America.
 Crescentia Cujete, *L.*, Calabash Tree; Trop. America.
 Crotalaria juncea, *L.*, Sunn Hemp; India.
 Croton Eleutheria, *Benn.*, Eleuthera Bark, Cascarilla; Bahamas.
 " niveum, *Jacq.*; Bahamas.
 " Tiglium, *L.*, Croton Oil; India.
 Cryptostegia grandiflora, *R. Br.*; India.
 " madagascariensis, *Boj.*; Madagascar.
 Cucumis Melo, *L.*, Melon.
 " sativus, *L.*, Cucumber.
 " " var. Sikkimensis, *Hk. f.*, Himalaya.
 Curcuma longa, *L.*, Turmeric; India.
 " Zedoaria, *Rosc.*, Zedoary Root; E. Indies.
 Cyperus esculentus, *L.*, Earth Almond; Orient.
 Cyphomandra betacea, *Sedtn.*; Cent. America.
 Cytisus proliferus, *L. f.*, Tagasaste; Canary Islands.
 Daphne papyracea, *Wall.*, Paper Daphne, India.
 Dacrydium Franklinii, *Hk. f.*, Huon Pine; Tasmania.
 Dalbergia Sissoo, *Roxb.*; E. Indies.
 Dammara australis, *Lamb.*, Kauri Pine; New Zealand.
 " robusta, *C. Moore*; Queensland.
 Derris elliptica, *Benth.*, Tubah; Ind. Arch.
 Detarium senegalense, *Gmel.*, Dattock; W. Trop. Africa.
 Dichopsis Gutta, *Benth.*, Gutta Percha; E. Indies.
 Dioscorea alata, *L.*, Yam; Moluccas and Java.
 Diospyros Embryopteris, *Pers.*, Gaub; E. Indies.
 " Ebenum, *Retz.*, Ceylon Ebony; Ceylon.
 " Kaki, *L.*, Kaki; China and Japan.
 Dipteryx odorata, *Willd.*, Tonquin Bean; Guiana.
 Dorstenia Contrayerva, *L.*, Contrayerva Root; Trop. America.

- Dracæna Draco*, *L.*, Dragon Tree; Teneriffe.
 sp., Dragons Blood; Socotra.
Drimys Winteri, *Forst.*, Winter's Bark; S. America.
Duboisia myoporoides, *Muell.*; Australia.
Durio Zibithinus, *L.*, Durian; Ind. Arch.
Elaeis guineensis, *Jacq.*, Oil Palm; W. Trop. Africa.
Elætaria Cardamomum, *Mat.*, Cardamoms; India.
Entada scandens, *L.*; Tropics.
Epipremnum mirabile, *Schott.*, Tonga; Malay and Pacific Islands.
Eriobotrya japonica, *Kampff.*, Loquat; China and Japan.
Eriodendron anfractuosum, *D.C.*, Silk Cotton Tree; Trop. America.
Erythroxylon Coca, *Lam.*, Coca; Peru.
Eucalyptus amygdalina, *Lab.*, Peppermint Tree; Australia.
 citriodora, *Hook.*; Queensland.
 Globulus, *Lab.*, Blue Gum; Australia.
 lenoxylon, *Muell.*, Iron Bark; New S. Wales.
Euchæna luxurians, *Mais.*, Teosinte; Guatemala.
Eugenia edulis, *Berg.*; Brazil.
 Jambolana, *Lam.*; India.
 Michellii, *Lam.*; Brazil.
 Ugni, *Hook and Arn.*; Chili.
Euonymus Sieboldianus, Pai-cha wood; China.
Euphorbia resinifera, *Berg.*, Gum Euphorbium; Morocco.
Eurybia argophylla, *Cass.*, Musk Wood; Tasmania.
Euterpe edulis, *Mart.*, Cabbage Palm; Brazil.
Excæcaria Agallochum, *L.*, Eagle wood; Trop. Asia.
Fatsia papyrifera, *Benth.*, Rice Paper Tree; Formosa.
Feronia Elephantum, *Corr.*, Wood Apple; India.
Ficus Carica, *L.*, Fig; Levant.
 bengalensis, *L.*, Banyan; India.
 elastica, *Roxb.*, India-rubber; India.
 religiosa, *L.*, Fig; India.
 sycamorus, *L.*, Sycamore Fig; Egypt.
Flacourtia sepiaria, *Roxb.*; India.
 Ramontchii, *L'Her.*; India.
Galactodendron utile, *H. B.*; Cow Tree; Venezuela.
