

KEW
REPORIS







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REPORT

ON

THE PROGRESS AND CONDITION

OF

THE ROYAL GARDENS AT KEW,

During the Year 1878.



LONDON:

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REPORT

ON

THE PROGRESS AND CONDITION

OF

THE ROYAL GARDENS AT KEW,

During the Year 1878.

Royal Gardens, Kew, January 1, 1879.

SIR,

THE number of visitors to the Royal Gardens during the past year exhibits a considerable increase over any previously reported. It is nearly 26,000 in excess of the attendance in 1874, the highest previously recorded, and 37,450 in excess of the attendance of the previous year, 1877. As in preceding years, the bank holiday in August brought the greatest crowd, though the number, 57,121, was slightly less than that in 1877, notwithstanding that the Gardens were opened three hours earlier in the day.

In accordance with the decision of the Board, to which I willingly assented (Kew Report for 1877, p. 10), the Gardens have been thrown open to the public at 10 a.m. on the four bank holidays. Considering the persistence and energy with which the movement for a daily early opening was pressed, I confess I am surprised at the small success, from that point of view, which has attended the experiment. I am confirmed in my belief that the demand does not really correspond to any widely-felt public want, and that the present ordinary hour of opening is entirely adequate to the convenience and needs of metropolitan visitors, while I am more than ever convinced that the early opening would be highly prejudicial to the unique character of the Royal Gardens as a place of public resort.

It must never be lost sight of that

Kew is a highly-kept garden, with all the beauty and amenity of a private establishment, and not an ordinary park for open-air recreation. On April 22 the total number of visitors from 10 a.m. to 7 p.m. was 46,201, the number in the preceding year from 1 to 7 p.m. being 29,296. But the numbers before 1 o'clock are only in the proportion of 1 out of 15 of the total number of visitors.

The figures for each hour are as follows:—

10 to 11 -	-	593
11 to 12 -	-	1,024
12 to 1 -	-	1,735

Total	-	3,352
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On June 10 the proportion of early visitors (6,703) to the total (56,715) is rather greater, while on August 5, when the number of early visitors was 3,997, it again bears about the same ratio of 1 to 15. On December 26 the entire number of visitors throughout the day was only 119.

The lessons given to the young gardeners in the evening, about twice a week throughout the year, and upon which the attendance is voluntary, continue to give satisfactory results. The subjects of the lectures are elementary meteorology, physics, and chemistry during the winter months, and structural, systematic, geographical, and economic botany during the summer. The importance of this instruction in

fitting the young men for public appointments in the colonies and elsewhere, which we are so constantly asked to fill up from Kew, cannot be over estimated.

BOTANIC GARDENS.

Palm House.—The hot-water apparatus described in the Report for 1877 (pp. 10, 11, with plan and sections) has proved eminently successful, and there has been no drawback of any kind in its working. An equable and sufficient temperature has been obtained throughout the winter months, and the growth of the plants has been proportionately vigorous. The consumption of fuel is very moderate, and the stoking, though requiring more care than with ordinary boilers, is in no sense more complicated or onerous. The flow and return pipe which has been carried round the gallery is a novel feature in the heating of large houses, and in every respect a most important one; it not only (by heating the upper part of the house) checks the rapid absorption and loss of the heat given off from the pipes in the body of the house, but reduces very much the amount of drip in wet weather, which results from the condensation of vapour on the iron rafters. I feel satisfied that no plant-house of any considerable height, whether built of wood or of iron, should be unprovided with a flow and return pipe at an elevation of at least half the height of the building, both for the good of the plants, and the preservation of the material used in construction. The Palm House heating apparatus has been inspected by visitors interested in horticulture from all parts of the kingdom and the continent, including His Majesty the King of the Belgians.

The extensive collection of *Bromeliaceæ*, of which the bulk is to be found on the shelves of the east transept in the Palm House, has

been carefully revised and catalogued by Mr. J. G. Baker, F.R.S., assistant keeper of the Herbarium. The list is attached to this Report as Appendix II., in continuation of the series of such catalogues which I promised in the Report for last year in which the *Aroideæ* were given.

Tropical Fern House (No. 2).

—The repairing and repainting of this important and popular house has again been postponed, and it is now fast passing into a condition which can only be described as ruinous. The rafters are extensively decayed, and in many places affected with dry rot. It is a matter well worthy of consideration whether some hard wood, such as teak or blue gum, could not be used in place of pine for the woodwork, which would be more durable under the moist conditions necessary for the cultivation of Ferns.

Mr. Peacock's Collection of

Succulents.—At the close of last year Mr. John T. Peacock of Sudbury House, Hammersmith, expressed a wish to exhibit in some public establishment his well-known and valuable collection of succulent plants. After consultation with the Board, it was decided to offer to Mr. Peacock for the purpose the South Octagon of the Temperate House. This proposal having been accepted, the collection has been deposited there by Mr. Peacock for a period of three years. It is particularly rich in specimen plants and in species of *Agave*, in which respect it supplements the immense general collection already in the possession of the Royal Gardens.

The introduction of uncommon specimen trees along the paths is being proceeded with, and will soon become an important feature. These are provided with upright slate tallies, lettered in black on a white ground, which have been found to be the most economical and efficient kind of tally.

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

- Adenium speciosum*, Forsk.
Albica Wakefieldii, Baker, sp. n.
 „ *juncifolia*, Baker, sp. n.; Bot. Mag. 6395.
Allium Erdelii, Zucc.; Bot. Mag. 6426.
Anemonopsis macrophylla, Sieb. et Zucc.; Bot. Mag. 6413.
Aponogeton spathaceum, var. *juncum*, Lehm. (sp.); Bot. Mag. 6399.
Argemone hispida, A. Gray; Bot. Mag. 6402.
Aristolochia trilobata, L.; Bot. Mag. 6389.
Aster Townshendii, Hook. f.; Bot. Mag. 6430.
Campanula macrostyli, Boiss.; Bot. Mag. 6394.
Chionodoxa Lucilæ, Boiss.; Bot. Mag. 6433.
Chlorophytum polyrhizon, Baker, sp. n.
Clematis grewieflora, D.C.; Bot. Mag. 6369.
Crassula alpestris, L. f.
Cotyledon ramosissima, Haw.; Bot. Mag. 6417.
Crinum Forbesianum, Herb.
 „ *Macowani*, Baker; Bot. Mag. 6381.
Crocus Elwesii, Maw, sp. n.
 „ *etruscus*, Parl.; Bot. Mag. 6362.
Daphne Blagayana, Freyer.
Deherainia smaragdina, Dene; Bot. Mag. 6373.
Derris elliptica, Benth. ("Tubah").
Dioscorea vittata, Hook. f.; Bot. Mag. 6409.
Encphalartos Frederici Guillemi, Lehm. (male).
Erythraea venusta, Gray; Bot. Mag. 6396.
Escallonia floribunda, H. B. K.; Bot. Mag. 6404.

- Euchlana luxurians*, D. R. & Aschs.; Bot. Mag. 6414.
Eucomis amaryllidifolia, Baker, sp. n.
Fritillaria Hookeri, Baker; Bot. Mag. 6385.
Fimbristylis Drummondii, Beckl.
Grammanthes chloraeflora, var. *cæsia*, E. Meyer, (sp.); Bot. Mag. 6401.
Grevillea cricifolia, Br.; Bot. Mag. 6361.
Griffinia ornata, T. Moore; Bot. Mag. 6367.
Hæmanthus Arnottii, Baker, sp. n.
Hedysarum Mackenzii, Richardson; Bot. Mag. 6386.
Huernia flava, N. E. Br. sp. n.
 „ *reticulata*, Mass.
Iris balkana, Janka.
 „ *cashmiriana*, Baker.
Loasa vulcanica, Ed. André; Bot. Mag. 6410.
Loxococcus rupicola, Wendl. & Drude; Bot. Mag. 6358.
Mascarenhasia, sp. n.
Malcolmia strigosa, Boiss.
Mesembryanthemum hirtum, N.E. Br. sp. n.
Montbretia Pottsii, Baker.
Nardostachys Jatamansi, D.C. (Spikenard).
Nymphaea alba, L., var. *rosea*.
Ornithogalum aurantiacum, Baker, sp. n.
Pentstemon Clevelandii, A. Gray.
Podolepis rugata, Labil.
Scoliopus Bigelovii, Torrey.
Sedum Semenovii, Mast.
Sempervivum Reginae Amelie, Held. & Sart.
Senecio subscandens, Hochst.; Bot. Mag. 6363.
Stapelia Curtisii, Haw.
 „ *glandulifera*, Haw.
 „ *glanduliflora*, Mass.
 „ *erectiflora*, N.E.Br., m.s., sp. n.
 „ *tsomoensis*, N.E.Br., m.s., sp. n.
 „ *glabricaulis*, N.E.Br., m.s., sp. n.
Tulipa kolpakowskiana, Regel.

Tillandsia circinalis, Griseb.
 " *paucifolia*, Baker.
Villarsia capitata, Hook. ; Bot.
 Mag. 6420.

ARBORETUM.

Whilst the loss of old trees in this piece of ground, by decay and the winter gales, goes on as usual, the plantations of young ones are flourishing, and have, in some places, attained a height of 15 to 20 feet. Still there is a great deal to be done both in removal of old trees and the planting of new; and as the plantations of the latter require digging twice a year, it is obvious that the keeping of the sylvan scenery of the Arboretum will ever entail a heavy cost, quite irrespective of the labour which must be bestowed upon the collections that are interspersed amongst the more openly timbered parts, and occupy the open spaces.

The most extensive of the young plantations is that along the river side, extending from the Brentford Ferry Gate to opposite Sion House, which was made in 1862 with the object of hiding the town of Brentford. It occupied the ground which had already been devoted to the collection of elms, walnuts, hickories, and a portion of that devoted to oaks, and contained 8,750 trees, besides shrubs in large quantities to act as nurses to the young trees. Owing to the badness of the soil and to the exposure to the west and south-west, this plantation made very slow growth for the first 10 years, since which period it has been more rapid, and the elms especially have, in many cases, assumed a very handsome appearance. From time to time this plantation had been thinned here and there, and in 1868 an avenue parallel to the river was cut through it; but it was not till the present year that it was taken in hand as a final measure, when all the trees that interfered with those best worth keeping, together with

the old shrubs, have been removed. During this clearing, many of the specimen elms and oaks which had been buried in the plantation have been exposed; of these the elms, being grafts in many cases, had, with a few exceptions, either dwindled or perished, but the oaks had greatly improved, and the *Quercetum* by the river, to which large additions of species are being yearly made, is already an important feature. The specimens will be provided with hanging wooden labels, giving their names and native countries.

The oak collection has been further extended by the transplantation of many species and varieties (whose roots were cut for the purpose last year (see 1877 Report, p. 13) to the sides of the paths from the nursery beds in which they were brought forward; these also have been provided with conspicuous labels.

The collection of beeches, chestnuts, hornbeams, &c. will have to be disposed of next year in a similar manner.

The collection of poplars along the path leading to the south from that which goes to the Brentford Gate has been much enlarged and improved by contributions of rare and new kinds, especially from Messrs. Van Volxen of Brussels and Booth of Hamburg, gentlemen whose liberality to this establishment has been continuous for many years. To these and to Messrs. Lee of Hammer-smith, Osborne of Fulham, and other firms whose names are recorded on p. 19, I have to tender my sincere acknowledgments for many contributions and much public-spirited support.

The beds of *Rosaceæ* to the west of the Pagoda Avenue have been supplied with fresh soil, thinned of shrubs, which had been planted amongst them as nurses, and improved in various ways.