Garcinia indica, *Choisy*, Kokum Oil; India.
 Hanburyi, *Hook. f.*, Siam Gamboge; Cambodia and Cochin China.
 Mangostana, *L.*, Mangosteen; Malay Arch.
 Morella, *Desrous.*, Ceylon Gamboge; Ceylon.
 Xanthochymus, *Hk. f.*; India.
Gelsemium sempervirens, *Ait.*, False Jessamine; N. America.
Genipa americana, *L.*; S. America.
Glycosmis pentaphylla, *Corr.*; E. Indies.
Gossypium arboreum, *L.*, Tree Cotton; cultivated.
 hirsutum, *L.*, Indian Cotton; cult.
 herbaceum, *L.*; cult.
Grias cauliflora, *L.*, Anchovy Pear; Jamaica.
Guaiaacum officinale, *L.*, Lignum Vitæ; W. Indies.
Guilfordia speciosa, *Mart.*, Peach Palm; Trop. America.
Guizotia oleifera, *D.C.*, Ram-til Oil; Abyssinia and India.
Gynocardia odorata, *Roxb.*, Chaulmugra; East Indies.
Hæmatoxylon campechianum, *L.*, Logwood; Cent. America.
Helichrysum serpyllifolium, *Less. V.*, Cape Colony Tea; Cape.
Hevea brasiliensis, *Mull.*, Para Rubber; Brazil.
 Spruceana, *Mull.*; Brazil.
Hibiscus Abelmoschus, *L.*, Okro; Tropics.
 mutabilis, *L.*; China.
Hippomane Mancinella, *L.*, Manchineel Tree; W. Indies.
Hura crepitans, *L.*, Sandbox Tree; Trop. America.
Hymenæa Courbaril, *L.*, Locust Tree; W. Indies.
 verrucosa, *Gartn.*, Copal; Madagascar.

- Hydnocarpus venenatus*, *Gartn.*, Fish Poison; Ceylon.
Ilex paraguayensis, *St. Hil.*, Paraguay Tea; Paraguay.
Illicium anisatum, *L.*, Star Anise; Japan and China.
 " *floridanum*, *L.*, Aniseed Tree; Florida.
Indigofera Anil, *L.*, Indigo; W. Indies.
 " *tinctoria*, *L.*, Indigo; Tropics, cultivated.
Ipomœa Purga, *Hayne.*, Jalap; Mexico.
Jambosa vulgaris, *D.C.*, Rose Apple; E. Indies.
Jateorrhiza Calumba, *Miers.*, Calumba Root; E. Africa.
Juniperus bermudiana, *L.*, Pencil Cedar; W. Indies.
Kaempferia Galanga, *L.*; China.
Lagetta lintearia, *Lam.*, Lace-bark Tree; Jamaica.
Lagenaria vulgaris, *Ser.*, Bottle Gourd; India.
Landolphia florida, *Benth.*, African Rubber; Trop. Africa.
 " *Kirkii*, *Dyer*, African Rubber; E. Trop. Africa.
 " *Petersiana*, *Dyer*, African Rubber; E. Trop. Africa.
Lansium domesticum, *Jack.*, Langsat; Malacca.
Lawsonia inermis, *L.*, Henna; Egypt.
Lecythis Pisonis, *Camb.*; Brazil.
 " *Zabucajo*, *Aubl.*, Sapucaia Nut; S. America.
Lucuma deliciosa, *Pl. and Ldl.*; New Grenada.
 " *mammosa*, *Gr.*; Trop. America.
Luffa acutangula, *L.*
 " *ægyptiaca*, *D.C.*
Lygeum Spartum, *L.*, Albardin; Europe.
Macadamia ternifolia, *Muell.*, Queensland Nut; E. Australia.
Machærium firmum, *L.*, Rosewood; Brazil.
Maclura tinctoria, *Don.*, Fustic; Trop. America.
Macrochloa tenacissima, *Kunth*, Esparto; N. Africa.
Mallotus philippinensis, *Mull.*, Kamala Dye; Eastern Tropics.
Malpighia glabra, *L.*, Barbadoes Cherry; Trop. America.
 " *urens*, *L.*; Trop. America.
 " *punicifolia*, *L.*; Trop. America.
Mammea americana, *L.*, Mammee Apple; W. Indies.
Mangifera indica, *L.*, Mango; Tropics, India.
Manicaria saccifera, *Gartn.*, Bussu Palm; Amazons.
Manihot Aipi, *Pohl.*, Sweet Cassava; Trop. America.