A collection of varieties of ivy has been made by the curved walks

leading up to the King William Temple on the south side.

A bed for the collection of *Clematis* has been made on the west side of the small garden near the Temple of Minden.

New beds for the heaths and allied plants (*Ericaceæ*) in the ground to the west of King William's Temple have been finished and filled with speci-

mens for the most part generously presented by the leading nurserymen.

INTERCHANGE OF PLANTS AND SEEDS.

The receipts have been, during the past year, 4,803 plants of all kinds and 2,337 packets of seeds from 239 contributors. They were distributed as follows :—

	Ward's Cases.	Packets of Seeds.	Stove and Greenhouse Plants.	Herbaceous Plants.	Trees and Shrubs.	Number of Contributors.
Britain - -	—	298	657	1,718	1,146	141
Continent - -	—	540	156	241	98	17
Asia - -	17	456	272	18	—	23
Africa - -	5	175	172	—	—	21
America - -	3	468	332	106	281	22
Australia and New Zealand.	6	400	146	—	—	15
	31	2,337	1,735	1,543	1,525	239

Cinchona. — 1. *Ceylon.* — The cultivation of *Cinchona* in Ceylon has had, during the past year, to struggle with serious difficulty owing to unfavourable weather. Mr. Morris writes (February 14th, 1878) :—

“ At Hakgalla the *Cinchona* plantation has suffered very severely from the unusually wet season. Nearly all the large trees, 20 or 30 feet high, and about 12 years old, are dying; the stock plants and about 300,000 cuttings have been killed. We hope to recover ourselves in time, and by opening fresh nurseries, there is every possibility of being able to meet the demand for plants. The private plantations have suffered very severely. Great care is required in selecting the aspect, soil, and exposure to which the plants are likely to be subjected. If these are carefully considered and we have moderate seasons the plantations are in a fair way to succeed. On the other hand, if we have

“ many seasons of continuous wet weather like the last the plants will suffer very seriously.

It is satisfactory, however, to find that the bark of the trees which were cut down by the planters on showing signs of bad health “ sold in the London market at prices little, if anything, below those obtained for the finest unbroken strips, peeled from perfectly healthy trees.” Most of such trees are sending up shoots again.

It is possible that it may be necessary in Ceylon to modify the practice of *Cinchona* cultivation. It is now stated there “ that returns can be obtained from a *Cinchona* plantation at almost as early a date after planting as from coffee or tea. For the longevity of the trees a climate distinguished by moderate wind and rain and open and deep soil may be necessary.” From more recent accounts *Cinchona* planting seems to have recovered entirely from the temporary discouragement.

ment of the early part of last year, and to now bid fair to add enormously to the wealth and prosperity of the island.

2. *Introduction of Columbian Barks into India.*—The Indian Government sent Mr. R. Cross to New Grenada for the purpose of bringing to England, for eventual transmission to India, plants of the species of *Cinchona*, yielding the "Soft Columbian" and "Hard Carthagena" barks of commerce. He arrived in this country in March of last year with five wardian cases containing 400 plants of the former and 200 of the latter. The Hard Carthagena included as many as six different kinds. The barks of all were, however, very carefully analysed by Mr. Howard, the well known quinologist. With regard to the Soft Columbian known as "Calisaya of Santa Fé," Mr. Howard reported that the bark analysed, and which was taken from the rejected cane-like shoots brought home by Mr. Cross, "was of the very best description, and such as indicates the probability of a much larger production of alkaloid in the bark of more mature and developed trees." This bark yielded 6.24 per cent. of alkaloids, of which 3.25 per cent. was quinine and 1.90 was cinchonidine. Mr. Howard considers that "if the young plants can be safely conveyed to India and established there it may not improbably prove *second to none*."

Of the "Hard Carthagena" bark plants the only one which Mr. Howard considered worthy of attention was the kind from Coralis Inza, in the Magdalena Valley. This yielded 4.75 per cent. of alkaloids, of which 1.88 was quinine and 1.18 was cinchonidine. "If a free grower, as I think would be the case, it might be well worth naturalising in India. The bark has met with a ready sale in commerce."

The plants were placed under Mr. Cross's charge at Kew, where every facility was afforded him for establishing and propagating them. On the 16th of October of last year he reported as follows to the Under Secretary of State:—

"On arrival in this country in March the plants of the 'Calisaya of Santa Fé,' carried all the way from the banks of the Caqueta River, were thought to be in a weak state. I am glad to state that, although the collection is now somewhat reduced, there are in all 40 plants more or less growing and rooting, and which I am convinced will soon become good established plants.

"The majority are from cuttings, but there are some also from original imported root pieces growing also, although these in general seemed unwilling to take root freely. The dry weather of summer was not so favourable for the development of growth, but the chief cause was the diminished vitality of the root pieces which were carried overland so great a distance. When it is considered that these were dug up and brought from the damp forest, whence rise one of the most important tributaries of the Amazon, across the eastern Cordillera down to Popayan, where in order to check the growth they were alternately covered up and exposed for nearly three months, then carried down to the hot Cauca Valley to the Pacific, after which there was a month of sea voyage, I think the result will be deemed rather remarkable."

"Of the other sort from the Magdalena valley (which caused the delay of the three months referred to) there are only 12 growing plants, but some of these are good."

At the close of the winter Mr. Cross reported that the collection of Santa Fé plants was reduced to 15

plants, and that of Hard Carthagena to 10. He considered, however, that the fate of both sorts was still quite safe.

3. *Jamaica*.—Further information confirms the prospect of success in the cultivation of *Cinchona* in Jamaica (see Kew Report for 1877, p. 15).

Mr. Thomson reports (August 13th, 1878,) that in the parish of Manchester the growth of *Cinchona* is an accomplished success. "The average height of the group of trees which I examined is over 25 feet, the largest specimen, however, measured 35 feet, with its trunk near the ground 2 feet in circumference; this latter size is about equal to our best specimens at the Government plantation, now nine years old. The trees in question are finely developed and very healthy, and are growing in an ordinary coffee field. These trees are growing at the remarkably low elevation of 2,000 feet. A few hundred pounds of bark taken from some of the same batch of trees was stripped and sent to England last year; this bark realised 2s. 1d. per lb., a very satisfactory price considering the age of the trees (seven years) and particularly the low elevation at which they were grown. . . . Thousands of acres in this beautiful parish, with an altitude of about 3,000 feet, present conditions more especially adapted to the plant."

A parcel of bark of *Cinchona succirubra* from Jamaica sold in London in September of last year fetched 2s. 10d. per lb., being a higher price than was reached by either East Indian or Ceylon bark sold at the same time.

Mr. Nock, who is in charge of the *Cinchona* plantation at Gordon Town, informs me while this Report

is in preparation, that "having cut down 100 trees of *C. succirubra* about 10 years old, the yield of bark amounted to 1,391 lbs. of trunk bark, and 269 lbs. of branch bark, making a total of 1,660 lbs. of green bark. I expect this to lose three-quarters in drying, which will bring it down to 415 lbs., which at 2s. 6d. per lb. will realise over 50l. As the trees are planted 303 to the acre, an acre is worth at 10 years over 150l., which proves *Cinchona* cultivation in Jamaica to be a profitable undertaking. The average height of the 100 trees was 22 feet, not including 3 feet of the young wood at top. The average circumference close to the ground being 18 inches, and at 5 feet above the ground 13 inches. The tallest tree was 35 feet, with a circumference close to the ground of 30 inches. The smallest was 11 feet high, circumference 13 inches." The Government has authorised the extension of this plantation by 100 acres.

Cork-oaks for the Punjáb.—

Mr. Baden-Powell reports the progress up to 1877 of the Cork-oaks sent out from Kew in 1875 (Kew Report for 1875, p. 8). At Pálam-pur 28 are alive, and most of them look healthy. They are about a foot-and-a-half high. At Kúlú 50 survive. Their height varies from a few inches to 2 feet. At Dhobi there are only six, one is about 2 feet high; it is in a sunny spot surrounded by a basket open at the top, and this is the only one that looks healthy and vigorous.

Fodder Plants.—The discovery of new and easily cultivated fodder plants, especially those adapted to hot countries, is a matter which now excites great attention in India and the colonies. It is inevitable that this should be the case, as the primitive physical conditions of newly

settled countries gradually give way before the changes brought about by their occupation for agricultural and other industrial purposes.

Both in North and South Australia the conservation of the natural pasture is already attracting grave consideration. Where the mischief has gone too far and is irremediable the vegetation which is gone must be replaced by some substitute foreign to the soil. Some of the more important of the fodder plants which during the past year have come under our notice at Kew are discussed in the following paragraphs:—

1. *Prangos pabularia*.—An application for seeds of this plant has been addressed to Kew from Queensland, where attention has been directed to it as a cure for fluke in sheep. Without estimating its merits in that respect, I felt obliged to point out that the plant was a native of Tibet, was no longer in cultivation in this country, and would, therefore, be difficult to procure. In Tibet it was useful in dry districts in defect of all other forage plants. It failed, however, in Kashmir, and is utterly unfitted for Queensland. Its cultivation was attempted in England some 30 years ago, and entirely disappointed all expectations.

2. "*Prickly Comfrey*."—This is a species of *Symphytum* which has recently been prominently brought into notice as a forage plant. It is apparently identical with a *Symphytum* which has long been naturalised in the neighbourhood of Bath and elsewhere, and which has been identified by botanists with *S. asperrimum*, a native of the Caucasus. Neither the naturalised nor the forage plant appear to be really identical with that species, but have been found by Mr. Baker to agree with *Symphytum peregrinum*, which appears to be not

certainly known as wild anywhere, but to be probably a hybrid of garden origin between *Symphytum officinale* and *S. asperrimum*.

Prickly Comfrey, with, it must be confessed, little judgment, has been tried in a variety of countries where the climate is wholly unsuited to its habit of growth. The result has been attended with a good deal of disappointment. In England it has been found very useful for winter fodder, as it forms large tufts of root-leaves which start into growth early in the year, and bear several cuttings. It is greedily eaten by animals which refuse ordinary Comfrey, the habit and appearance of which is not very dissimilar.

In India Mr. Buck, Director of the Department of Agriculture and Commerce of the North-west Provinces, reports:—"The general result of the experiment in this department is that the climate of the plains is quite unsuitable to the Prickly Comfrey, the plant having failed whenever it has been tried; but there is still some chance of its succeeding under proper treatment in the hills." (Journ. Agri. Hort. Soc. Ind., N.S., Vol. vi, p. 54.) On the other hand, the Rev. G. Richter reports from Coorg:—"The Prickly Comfrey appears to be firmly established in Coorg; fields seen in different coffee plantations are as luxuriant as can be desired."

Dr. Schomburgk, Director of the Adelaide Botanic Garden, is convinced that the plant is of little use, at least, to the South Australian plains:—"During the winter months the plants thrive satisfactorily and produced some fine leaves, but in the month of October the leaves began to suffer, and . . . dried up before any of the grasses. . . . The same complaint we hear from

" New South Wales, Victoria, even
 " from tropical countries, such as
 " Queensland, Ceylon, Singapore,
 " &c., where the planters have been
 " disappointed with it."

3. *Téosinté*.—A new tropical fodder-grass, which has attracted a good deal of attention, deserves to be mentioned in this place. The seeds were originally sent in 1868 to M. Durieu de Maisonneuve, Director of the Botanic Garden at Bordeaux, from Guatemala. He communicated the first notice of the plant which has appeared to the Société d'Acclimatation at Paris in 1872. Subsequently the seeds were widely distributed by the Society, and I have received their produce in quantity from Dr. King in Calcutta, and from Dr. Schweinfurth in Cairo. From Kew they have been sent to Bahamas and the West Indies generally, Cyprus, South and Tropical Africa, Australia, the United States, and numerous applicants and correspondents.