 " *Glaziovii*, *Mull.*, Ceara Rubber; Brazil.
 " *utilissima*, *Pohl.*, Bitter Cassava; Trop. America.
Maranta arundinacea, *Rosc.*, Arrowroot; S. America.
Marcgraavia umbellata, *L.*; Trop. America.
Marsdenia Condurango, *Reich f.*; Colombia.
Mauritia flexuosa, *L.f.*, Ita Palm; Trop. S. America.
Melaleuca Cajeputi, *Roxb.*, Cajeput Tree; Ind. Arch.
Melia Azedarach, *L.*, Persian Lilac; India.
Melicococa bijuga, *L.*, Genip Tree; Trinidad, Colombia.
Mesembryanthemum edule, *L.*, Hottentot Fig; Cape.
Mimusops Elengi, *L.*; India.
 " *globosa*, *Gartn.*, Gum Balata; Tropics.
Monodora Myristica, *Dun.*, Calabash Nutmeg; W. Trop. Africa.
Monizia edulis, *Love*, Carrot Tree; Madeira.
Mora exelsa, *Schomb.*, Mora; Guiana.
Monstera deliciosa, *Liebm.*; Mexico.
Moringa cancanensis, *Nimm.*; India.
 " *pterygosperma*, *Gartn.*, Horse-radish Tree; India.
Mucuna pruriens, *D.C.*, Cowitch; India.
Musa Cavendishii, *Paxl.*, Dwarf Banana; Cultivated.
 " *paradisica*, *L.*, Plantain; Tropics.
 " *textilis*, *Nees*, Manilla Hemp; Ind. Arch.
Myristica moschata, *Thunb.*, Nutmeg; Ind. Arch.
Nectandra Rodiaci, *Schomb.*, Greenheart; Guiana.
Nephelium Litchi, *Don*, Litchi; China.

- Nicotiana Tabacum, L.*, Tobacco; cultivated.
 rustica, L., Turkish Tobacco; cultivated.
Olea europea, L., Olive; cultivated.
Opuntia cochinillifera, Haw., Cochineal Cactus; S. America.
 Ficus-indica, L., Indian Fig; Trop. America.
Oryza sativa, L., Rice plant; India, cult.
Osmanthus fragrans, Lour.; Japan and China.
Oxalis Deppei, Lodd.; Mexico.
Pæderia fetida, L., Bedolee Sutta; India and Japan.
Pandanus utilis, Bory., Vacoua; Mauritius.
Paritium elatum, Dou., Cuba Bast.; W. Indies.
Parmentiera cereifera, Sum., Candle Tree; Panama.
Passiflora edulis, Sims, Granadilla; Brazil.
 macrocarpa Mast.; Brazil.
 quadrangularis, L.; Jamaica.
Paullinia pinnata, L.; Trop. America.
Pelargonium capitatum, Ait.; Cape.
Penicillaria spicata, Willd., Gero; Trop. Africa.
Pentzia virgata, Lees; Cape.
Perilla ocimodes, L., Ye-goma; Japan.
Persea gratissima, Gartin., Avocado Pear; Trop. America.
Petiveria alliacea, L., Toothache Tree; Trop. America.
Phaseolus Mungo, L., Moong; Trop. Asia.
Phoenix dactylifera, L., Date Palm; Africa and Asia.
Physalis edulis, Sims, Cape Gooseberry; Peru.
Phyostigma venenosum, Balf., Calabar Ordeal Bean; W. Trop. Africa.
Phytalephas macrocarpa, R. and P., Vegetable Ivory; Trop. America.
Picramnia excelsa, L., Jamaica Quassia; W. Indies.
Pilocarpus pennatifolius, Lem., Jaborandi; Brazil.
Pimenta acris, Wight, Wild Clove; W. Indies.
 officinalis, Ldl., Allspice; W. Indies.
Piper Cubeba, L.f., Cubebs; Ind. Arch.
 Betel, L., Betel Pepper Leaf.
 methysticum, Forst.; Kava-kava; Pacific Islands.
 nigrum, L., Black Pepper; Trop. Asia.
Pistacia Terebinthus, L., Chian Turpentine; Mediterranean Region.
 Lentiscus, L., Mastice; Greek Arch.
 vera, L., Pistacia; S. Europe.
Pogostemon Patchouli, Pell., Patchouli; Ind. Arch.
Pronium Palmita, E.M., Palmito; S. Africa.
Prosopis juliflora, D.C., Algarobo; W. Trop. Africa.
Psidium Guava, Raddi, Guava; S. America.