The grass is essentially tropical in its habits. Mons. Thozet in Queensland found single seeds to give rise to as many as 32 stems, each 12 feet high. Dr. Schweinfurth is said to have harvested at Cairo as many as 12,000 seeds as the produce of three single grains, and Vice-Consul Calvert states that at the same place in July of last year "the plant, after having been "mown down, grew one foot in four "days."

Dr. R. C. Sandars, of Azimghurh, reports to the Agri-Horticultural Society of Madras:—"Each seed "was put in at intervals of five feet, "but some two months back each "plant had so spread that all "touched; some have from 100 to "120 shoots. To give air to those "plants which I wished to seed, I "had some of the plants cut nearly "to the ground. Cattle eat what "was cut most greedily, both in its

"fresh state and also when dry;
 "and the plants which were cut
 "instantly grew again, and are now
 "fit to cut afresh. The plants
 "have had the advantage of the
 "jail garden, which includes a rich
 "soil and abundance of water."

It is also suggested that it would be a valuable fodder for elephants during the hot months.

Mr. Murton writes from Singapore (2nd October 1878):—"I am going "in largely for the *Euchlana*; it "promises to turn out a capital "fodder-plant for this place."

Dr. Schomburgk reports from Adelaide:—"I am in hopes that "the plant will turn out a great "acquisition to our summer fodder "plants Notwithstand- "ing that after planting our young "plants have never been watered, "and considering the great dryness "of the season, their growth is "vigorous."

From the United States the Commissioner of Agriculture reports the attempt to extract sugar from the stalks, "but though a fair proportion "of syrup was obtained, crystalli- "sation could not be induced, and "the results were unsatisfactory."

Botanically the grass is of very great interest. It is remarkable that before its introduction as a fodder-plant it was unknown to science, and it was at first incor- rectly referred to the genera *Tripsacum* and *Reana*. It unites the habit of maize (*Zea*) with, in many respects, the structure of *Tripsacum*. As *Euchlana* and *Tripsacum* are incontestably American genera, this fact supplies, as has been pointed out, an argument for the new world origin of maize, a matter which has been disputed.

Euchlana luxurians grew and flowered under stove treatment in the Royal Gardens last year. It was figured in the Botanical Magazine (Tab. 6414) from this source

this being the first published illustration of the plant. An impression of the plate is given with this report.*

India - rubber. — *Hevea and Castilloa*.—I have to report the continued satisfactory progress of the South American rubber-yielding plants, the establishment of which in Ceylon and India is recorded in the Kew Report for 1877 (pp. 15-17).

Mr. Morris, the Assistant Director of the Royal Botanic Garden, Ceylon, writes (18th May 1878):—"The rubbers are doing remarkably well, both here (Peradeniya) and at Heneratgodde. The *Heveas* are nearly 12 feet high and look quite handsome trees. The *Castilloas* had grown so much that I quite failed to recognise them. They grow into broad spreading trees with a very majestic air."

Dr. Thwaites, the Director, reported up to the end of last year:—"The rubber plants are thriving very satisfactorily, but *Hevea* and *Castilloa* do not seem disposed to flower yet. We manage to strike a good many cuttings of *Hevea*, but *Castilloa* we cannot strike from cuttings of the stem, and the roots are not yet large enough to furnish good chunks for getting plants from."

While this Report is in preparation Dr. Thwaites writes to me (17th April 1879):—"I have sent off 516 plants raised from cuttings of

Hevea brasiliensis to the Conservator of Forests at Moulmein in charge of a person he sent to take care of them. I am expecting a man from the Conservator of Forests at Madras for some *Hevea* plants to be tried in the neighbourhood of Calicut. Our *Hevea* plants are now becoming more branched, and so it is to be hoped they will flower before very long, and save us the necessity of raising plants from cuttings, which is not easy from comparatively young plants. I have sent the Conservator of Forests at Moulmein also two growing plants of *Castilloa* which we managed to take up from the ground successfully, and I hope they will reach him in good order. From the appearance of the trees I hardly think that *Castilloa* will produce seeds for some years, and until it becomes a very large tree."

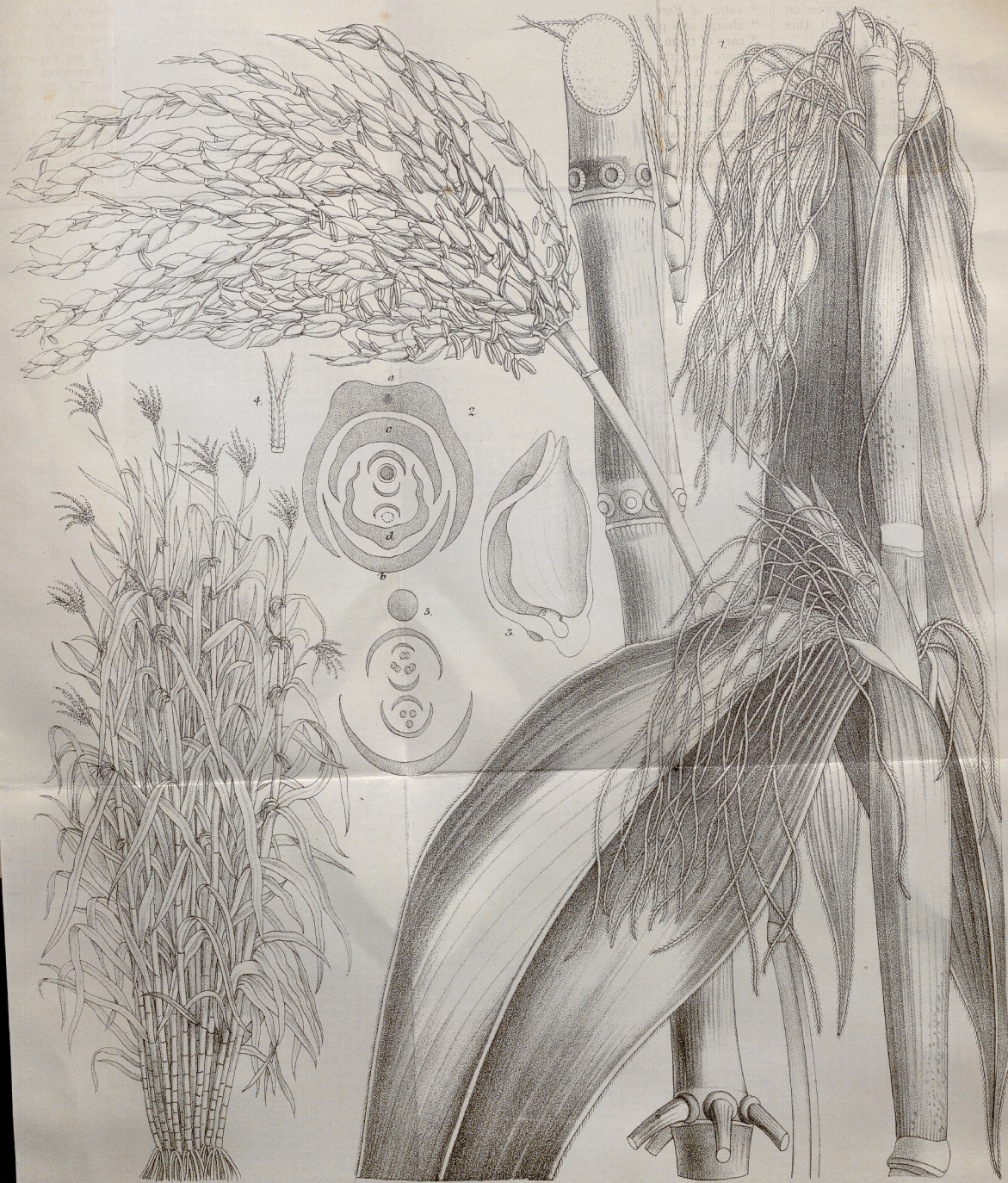
The propagation of *Castilloa* is still continued at Kew. Progress is slow on account of the small stock which has been retained to work upon, but otherwise the difficulty of which Dr. Thwaites complains has not been met with.

At my request Mr. Murton, the Superintendent of the Botanic Gardens, Singapore, has sent plants of *Hevea*, *Castilloa*, and also of the Ceará rubber, to Queensland, where they have arrived in good condition.

From Singapore the two former have also been introduced into Perak, where Mr. Low reports (February 3rd, 1879):—"The *Heveas* are now 12 to 14 feet high. They take to the country immensely. The *Castilloa* is a large tree, 10 feet high, with branches 5 feet long." Mr. Murton adds:—"As regards their propagation, which Mr. Low seems to have found rather difficult, I find that the half-ripened shoots with a shield of hard wood are best; but, unless kept tolerably dry, are very apt to rot off."

* *Description of the Analytical Figures.*

—1, portion of female spike of the natural size; 2, diagram explanatory of the position, &c. of the dilated rachis (*a*) and of the female spikelet (*b* outer, *c* inner empty glume, *d* lower flowering glume); 3, vertical section through rachis and outer empty glume, showing points of attachment above and below of successive joints of the inflorescence; 4, tips of the stigma; 5, diagram explaining the relative position of the parts of the male spikelet; figs. 2-5 all much enlarged.



H.T.D. del. J.N. Fitch lith.

L. Reeve & Co. London.

Brachlaena luxurians var.

Vincent Brookes & Co. Imp.

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all the wet sea-

From Kew, plants of *Hevea* have been sent to Dr. Kirk, at Zanzibar, and also to Fiji; in the latter case without success.

With regard to the *Hevea* plants sent to Assam (see Kew Report for 1877, p. 15), Mr. Mann reports:—"Soon after transplanting the leaves turned white and dropped off, and subsequently the wood of the young trees withered away gradually, and by July there was not one of the plants alive. This failure had been anticipated, and is attributed to the comparatively low temperature in Assam."

2. *Ceará Rubber*.—At the end of August of last year consignments of plants of the *Ceará* rubber, consisting, in each instance, of two wardian cases containing 80 plants, and one dry box containing 40 plants, were sent to Lieut.-Colonel Beddome, Conservator of Forests, Madras, and Dr. King, of the Royal Botanic Gardens, Calcutta. Of those sent to Madras all were alive on arrival in the wardian cases, while of the contents of the dry box about half were saved. Those originally sent to Dr. King (see Kew Report for 1877, p. 16) arrived in rather bad condition. Few were saved, and the growth of these did not impress Dr. King favourably. "They all look more or less weak and lanky, as if the climate were too damp for them." This was, perhaps, a premature judgment from want of familiarity with the habit of the plant. Dr. King now writes:—"Ceará rubber is going to be a success here."

At Ceylon, in April one of the plants first sent out had already made an attempt to flower, and by the end of the year Dr. Thwaites was distributing copious supplies of seed to Calcutta, Burmah, Madras, and Singapore (where, however, it seems unable to stand the wet season).

I regard, therefore, the work of Kew completed as regards the *Ceará* rubber. Living plants of it have been distributed during the past year to Dominica, Fiji, Jamaica, Java, Sydney, Trinidad, Queensland, and Zanzibar.

Liberian Coffee.—I quote the following from a report furnished to the Colonial Office by the President of Dominica:—

"The Liberian coffee plants are thriving in many parts of the island, but under the fostering care of the Hon. Dr. Imray, to whom the community is entirely indebted for the real establishment of the coffee tree in Dominica. Some of the early imported trees have borne fruit, and the Creole seeds have been sown and are coming up, and the plants showing every sign of vigour and health. . . . The native coffee is still suffering from blight. . . . The Liberian coffee trees, although in close proximity to the native coffee, seem to bid defiance to the ravages of this scourge, while the luxuriance of its foliage causes a painful contrast."