 Cattleianum, Lab.; W. Indies.
 polycarpum, Lam.; Jamaica.
Psophocarpus tetragonolobus, D. C.; W. Trop. Africa.
Punica granatum, L., Pomegranite; cultivated.
Putranjiva Roxburghii, Wall.; India.
Quassia amara, L., Surinam Quassia; Guiana.
Quercus Egilops, L., Valonia Oak; Asia Minor.
 Iusitanica var. infectoria, A.D.C., Aleppo Gall Oak; Asia Minor.
Rhus vernicifera, D.C., Lacquer Tree; Japan.
 succedanea, L., Japan Wax; Japan.
Ricinus communis, L., Castor Oil; India.
Rubia cordifolia, L., Indian Madder; India.
Saccharum officinarum, L., Sugar Cane; cultivated.
Salvadora persica, L., Reputed "Mustard Tree" of Scripture; Syria to India.
Sansevieria cylindrica, Boj., Ite; Trop. Africa.
 zeylanica, Willd., Bow-string Hemp; India.
Sapindus acuminatus, Wall.; India.
 Saponaria, L., Soap Berry; Trop. America.
Sarcocephalus esculentus, Lab., Negro Peach; W. Trop. Africa.
Schinus Molle, L., Peruvian Mastic; Brazil and Peru.

- Schleichera trijuga*, W. ; India, &c.
Schenocaulon officinale, Gray, Sabadilla ; Trop. America.
Seilla maritima, L., Squills ; Medit. shores.
Sesamum indicum, L., Gingelly oil ; cultivated.
Sida rhombifolia, L. ; India, &c.
Simaba Cedron, Planch., Cedron ; New Grenada.
Simaruba amara, Aubl. ; W. Indies and Guiana.
Smilax officinale, H.B.K., Sarsaparilla ; Colombia.
 " sp., Caracas Sarsaparilla ; Caracas.
Solanum Melongena, L., Aubergine ; India.
Sorghum saccharatum, Manch., Millet ; cultivated.
Spondias lutea, L., Golden Apple ; Trop. America.
 " mangifera, Pers., Hog Plum ; India.
 " pleiogyne, Muell. ; Australia.
Stenotaphrum americanum, Sch. ; Trop. America.
Sterculia Chicha, St. Hil. ; Brazil.
Stillingia sebifera, Michx., Chinese Tallow-tree ; China.
Strychnos Ignatii, Ignatius Bean ; Borneo ?
 " Nux-vomica, L., Vomit Nut ; E. Indies.
 " potatorium, L. fil., Clearing Nut ; India.
Styrax officinale, L., True Storax ; S. Europe.
Swietenia Mahagoni, L., Mahogany ; Trop. America.
Tacca pinnatifida, L., Ti ; Ind. Arch.
Tabernamontana crassa, Benth.
Tamarindus indica, L., Tamarind ; Trop. Africa.
Tanghinia venenifera, Poir., Tanghin Poison ; Madagascar.
Tectona grandis, L., Teak ; E. Indies.
Terminalia Bellerica, Roxb., Myrabolans ; India.
 " Catappa, L., Indian Almond ; Tropics.
Thea chinensis, L., Tea ; China.
 " var. assamica, Mast., Assam Tea.
Theobroma Cacao, L., Cocoa ; Trop. America.
Tinospora cordifolia, Miers., Galancha ; India, &c.
Toddalea aculeata, Pers., Toddalia root ; India.
Toluifera Balsamum, L., Balsam of Tolu ; Venezuela.
 " Pereiræ, Baill., Balsam of Peru ; San Salvador.
 " peruifera, Baill., Peru and Brazil.
Trachylobium Hornemannianum, Hayne, Copal ; E. Trop. Africa.
Triphasia trifoliata, D.C. ; China.
Tylophora asthmatica, W. & A., Indian Ipecacuanha ; E. Indies.
Urostigma Vogeli, Miq. ; Liberia.
Vahea gummifera, D.C. ; Madagascar Rubber.
Vangueria edulis, Vahl, Voa Vanga ; Madagascar.
Vanilla planifolia, And., Vanilla ; Mexico and W. Indies.
Vigna Catjang, Endl., Chowlee ; E. Indies.
Vitis vinifera, L., Grape Vine ; Levant.
 " var. corinthiaca, Currant Vine ; Levant.
Walsura Piscidia, Roxb., Fish Poison ; India.
Zingiber officinale, Roscoe, Ginger ; Tropics.
Zizyphus Jujuba, Lam., Jujube ; Old World Tropics.

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