Dr. Imray writes to me in May of last year:—"I have several hundred seedlings coming on, raised from the seeds of the plants sent by you. The trees have again flowered, and there is a large crop on them for next year. They still continue very healthy, and increase in size. I cordially join in your aspirations that the dire consequences of natural selection may be averted as regards the *Cemistoma*. Hitherto all its efforts have failed, and as the operation of natural selection and the survival of the fittest is somewhat tardy, we may look forward to a period of at least two or three millions of years before the creature can possibly have 'acquired' an instrument strong enough to

" tap the flinty cuticle of a Liberian coffee leaf.

" Further observation has shown me that there is a considerable difference between the two species of coffee in regard to the ripening of the fruit, which may be of some importance if the cultivation extends in the island. In *C. arabica* when the berry is full it soon takes on a rather bright red colour, quickly softens, becomes detached from the tree, and falls to the ground. The outer coating of the pericarp is thin, and the surface smooth; within there is a loose sweetish tasted pulp, from which the seeds are separated without much difficulty. The pericarp of the seed of *C. liberica* is a hard fibrous covering, rather rough on the surface as compared with *C. arabica*, of a greenish-red colour, containing very little pulpy matter, and, so far as I have observed, never softening on the tree, or indeed after it is gathered, but in a very slight degree. The peduncle is short and very strong, and the fruit, instead of dropping when ripe, as in *Coffea arabica*, remains firmly fixed; in time it shrivels up, but still (so far as I have noticed) continues attached to the branch, becoming dark-coloured and very hard.

" From this difference in the ripening of the berries of Liberian coffee, I think I have been rather misled as to the length of time required for their full maturity. I believe I might have gathered all the berries on my trees six weeks or two months earlier. I waited week after week, watching when the softening process would commence. Having some misgivings, however, I gathered a few berries and planted the seeds. In six weeks (the usual time) they began to germinate and appeared above ground.

" I hesitated no longer, but at once collected all the seeds that were quite full and of a red colour. They never look so bright as the coffee of the country.

" In former times, when the cultivation of coffee in this island was general, the plantations that were short-handed often suffered considerable loss, for as the coffee ripened all at once, unless the berries were gathered immediately they dropped on the ground and rotted. With the Liberian coffee no such loss need be feared, for the berry remains so long on the tree that ample time would be allowed to gather in the crop with comparatively few hands."

Mr. Murton reports from Singapore:—"Two of the plants from the number sent here in August 1877 from Kew, when they were not two inches high, were setting fruit at the end of 1878. A few plants were sent to Sarawak, but I have heard nothing about them, except that they arrived in excellent condition. I find this species of coffee very easy of propagation by cuttings, but the plants appear to grow very slowly after being rooted, and this plan of raising a stock is not, in my opinion, to be recommended."

From Ceylon I have received a report of the first Liberian coffee estate opened at Kalutara. An average tree was found, in November of last year, to bear 1,500 berries, which was calculated to be at the rate of 150 bushels to the acre, equivalent to 8'3 cwt. of clean coffee. It is hoped that by its means vast tracts in Ceylon of abandoned or semi-abandoned low lying land will be redeemed for cultivation.

From Southern India the reports are not very favourable, and the climate is no doubt unsuitable. The Rev. G. Richter states, August 30, 1878:—"The various experiments

"with Liberian coffee do not appear to be encouraging. The most successful plants blossomed this season but scantily and have now some berries. Those lately received from Kew, and distributed in small pots by the Mysore Government, have not done well with me and several other planters. Though transplanted into bamboo baskets and kept in a conservatory, they remained sickly, contracted leaf-disease, and are not healthy, even after being put out into good rich soil in the open garden."

At my request Dr. Thwaites obligingly forwarded to the Maharajah of Johore 400 young plants of Liberian coffee, and he has also been so good as to send to Fiji a parcel of the seeds.

Mahogany Seed for India.—

All the available supplies of mahogany seed which reach Kew in a sound condition have been sent with all possible expedition to India through the India Office. As stated in the last Kew Report, mahogany produces good marketable furniture wood in Bengal and Burma.

Lieut.-Col. Beddome, Conservator of Forests, Madras Presidency, reports (April 20, 1878):—"The mahogany grows so splendidly at Nelumbur, and in amongst the teak trees (not objecting to shade), that it is a pity large supplies of its seeds cannot be procured."

Capt. Doveton, Conservator of Forests, Central Provinces, reports that at Telenkheri mahogany does well.

Supplies of the seed have also been sent from Kew to Mauritius.

Mesquit Beans.—The attempt (see Kew Report for 1877, p. 20) to secure the introduction into India and the colonies of these cattle-feeding plants, which are found so useful in hot dry countries, has met

with a varied amount of success. The Screw Bean (*Prosopis pubescens*) appears to be the most difficult to establish.

Dr. Schomburgk reports from Adelaide that the South Australian climate does not suit the growth of the Screw Bean, about 100 young plants in pots having perished. In the case *Prosopis juliflora*, trees of last year's planting reached the height of 5 to 6 feet.

Mr. Bernays writes from Brisbane that both *P. pubescens* and *P. juliflora* are growing in the open ground from Kew seeds, and that there are strong young trees of the latter in Bowen Park also raised from the seed sent from Kew.

Mr. Keit, Curator of the Natal Botanic Gardens, writes to me:—"Regarding *Prosopis pubescens*, I beg to state that the seeds sown here germinated freely and grew for some time, but, notwithstanding all the care bestowed upon them, the young plants were, especially after rain, attacked and subsequently destroyed by a minute fungus. But I am glad to be able to add that one of my correspondents residing in the country has succeeded in rearing a couple of young plants, which are doing well. It appears to me that the interior of the country is more suitable for the cultivation of these plants than the coast districts."

Mr. Duthie, of the Saharunpore Botanic Gardens, states that "*Prosopis juliflora* is doing very well, and should give seed next year or the year after. *P. pubescens* failed during the rains."

In Southern India, Lieut.-Col. Beddome reports that the experimental planting of *Prosopis juliflora* at Cuddapah promises to be a success.

Pithecolobium Saman.—This South American tree is referred to

below in what is said with respect to the Rain tree. According to Spruce, in its native country the pods are greedily eaten by deer and cattle. Mr. Jenman, the Superintendent of the Castleton Botanic Garden, Jamaica, has pointed out to the Colonial Office the remarkable merit of the tree for cultivation in hot tropical countries, as the foliage affords a very grateful shade, while the pods supply fodder of excellent quality. The following remarks are extracted from Mr. Jenman's report:—

"*Pithecolobium Saman*, popularly known in Jamaica as *Guango*, was originally introduced from the American mainland, but has now become thoroughly naturalised in all the dry regions. It is a lofty tree, in habit resembling the English oak. Trees are not uncommon seventy feet high, the spread of whose branches covers a diameter of one hundred and thirty feet. Owing to the folding of the leaves at night, the shade of the tree is said not to impede the deposit of dew beneath its branches. Grass grows freely even up to the trunk. The fruit is a bright dark-coloured pod when ripe, six to ten inches long, hardly one inch wide by a quarter of an inch thick, in substance consisting of a sugary amber-coloured pulp. The pods are borne in great profusion and hang prior to their maturity dangling in clusters from every branchlet. As they ripen they drop to the ground, and are picked up and eaten with much relish by all stock, even sheep and goats. Cattle may be seen lingering about the trees waiting for the passing breeze to shake the fruit down. Its excellent quality as a fodder is evident by its fattening effect. Stock having access to it improve markedly during the time it is in season. From the sugary nature of the

fruit, it will keep a good while packed after maturity. It is therefore often gathered, packed in barrels, and kept for use till the dry early spring season has parched up grass and made herbage scarce. There is no doubt, I think, that it would make as good a preserved cattle-food mixed with other ingredients as the Carob (*Ceratonia Siliqua*), which is largely imported into England from the shores of the Mediterranean for this purpose. *Pithecolobium Saman* thrives best in dry hot plains having a rainfall of from thirty to sixty inches. Though of quick growth the wood is hard and very ornamental in the grain."

Seeds of this tree received from Jamaica were sent to the following places: Bombay, Brisbane, Calcutta, Ceylon, Hong Kong, Madras, Mauritius, Natal, Saharanpore, Travancore, and a further supply was distributed through the India Office.

It is of course premature to expect any immediate result from the experiment. I learn, however, that in August of last year the Agricultural Society of Madras had a large number of fine young plants ready for distribution. About the same time Mr. Ford, in Hong Kong, had upwards of 1,000 "good healthy plants." Mr. Duthie reported from Saharanpore in September:—"The *Pithecolobium* is doing most splendidly here; every seed is germinating, and the plant is looking healthy in every respect."

Dr. King reports from Calcutta:—"There are in the garden two sets of this tree, one consisting of five trees about 11 years old, and the other consisting of 84 trees, which were planted in an avenue four years ago. The tree is an extremely rapid grower, and seems perfectly at home in the climate and soil of Lower Bengal.

"The habit of growth and softness of the timber make the tree of little value as a building material, but it would probably answer well as a firewood tree, and as a shade tree I know nothing to equal it in Bengal. . . . The older trees have this year for the first time given seed; the pod is quite as sweet as that of the Carob, and is abundantly produced, and altogether I consider *Pithecolobium Saman* a much more hopeful source of cattle-fodder than the Carob, while as a rapid grower it is unrivalled."

Wagatea spicata.—Mr. G. M. Woodrow, Superintendent of the

Botanical Gardens, Ganesh Khind, Poona, has sent to Kew seeds of *Wagatea spicata*, a scrambling thorny shrub, native of the Concan, and interesting on account of the beauty of its foliage and flowers. The pods have been found by the Government analyst to contain 15 per cent. of tannic acid, and some tons have been sent home to test their value for tanning.

Seeds were distributed from Kew to Demerara, Dominica, Jamaica, Trinidad, and other correspondents.

The following is a statement of the plants, &c. sent out during the past year, and included in 365 consignments:—

—	Ward's Cases.	Packets of Seeds.	Stove and Greenhouse Plants.	Herbaceous Plants.	Trees and Shrubs.	Number of Recipients.
Britain - -	—	868	5,313	1,094	1,248	106
Continent - -	—	81	714	88	—	21
Asia - -	10	105	640	—	—	8
Africa - -	4	11	238	—	218	7
America - -	8	195	424	8	—	18
Australia and New Zealand.	4	105	287	12	118	8
	26	1,365	7,616	1,202	1,584	168

I. Britain.

The usual exchanges have been made with the Botanic Gardens of Birmingham, Edinburgh, Glasgow, Manchester, and Oxford; with the Royal Horticultural Society, Chiswick; the Royal Botanic Society, Regent's Park; and also with the principal nurserymen, especially with Messrs. Backhouse of York, Barr and Sugden of Covent Garden, Bull of Chelsea, Dicksons and Co. of Edinburgh, Dickson and Turnbull of Perth, Henderson of St. John's Wood, Ireland and Thompson of Edinburgh, Jackson and Son of

Kingston, Kinghorn and Son of Richmond, Lawson Seed and Nursery Company of Edinburgh, Kinnmont and Kidd of Canterbury, Low of Clapton, New Plant and Bulb Company of Colchester, Osborn of Fulham, Parker of Tooting, Paul and Son of Waltham, Robertson and Co. of Edinburgh, Rodger, McClelland, and Co. of Newry, Rolison and Sons of Tooting, Smith of Worcester, Stuart Mien and Allen of Kelso, Stansfield and Son of Todmorden, Thompson of Ipswich, Veitch and Sons of Chelsea, Ware of Tottenham, Williams of Holloway, and Wills of Kensington.

Contributions have been received from upwards of 100 different sources; of these the principal have been:—

Atkins, J.; *Mamillaria senilis* and choice herbaceous plants.

Bennett, A.; *Carduus tuberosus*, *Echium plantagineum*, and other rare British plants.

Christy, Thos.; *Urostigma Vogelii* of the West Coast of Africa; *Platynerium aethiopicum*; seeds of *Kentia* and *Sterculia Kola*.

Clark, Col. T.; *Urginea exuvata*.

Clowes, Miss Agnes; *Ranunculus Lyallii*.

Cooper, Thos.; *Cotyledon coruscans*, *Aloe striatula*.

Corderoy, J.; *Stapelia Corderoi* and other choice succulents.

Crewe, Rev. H. Harpur; *Crocus syriacus*, *Calceolaria lobata*.

Cruttenden, Capt.; large plants *Adenium obesum*.

Darwin, Ch.; grass from South Brazil with cleistogamic flowers; seeds various plants.

Dickson, Prof. A.; *Isoetes echinospora* from Glen Callater.

Duff, M. E. Grant, M.P.; plants of *Ambrosinia Bassii* (Bot. Mag. 6360).

Ellacombe, Rev. H. N.; *Siphocampylus bicolor*, *Galanthus nivalis*; var. *Sharlockii*, *Narcissus calathinus*, and other choice herbaceous plants; seeds *Echeandra cleutherandra*.

Elwes, H. J.; choice lilies, *Halenia elliptica*, *Cyrtanthus*, *Pleione Hookeri*, *Paranephelius uniflorus*, choice herbaceous plants, and hardy and other bulbs.

Ewbank, Rev. H.; *Omphalodes Lucilæ*, var. *alba*, and other herbaceous plants.

Head, A.; *Amherstia nobilis*, *Asparagus plumosus*, *Begonia Listeri*, *Cycas revoluta* 10 feet high, *Kumquat*, *Phalænopsis*, sp., and a variety of other plants from India.

Hiern, W. P.; *Isolepis Holschæus*, *Polygonum maritimum*.

Henry, I. A.; *Ranunculus pinguis*.

Holmes, E. M.; *Pastinaca grandis* the Doo-goo of Royle's Mat. Medica, seeds of *Physostigma venenosum*, *Angræcum* sp. n. of West Tropical Africa, and other seeds and plants.

Hooke, B.; *Mutisia decurrens*; many choice herbaceous plants, particularly a collection of Hellebores.

Howard, J. E.; *Mantisia saltatoria*.

Irvine, Jas.; seeds Liberian coffee; palm seeds, including *Elæis* and two species of *Raphia* from the Cameroon Mountains.

Joad, G.; *Hypericum Coris*, *Campanula petraea*, *Calceolaria plantaginea*, and many rare and choice herbaceous plants.

Laver, H.; *Euphorbia arborescens*, var.

Lawrence, Sir Trevor; collection of choice orchids.

Lewis, Earl of; two large specimens of *Cyathea*.

MacLeay, Sir G.; *Billbergia melanantha*, *Nidularium Scheremetiefii*, *Hippiella atrosanguinea*, and other choice stove plants; rare herbaceous plants, including a fine crown of *Gunnera manicata*; miscellaneous seeds.

Maw, G.; several choice *Narcissi*, *Crocus syriacus*, *Iris lacustris*, &c.

Miles, F.; seeds *Nymphæa alba*, *N. cœrulea*, *Primula*, sp. n., plant *Senecio pulcher*.

Parish, Rev. C.; *Dendrobium Findlayanum*, *D. Fytchianum*, *Vanda cœrulea*, and many other choice orchids.

Paterson, Dr.; *Encephalartos villosus*, var.

Peacock, J.; *Aloe socotrina*.

Perry, W. W.; seeds *Echiochiton*, stems *Vitis*, sp. n., species of *Boucerosia*, *Dracana Ombet*, *Balsumodendron Playfairi*, Hk. f., species of *Boswellia*, &c.

Roberts, Maccubbin, & Co.; seeds of *Adansonia madagascariensis*.

Roezl, B.; *Odontoglossum Edwardsii* and other new kinds.

Salter, Jas.; various kinds of *Salix*.

Sherrings, R. V.; *Dicksonia conifolia* and other ferns.

Walker, A. O.; *Adiantum*, sp. n. aff. *subrotundifolium*.

Wigan, Fred.; large specimen *Cyathea medullaris*.

Williamson, Prof.; *Drosera spatulata* and *Dionaea muscipula*.

Wilson, Geo.; *Polygala hutea* and other choice herbaceous plants, lilies.

Young, Liston; *Cheilanthes chlorophylla* and *Rhapis humilis*.

II. Continent.

Arcangeli, Dr., Florence; collection of seeds, plant *Pistacia Terebinthus*.

Bommer, Prof. J. E., Brussels; *Asplenium laxum*, *Cyathea funebris*, and various choice ferns.

Bouché, A., Berlin; *Encephalartos Hildebrandti*, *Cycas Thouarsii*, and palms.

Decaisne, Prof. J., Paris; *Azolla pinnata*, *Salvinia natans*, *Asphodeline damascena*, &c.

Fröbel & Co., Messrs., Zürich; choice species of *Yucca*, European species of *Rhododendron*, herbaceous plants and seeds.

Godefroy-Lebeuf, A., Argenteuil; *Torenia Baillonii*, many herbaceous plants, *Pseudodracontium* (gen. n.) *anomalum*, N.E. Br.

Groves, H., Florence; *Narcissus*, sp. n., several choice species of *Tulipa*, *Iris Sisyrinchium*, seeds *Ononis ornithopodioides*.

Krelage & Son, E. H., Haarlem; *Hippeastrum concolor*, Baker, sp. n.

Leichtlin, Max., Baden-Baden; *Coptis brachypetala*, *Edraianthus Kitaibelii*, *E. pumiliorum*, *Euryan-gium Sumbul*, and many other choice herbaceous plants, *Clematis*

Pitcheri, *Bomarea oligantha*, sp. n., *Massonia*, sp. n., *Cyrtanthus Tuckeri*, *Schizophragma hydrangeoides*, seeds *Acantholimon venustum*.

Post, Dr. G. E., Syria; bulbs *Allium Erdelii* (Bot. Mag. 6426).

Regel, Dr., St. Petersburg; seeds *Pugionum cornutum*, various *Coniferae*, &c., bulbs *Fritillaria (Rhino-petalum) Karelini* (Bot. Mag. 6406), *Leontice vesicaria*, *Cypripedium macranthum*, *Selaginella sanguinolenta*, sp. n., many choice bulbs.

Reichenbach, Prof., Hamburg; *Leontice altaica* and *Vallisneria spiralis*, mas.

Smets, Louis de, Ghent; *Agave Victoriae Reginae*, *A. Shawii*, *A. Desertii*, and several other choice kinds, *Echeverias*.

Van Houtte, Louis, Ghent; collection of trees and shrubs, including *Pterostyrax hispidum* and *Xantho-ceras sorbifolia*; *Tropaeolum speciosum*.

Vilmorin, Andrieux et Cie, Paris; tubers *Dioscorea Batatas*.

III. Asia.

Agri-Hort. Society, Madras; wardian case containing *Schleicheria trigyna* and other plants.

Aitchison, Dr.; collection of seeds from Kashmir, *Eremurus himalaica*, seeds *Malcolmia stri-gosa*, bulbs, &c.

Beddome, Lieut.-Col., Madras; seeds of *Bentinckia*, prickly bamboo, *Musa* spp., and palms.

Duthie, J. F., Saharunpore; roots *Nymphaea pygmaea*; seeds *Abies smithiana*, *Chamaerops Fortunei*, *C. martiana*, and others.

Ellis, R., Forest Dept., Punjab; various seeds *Delphinium brunon-ianum*, &c.

Ford, C., Hong Kong; wardian case *Rhodoleia*, *Arundina chinensis* and *Asophila tomentosa*.

Gammie, J., Darjeeling; trunks *Cycas pectinata*, *Hemitelia decipiens*,

and other tree-ferns; seeds *Ilex insignis* and *Luculia gratissima*.

Gardiner, Col. P. F., Hazara; corms saffron crocus of Kashmir (*Crocus sativus*, var. *kashmirianus*), several bulbs, &c.

Hance, Dr. H. F., Hong Kong; various seeds.

King, Dr., Calcutta; seed collections of *Rhododendron* and *Conifera*, set of seeds from Sikkim, seeds of *Eniclaena* (Reana) *luxurians*, *Chamaerops martiana*, *Nipa fruticans*, and *Cycas Rumphii*, large collection of Indian ferns, including *Nephrodium cochleatum*, *N. stigmosum*, and *N. flaccidum*.

Murton, H. J., Singapore; wardian case of *Durio zibethinus*, of *Ptychosperma singaporensis* and seeds of same, case of orchids and box of palm seeds.

Scheffer, Dr., Buitenzorg; wardian cases of various plants, inclusive of *Shorea*, *Orania regalis*, and *Pholidocarpus Thuri*, seeds *Soya hispida*, &c.

Thwaites, G. H. K., Ceylon; wardian cases containing *Arundinaria griffithiana*, *Boucerosia umbellata*, *Diospyros quesisita*, *Dipterocarpus hybridus*, and *D. glandulosus*, &c., seeds of *Nepenthes*, tubers of *Ipssea speciosa*.

IV. Africa.

Ayres, Ch., Cape Town; seeds *Leucadendron argenteum*.

Bolus, H., Graaf Reinet; *Disa barbata*, *Satyrums*, seeds *Acanthosicyos horridus*, *Pelargonium* stems, and various bulbs.

Bowker, Commandant J. H., Basutoland; *Aponogeton spathaceum*, var. *junceum* (Bot. Mag. 6399), cuttings *Aloe Barbata* and seeds.

Hay, His Excellency Sir J. D., Tanjiers; seeds *Juniperus phoenicea*.

Hutton, H., S. Africa; seeds *Rhus Thunbergii* and of other trees and shrubs.

Keit, Wm., Natal; *Encephalartos Ghellinckii*, *E. villosus*, *Hemanthus Catherina*, *Crinum* sp., and orchids.

Kirk, Dr., Zanzibar; fine trunk *Encephalartos Hildebrandti*; cases containing *Landolphia*, *Cocos nucifera*, *Adenium*; orchids from Johannesburg.

McOwan, Prof., Somerset East; seeds *Aloe hanburyana*, *Podanthes pulchra*, and *Stapelia*; bulbs *Scilla*, &c.

Monteiro, Mrs. Rose, Delagoa Bay; *Crinum forbesianum* and other plants in wardian case.

Oliver, Captain, St. Helena; fine collection of St. Helena ferns, contained in three wardian cases, including *Acrostichum dimorphum*, *Asplenium platybasis*, *Dicksonia arborescens*, *Nephrodium Napoleonis*, and *Polypodium molle*.

Salmon, C. S.; case of palms from the Seychelles.

Schweinfurth, Dr.; seeds *Euchlaena* (Reana) *luxurians* and of *Smithia Pfundi*, South Kordofan.

Tidmarsh, E., Grahamstown; box of *Hemitelia* stems.

Wakefield, Rev. T.; bulbs *Albuca Wakefieldi*, sp. n. (Bot. Mag. 6429), rhizomes from Nyika country.

Whitehead, H., St. Helena; two cases of ferns *Dicksonia arborescens*, &c.

V. New World.

Austin, Mrs. R. M., California; bulbs and seeds.

Barlee, His Excellency F. P., Belize; several kinds of seeds, including those of *Pachira aquatica*.

Capanema, Dr., Brazil; seeds *Merostachys Clausenii*, Munro.

Department of Agriculture, Washington; various tree and shrub seeds, seeds *Sabal Palmetto* and *Nelumbium luteum*.

Engelman, Dr., St. Louis; seeds *Yucca filamentosa*, var. *bracteata*.

Ernst, Dr., Caraccas; roots of *Asagraea officinalis*, seeds *Bomarea bredemeyeriana*.

Gray, Prof. Asa, Harvard; roots of *Aralia quinquefolia*.

Huxham, Rd.; orchids and bulbs from Bahia.

Inrray, Dr., Dominica; *Blakea*, *Alloplectus cristatus* and *Chato-gastra*.

Jenman, G. S., Jamaica; valuable fern collections, including *Asplenium erosum*, *Dicksonia conifolia*, *Nephrodium pedatum*, *N. Jenmanii*, *Cyathea gracilis*, *C. pubescens*, &c., tree ferns, clumps of *Chusquea*; seeds of *Pithecolobium Saman*, *Persea gratissima*, *Mannea americana*, *Copernicia*, and other palms, mahogany, &c.; *Broughtonia sanguinea* and other orchids.

Merrill, J. Warren, Boston; *Davallia clavata* and other ferns.

Missouri Botanic Garden; collection of herbaceous seeds.

Philippi, R. A., Santiago; seeds *Prumnopitys elegans* and *Ceroxyton australe*.

Prestoe, H., Trinidad; seeds *Carica* sp., *Colvillea racemosa*, and others, miscellaneous orchids.

Sargent, Prof. C. S., Harvard; large seed collections, including *Antirrhinum nuttallianum*, *Frasera thyrsiflora*, *Staphylea Bolanderi*, *Juniperus californica*, var. *utahensis*, *Garrya Fremonti*, *Cercidophyllum japonicum*, &c.; collection of young oaks, *Coniferae*, and other shrubs; various herbaceous plants, *Nymphaea flava*, *Erythronium albidum*, seeds of the new *Eucharidium Breweri*; collection of ferns from the Sandwich Islands, also North American species; choice succulents.

Sturtevant, E. D., New Jersey; *Nelumbium luteum*, *Nymphaea flava*, and *Sarracenia purpurea*.

VI. Australia and New Zealand.

Abbott, F., Bot. Garden, Tasmania; seeds of *Eucalypti*, wardian case of miscellaneous plants.

Bancroft, Dr. Jos.; cuttings of *Nerium* with *Loranthus* or *Viscum* seeds attached, seeds *Cassytha* sp. and *Duboisia myoporoides*.

Bernays, L. A., Brisbane; seeds of probably new *Nymphaea*, seeds of *Kentia* and *Ptychosperma*.

Guilfoyle, W. R., Melbourne; wardian case containing *Alpinia caerulea*, *Coprosma microphylla*, and others; various seeds.

Hector, Dr., New Zealand; seeds of *Pittosporum crassifolium*, *Olearia Haastii*, and various others.

Hill, W., Brisbane; various *Cycadeae*, *Platyserium alaicorne majus* (*P. Hillii*), seeds *Ptychosperma Drudei*.

Moore, C., Sydney; poison plants of Santa Cruz Island, large collection of seeds.

Mueller, Baron von, Melbourne; seeds of many interesting plants, *Atriplex vesicaria* (used as fodder), *Nyctisia floribunda*, *Duboisia myoporoides*, *Villarsia* spp., &c.

Parr, Wm. Fillingham, Fiji; wardian case of choice plants, *Ptychosperma Seemanni*, *Sagus citiensis*, *Dammara vitiensis*, &c.

Schomburg, Dr., Adelaide; wardian case of plants in variety.

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

A supply of plants for the Art Schools and for the examinations in botany (about 16,000 specimens) 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.

Applications have been received from several medical schools in the metropolis for assistance in the illustration of the lectures on botany. To comply with this request would necessitate growing large quantities of a number of plants suitable for the purpose, and the matter has been referred to the Board, by whom it is still under consideration.

INDIAN AND COLONIAL BOTANIC GARDENS.

Exchanges and correspondence are constantly maintained between Kew and the numerous botanic gardens which exist in British dependencies. This constant intercommunication is, on the one hand, indispensable to the maintenance and perfection of the Kew collections, on the other hand, it is of great advantage in facilitating the exchange from one garden to another of the vegetable products of different parts of the Empire. I am anxious, however, to see the botanic gardens establish to a greater extent than at present a chain of independent interchanges, which would increase their own usefulness and enormously facilitate the work which is done at Kew. We have attempted, for example, to send plants to Fiji, but with but little success, on account of the great distance. Any particular plant could, however, be established in Ceylon with moderate difficulty; from thence it could be sent to Singapore, and so on to Brisbane and Sydney, and finally to Fiji. At each successive stage, in case of a failure, the difficulty of renewing the attempt would be much smaller than if it were necessary to start afresh from Kew.

I am the more led to make these remarks from having had my attention repeatedly drawn by applications made to Kew from residents in the colonies to the fact that some of the most important functions of a Colo-

nial botanic garden, are often apt to be lost sight of. Such institutions are obviously likely in most cases sooner or later to develop into the pleasure grounds of the towns and cities near which they are situated. But without disparaging their public usefulness in this respect, it is important that their primary function of promoting the botanical interests of their respective colonies should not be forgotten. That there is some risk of this happening I can only assume from the constant applications made direct to Kew for information, seeds, or plants which it is clearly the business of the botanic garden of the applicants' colony either to supply or procure.

This leads to another point. No colonial garden can discharge its functions efficiently if the superintendent does not occasionally make journeys with a view to discovering new and interesting plants for the purpose of interchange with other establishments. But the demands made upon his time often prevent the superintendent attending to this part of his duty, which is so important in keeping up an imperial system of exchange, besides promoting the interest of the garden under his charge, and varying the monotony of a life of unintelligent routine. I am afraid that this is sometimes overlooked by the local governments and managers; one superintendent is tied by meteorological observations, another by growing vegetables for sale. In every case where some obstacle of this kind is allowed to override the legitimate freedom of action of the superintendent, I am convinced the interests of his establishment suffer in a variety of ways, and that the policy is a short-sighted one.

Bengal Cinchona Plantation.

—On the application of the Government of India, Robert Pantling was recommended from the Royal Gar-

dens as a gardener for the Sikkim Cinchona plantations, and has proceeded to Calcutta.

Demerara Botanic Garden.

The Government of British Guiana have for some time had under consideration the establishment of a botanic garden near the town of Georgetown. I am glad to say that this is now in a fair way of being accomplished. With the permission of the Government of Trinidad, Mr. Prestoe, the Government botanist of that colony, visited British Guiana during the month of September, for the purpose of deciding on a site and furnishing a plan.

Mr. Prestoe writes to me:—

"The country for miles on the seaboard is one dead level, and this unpleasant feature has been intensified by almost complete denudation in favour of sugar-cane culture. Along the coast the destruction of the 'Cuneda' trees is costing thousands of pounds for artificial breakwaters, to prevent the indefinite encroachment of the sea on the estates. 40,000*l.* was spent in two years by one company alone for a sea-wall, consisting of hardened mud and bastions, and another large proprietor has spent about 80,000*l.* in about the same time. The dead level operates fatally against the realisation of any design for really beautiful grounds that should, of course, be comprised in any public gardens, except at enormous expense and prolonged delay, and thus the Guiana gardens will ever be under a great disadvantage. I trust, however, to be able to modify this disadvantage by the formation of a large ornamental lake. The parcel of land available for the gardens, &c. is about 140 acres, and in shape is a parallelogram. Almost the only large trees for miles round are a few Erythrinæ, originally planted as an avenue across the ground, and but

"for these—fortunately a very good and striking feature—the ground is an open flat. The gardens will therefore be a new work in every particular. Extensive drainage works will, of course, be necessary, and the authorities are even prepared to effect it by steam-pump, if found necessary.

"The Lamaha fresh water canal (of 21 miles length) bounds the future gardens on the north side at an elevation of 4 or 5 feet, so that there will be a ready water supply for dry weather, which is sometimes excessively severe.

"In the design for the garden I intend to make provision for the cultivation of native timber and other economic trees as one of the most important features, with the double effect of familiarising colonists with the features and uses of the components of their vast forests, and furnishing material for study in connexion with forest conservancy, and especially to meet the great requirement of reforesting the immense tracts of seaboard lands which have been and still are being abandoned for sugar cultivation."

Jamaica.—Mr. Robert Thompson, Superintendent of the Botanic Gardens (in charge of the Cinchona plantations), has retired upon pension. The botanical establishments in the island are likely to be reorganised, with a view to making them more useful, and so opening up new industries. There seems no reason why the West Indies should not enter upon a new course of prosperity if they would endeavour to grow fruits and vegetables commanding a comparatively high price in the United States, instead of staple commodities like sugar, which there appears to be great difficulty in making remunerative.

Singapore.—I regret to have to record the sudden death of G. Smith, whose appointment from the

Royal Gardens as assistant to the Superintendent of the Botanic Gardens, Singapore, was noted in the last Report (p. 21).

OFFICIAL CORRESPONDENCE.

This department of the work of the Royal Gardens yearly augments both in the number of communications which we receive and the variety of the subjects with which they deal. The plan of recording in these reports some of the more generally interesting matters which are thus brought under our notice has proved very useful to our correspondents in distant countries. Large portions of the Report for last year have been reprinted in various colonial journals, and have been also translated into German. By giving this wide diffusion to carefully considered expressions of opinion, prepared in the first instance perhaps to meet a single inquiry from a Government department, a great deal of labour in replying on the same subject to successive applicants has been saved.

In matters dealing with the ravages of insects I have had to rely on the kind assistance of Mr. R. McLachlan, F.R.S., who has aided us with an amount of knowledge and patient research which the Government could hardly have counted upon obtaining at the hands of a scientific man not in official employ. It appears to me a somewhat striking anomaly that we do not possess in this country any practical entomologist in the service of the Government who would occupy the same position as those employed by several of the members of the United States of America. I do not overlook the existence of the Entomological Department of the British Museum; but the officers attached to it are necessarily occupied with the custody of the collections in their

charge. What is wanted is a consulting entomologist who should be at the disposal of the different Government offices, and who should receive a retaining fee in return for investigating and reporting upon the various questions with regard to which, as will be seen from the following pages, the residents in various British dependencies are constantly needing his aid.

African Oil Palm for Labuan.—In my Report for 1876 I stated that a correspondence had taken place with the Colonial Office on the subject of the introduction of the *Eleis guineensis* from the West Coast of Africa into the island of Labuan, and that I had taken steps to obtain seeds from Africa and also detailed information as to the methods in use there in the extraction of the oil. The substance of a very full report transmitted to me, through the Colonial Office, from Mr. Freeling, the Governor of the Gold Coast, was printed in the Gardeners' Chronicle for June 30, 1877, and was also sent to Labuan. A supply of fresh seeds was received from the West Coast of Africa in March of the same year, and despatched to Labuan, where they were received and planted on the island of Daat in the following August. Mr. Treacher, the Acting Governor, reports that 700 young trees were yielded by this experiment, and "notwithstanding" a drought which was quite exceptional and lasted for nearly "five months, flourished and were" transplanted in July last." Mr. Burbidge (formerly engaged in the Royal Gardens), who is travelling in Borneo for Messrs. Veitch and Sons of Chelsea, saw the trees before and after transplantation, and pronounced them to be in the most healthy condition.

Anisoplia Austriaca at Taganrog.—Copies of correspondence

were received from the Foreign Office relative to the ravages of this beetle upon growing corn in Southern Russia, where it appears to have effected very great mischief. At our suggestion the matter was referred to the Entomological Society. A sub-committee was appointed by this body, and a very full report submitted to the Board of Trade by Mr. M'Lachlan, F.R.S., and Mr. C. O. Waterhouse. From this it appears that the *Anisoplia* is allied to the common cockchafer, but is much smaller. The larvæ feed upon the roots of corn and grasses, and form a cocoon probably at the end of the second year. In the following spring the perfect insect makes its appearance, and then becomes mischievous by feeding upon the green corn in the ear. In 1867 there was a visitation of this insect in Hungary, and enormous numbers were caught by stretching a long cord over a field and drawing it along by a horse at either end, so as to dislodge the insects: these flew away and were afterwards collected by hand and destroyed. The sub-committee attached great importance to the collection and destruction of the greatest possible numbers of the perfect insects, and also to the protection of insectivorous birds. They thought that there was no reason to apprehend the recurrence year after year of such multitudes of beetles. Their extraordinary abundance in particular seasons was due to causes imperfectly understood, but which, it might be taken as certain, were not of constant operation.

Arrow-Poison.—Living specimens of the plants which are used in making the arrow-poison of the New Hebrides were procured by Mr. Braithwaite, of the mission ship "Day Spring," and conveyed to the Sydney Botanic Garden. At the instance of Fleet Surgeon A. B. Messer, examples were transmitted

to Kew for identification (Kew Report for 1877, p. 42). They did not arrive, however, in a condition very suitable for determination,—indeed, dried specimens would have been more useful,—and upon two only can an opinion be pronounced with any certainty. That called *Natoto* is undoubtedly *Excacaria Agallocha*, as had been previously made out by the Rev. Thos. Powell. Another sent without a name is *Vitis acuminata*, which is certainly innocuous. This is probably the plant called in Montague Island Na mamakaru, and in Sandwich Island Namkatikut. It is the only arrow-poison plant which could be described as a creeper, and the juice expressed from the cooked leaves is mixed with the other ingredients of the mixture used for coating the arrows.

Ascension.—The small garrison at Ascension is almost entirely dependent for vegetables upon those which are raised in the island. The following report, which was transmitted by the Admiralty to Kew for advice, revealed a state of things which called for very serious consideration: "Three acres of cabbage and one acre of Kohl-Rabi were planted out in the weather gardens and promised to be a fine crop up to the end of November (1877), when they were attacked by the caterpillars and black grub in such numbers as to render it impossible to save them; this has been a great loss, as the cabbage would have supplied the island for some months; now only a few of the most forward will be fit for use. . . . The caterpillars and grubs are now so numerous that it is useless to put in any crops in the outlying gardens, the pastures are also alive with them, and they are doing much damage to the young grass.

"Five acres of land in the sheep-walk gardens have been prepared for planting sweet potatoes, &c., but the caterpillars have so damaged the young vines as to prevent any cuttings being taken from the plants saved for the purpose."

The first thing to be done was to ascertain the exact nature of the insects which did the damage. Acting on this suggestion, the Admiralty obtained and transmitted to Kew a collection of the larvæ and mature insects, and these were submitted to Mr. McLachlan for identification. He reported that it was probable that all had been introduced into Ascension, and that most of them were species of wide distribution.

The most mischievous kinds he considered to be the following; they are all Noctuid moths:—

Agrotis segetum, extremely common in Europe and very destructive. Found also in India, Cape of Good Hope, &c., &c. The moth is nocturnal, as is also the larva, the latter retiring into the earth during the day. This is the most to be dreaded on account of its abundance and concealed mode of life.

Prodenia retina, a moth of very wide distribution. There does not appear to be any record of its larvæ having appeared in sufficient numbers to be injurious.

Plusia aurifera, a common African species.

Plusia U-aureum, the Ascension insect cannot be separated from that of the North of Europe.

Leucania, apparently identical with *L. Loreyi*.

It is noteworthy that the island of St. Helena has long been infested with similar insect pests; which, indeed, allowing for divergence of entomological determination, might even be identical with those of Ascension. Mr. Melliss informs me that the green caterpillar of *Plusia*

aurifera, and the brown caterpillars of *Leucania extranea* and *Prodenia testaceoides*, are abundant in St. Helena, and are at times very destructive of vegetation, especially cabbage and Kohl-Rabi crops. In that island young broods of the common barn-door fowl and domestic duck are found useful in destroying these caterpillars, which they devour greedily. The black grub of St. Helena is *Agrotis obliquosa*; at times, particularly after one or more dry seasons, this is exceedingly destructive to crops. "The grubs," Mr. Melliss states, "are seldom seen above ground, but just beneath the surface they voraciously attack the young stems and shoots of vegetation. The earth-coloured moths are nocturnal in their habits, and therefore are seldom seen. Both grubs and moths are of an exceedingly sluggish disposition, and do not readily migrate. General Beatson found that the best mode of ridding the land of them is to starve them by a clean fallow during the warm dry weather."

Various opinions were obtained as to the kind of birds which might be introduced into Ascension to keep the insects in check. The island being treeless, rooks would be unlikely to thrive. Sparrows also would be useless, because the grubs are subterranean and too large for them to feed upon. The general agreement was that starlings would be most useful. Mr. Bartlett, of the Zoological Society, reports:—"No bird would answer better; they can be obtained in the spring in large numbers; they are very hardy and easily kept on the voyage, and will thrive in any climate where insects are abundant." If the common starling failed, that known in Mauritius as the martin (*Acridotheres tristis*) might be tried.

Later in the year we were again applied to with regard to a beetle which was found very destructive to grape vines imported into Ascension from S. Africa. The specimens were submitted to Mr. McLachlan, who obligingly furnished a report upon them, from which I extract the following remarks:—

"Mr. F. P. Pascoe, a specialist in "exotic *Cureulionidae*, informs me "that they belong to the genus "*Siderodactylus*, which is peculiarly South and West African, "and of limited extent. He considers the species not to have "been previously noticed, and has "named it *S. ornatus*. So far as I "am aware, nothing has been previously recorded of the habits of "the genus. The larvæ probably "feed underground on the roots "of herbaceous plants, and undergo their transformation in the "earth. As remedies it might "be desirable to dust the vines "with powdered sulphur or with "Paris Green, so much vaunted "as a preventive against the "attacks of the Colorado Beetle in "America; or the beetles themselves might be collected on sheets "or circular nets placed round the "vines, after being dislodged by a "shake or sudden blow on the "lower part of the stem."

Bahamas.—I learn with satisfaction the continued success which follows the energetic attempts of his Excellency Governor Robinson to develop the agricultural industries of these islands.

The exportation of *Tomatos* has grown with extraordinary rapidity, as shown by the following figures:—

1875	-	2 crates,
1876	-	200 "
1877	-	7,000 "
1878	-	20,000 " (estimated).

Governor Robinson thinks that there is no reason why the Bahamas should not, like the Bermudas, be

able to send to the United States market 150,000 boxes of *Tomatos* annually of a value of from 10,000*l.* to 12,000*l.*

In July of last year *Onions* (of which I had sent out some of the best procurable European seed) were for the first time exported from the Bahamas. Governor Robinson states:—"Nearly 4,000 "tons weight of Madeira onions "are sent from Bermuda to the "New York market annually, and "I think it has been abundantly "proved that it only requires industry and energy on the part of "the farmers in these islands to "enable them to enter into successful competition with those islands "which have hitherto enjoyed "something akin to a monopoly in "the export of these products."

Governor Robinson also reports the exportation of *Tobacco* from the Bahamas for the first time in July 1878, when 2,000 lbs. of fine tobacco from Vuelta Abajo seed were sent to New York.

Bahama cigars have been also sold for export to America, at the rate of 40 dollars per 1,000.

"Thousands of cigars of native tobacco and manufacture are now smoked in this Colony, and though they fall far short of Havana cigars, I believe their radical defect is rather in the incomplete fermentation and cure of the leaf than in its inferiority to that of the plant grown in the island of Cuba."

Bamia Cotton.—This appears to be nothing more than a fastigate variety of Egyptian cotton (Kew Report for 1877, pp. 26, 27). This habit is a very common form of variation, the Lombardy poplar and Irish yew being well-known examples. Some disappointment has been expressed by the recipients of the seed (in the Bahamas, Fiji Islands, and elsewhere) which we distributed at the plant growing up

with the ordinary bushy habit of the cotton plant. The explanation appears to be that when the demand set in for the seed and the price rose, it was unscrupulously adulterated.

Mr. Chapman reports from Alexandria:—"Here the Bamia plant is mostly a failure, requiring an immense amount of water, and growing too tall, as high as 15 feet."

On the other hand, Acting-Consul Calvert reports from the same place at the end of last year:—"The Bamyah cotton, introduced in this country four years ago, the cultivation of which is yearly increasing, is giving satisfactory results to the grower and consumer, and has commanded this season exceptionally high values, having obtained in Liverpool the classification of extra fine Ashmuni, and the comparatively small quantity available this season has been eagerly sought after."

It has been tried experimentally in various parts of India with varying success. The quality of the cotton has not appeared to be materially different from that of ordinary Egyptian.

Chinese Coffin-woods.—The inquiries made at the instance of the Inspector-General of Forests in India with regard to the identity of the Nan-mu wood, so highly valued by the Chinese for coffins, has elicited a good deal of additional information upon the subject. Mr. Cecil C. Smith, late Colonial Secretary at Hong Kong, has sent us a collection of 10 different kinds of wood used by the Chinese for coffins. He writes: "I regret much that I have been unable to give you the botanical names of the different kinds of wood, but you know far better than I do that without dried or fresh specimens of the

"trees producing them in flower and fruit it is impossible to ascertain their botanical origin. The wood is brought down from distant places, and it is hopeless to get the specimens referred to from Chinese sources. The prices charged by different undertakers have been averaged, and I give you the figures in sterling. The extreme prices are not added, for they run out to fabulous amounts. In one case that I know of the coffin of a mandarin cost over 6000. It was, as usual, of wood alone."

I give Mr. Cecil Smith's list, as it is quite possible that a copy of this report may find its way into the hands of some person in China who may be able to assist us in the identification of some of these woods:—

1. Pine from the upper four districts of Ting-chow, in Fok-kien. Price 10*l.* to 150*l.*
2. Pine from the Tsing-lan (river), in Ting-chow, in Fok-kien. Price 6*l.* to 100*l.*
3. Pine from Lan-chow, in Kwang-si. Price from 4*l.* to 60*l.*
4. Pine from Fu-chuen, in Kwang-si. Price from 4*l.* to 40*l.*
5. Pine from Foo-chow, in Fok-kien. Price from 4*l.* to 40*l.*
6. Pak-heung or Fragrant Cedar from Kwang-si. Price 34*l.*
7. Yan-sha from Sz-chuen. Price 80*l.*
8. Wai-muk (or Mast End) from Kwang-si. Price 2*l.*
9. Pine from Tung-kong (Eastern River) in Wai-chow, in Kwang-tung. Price 1*l.*
10. Pine (common kind), named Sz-ui-luk, from Sz-ni, in Kwangtung. Price 15*l.*

The woods are all coniferous, but we have not succeeded in identifying any of them further. Nos. 1-5 probably all belong to the same species.

The wood is dark, cedar-coloured, and exceedingly fragrant.

No. 6 is a pale compact wood, also fragrant. It is very similar in texture to the wood of *Cupressus funebris*, which is also said to be used in China for coffins.

No. 7 is a light wood of a dark cedar colour, very fragrant, and with very close annual rings.

Nos. 8-10 may all possibly belong to the same species. They are lighter, paler in colour, and less fragrant than Nos. 1-5. The value of all these woods, in the estimation of the Chinese, appears to depend upon their scent, and it is a question whether, seeing the high prices which scented woods command, it would not pay to import similar kinds into China.

Cinchona-disease in Jamaica.

—Mr. Thomson, late Superintendent of the Botanical Gardens, Jamaica, has drawn my attention to a disease affecting trees of *Cinchona succirubra* in Jamaica, which first attracted notice in 1877. He describes the course of the disease in the following terms:—"A tree, say, 20 feet high, appears in the early stage of decline to be quite luxuriant, with the exception of a slight discoloration of the foliage; near the centre of the trunk, which is quite healthy above and below, a space varying from a few inches to a few feet is contracted; the bark is utterly dead, and the wood underneath the bark is equally affected. Towards the heartwood the wood becomes fresh, and through this the vital functions of the upper part of the plant are maintained irrespective of the lifeless condition of the bark, &c."

This description evidently points to the disease being quite local, and confined to the main stem some feet above the ground. That the roots are unaffected is shown by the lower

part of the stem sending up young shoots freely after the death of the upper portion. Under the bark of the diseased trees a small wood-louse (*Podura*) is met with. The trees when diseased are also bored by a small Bostrychoid beetle, but this only appears to complete the destruction which is brought about independently.

On making a section of a diseased stem it is evident that the external portion of the wood, the cambium layer, and the bark are all perfectly dead, and there is little doubt that this is brought about by their being permeated by the mycelium of a fungus, the spores of which probably lodge in fissures of the bark, at the bottom of which the tissues are sufficiently soft to be readily invaded by the mycelial filaments produced by the spores. The injury caused to the tree by the diseased condition of the young wood and bark of the stem is exactly of the same kind as is effected by ring-boring. All above the zone of injury dies, while the stem below remains unaffected and is capable of throwing up vigorous shoots.

Fortunately the number of trees attacked is comparatively small. The disease, which is doubtless quite incurable, will be best met by felling the trees and securing the bark as soon as they appear unhealthy. All the waste and debris should be scrupulously burned. The base of the stem will generally "coppice" freely if it is thought worth while to take advantage of that method of renewing the plantation.

Cinchona febrifuge.—Dr. King reports:—"Increased experience in the use of the new medicine during the past year has served to establish a large amount of confidence in it. Complaints of its nauseating are now rarely heard, and many medical practitioners of experience affirm that

"instead of being less potent in the
"cure of fever than quinine, the
"Cinchona febrifuge is quite equal,
"if not superior, to the more ex-
"pensive drug. The proper dose of
"the febrifuge is, moreover, found
"to be about the same as or even
"less than the dose of quinine."

The nausea and vomiting which the febrifuge has been credited with producing appear to have been the result of the too large doses which were given. Similar effects would have followed from equally large doses of quinine. The presence of aricine in the febrifuge, to which these unpleasant effects were attributed, appears to be doubtful, according to Dr. O. Hesse (Pharm. Journ. 3rd ser., vol. ix., p. 839).

"Quinine," Dr. King states, "during the year 1877-78, was
"very high in price, and in Cal-
"cutta it for some time stood at
"20 rupees per ounce, a sum for
"which 16 ounces of the febrifuge
"were always obtainable. The
"saving to Government by the sub-
"stitution of Cinchona febrifuge for
"quinine in their hospitals and dis-
"pensaries has already been con-
"siderable. I calculate that at a
"moderate estimate it amounts to
"over three lakhs of rupees
"(30,000*l.* sterling)."

**Cocoa-nut Beetle in Zanzi-
bar.**—Dr. Kirk has sent us speci-
mens of a beetle whose larva is very
destructive to cocoa-nut trees from
two to five years old. Until the
time of the hurricane the planta-
tions suffered little, but after the
scope given for their development
by the thousands of rotting and
fallen palm trunks, they became a
serious danger, and plantations often
lost 25 per cent. of their young
trees. These may be saved by
cutting out the larva when the
chewed leaf seen on the outside of
the shoot shows that the plant has
been attacked. If the central shoot

is destroyed by the larva, the plant
either dies or puts out a lateral
shoot: this only happens when the
plant is very young.

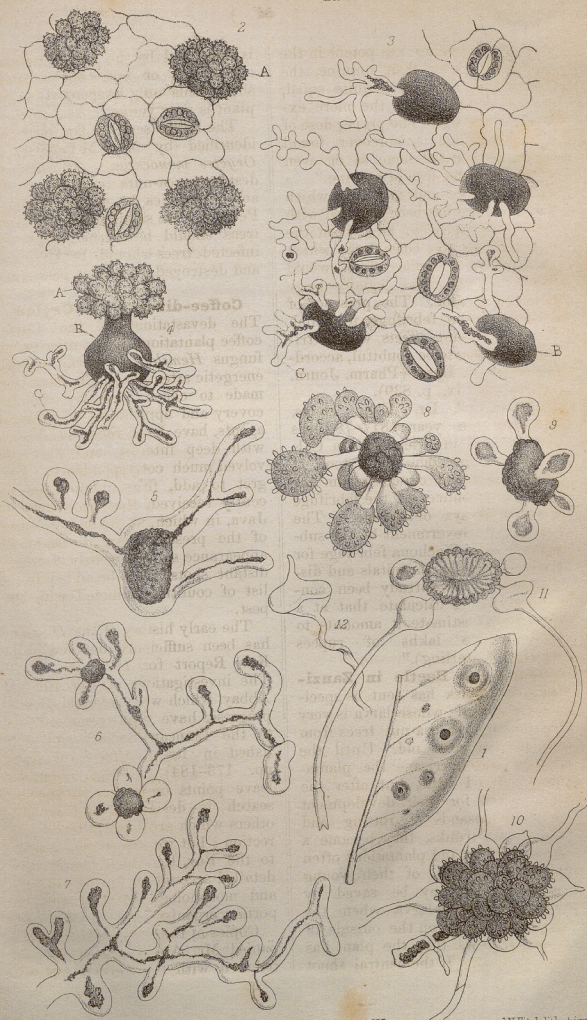
The beetle sent by Dr. Kirk was
identified by Mr. McLachlan as
Oryctes monoceros. *O. insularis*
destroy cocoa-nuts in Réunion, and
another species is very injurious in
Penang. He suggests that all fallen
trees should be burned, and that
infected trees should be cut down
and destroyed as soon as possible.

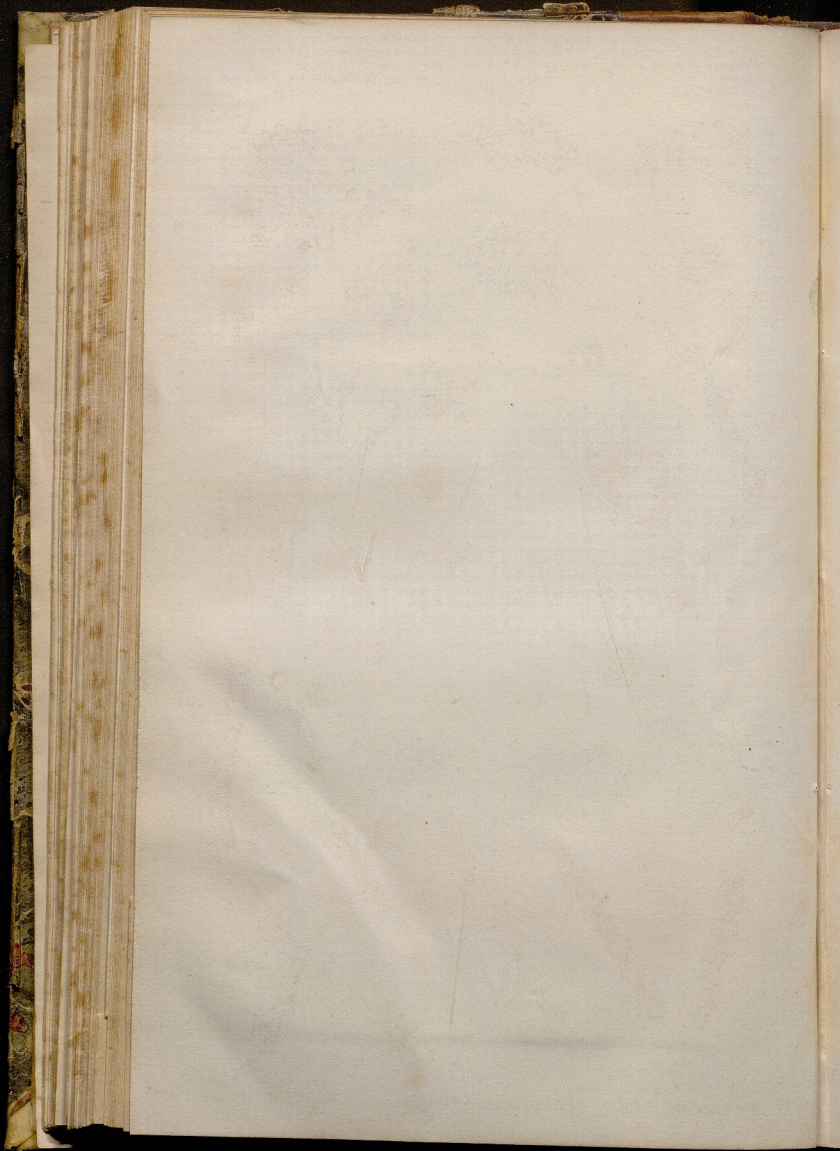
Coffee-disease in Ceylon.—

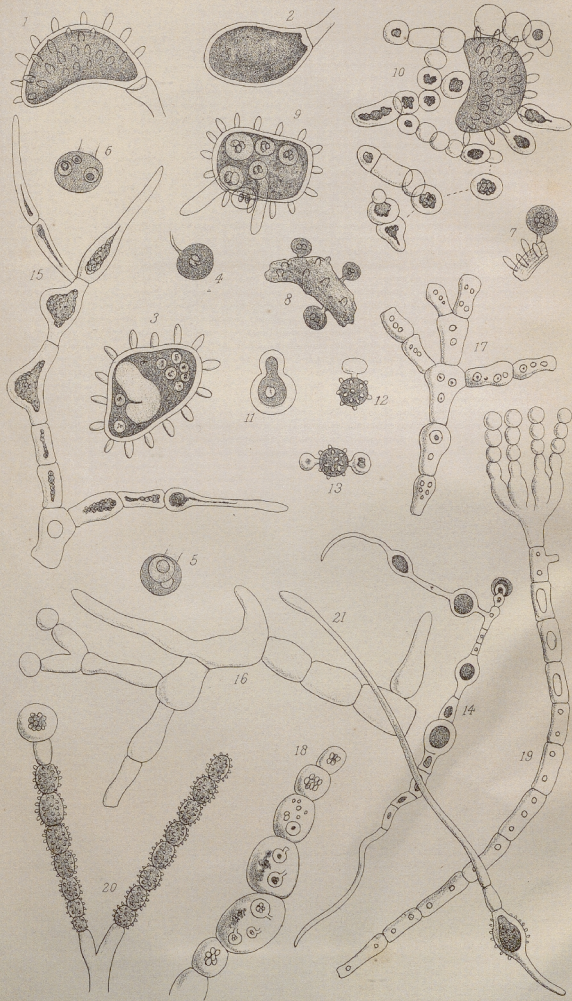
The devastations of the Ceylon
coffee plantations by the microscopic
fungus *Hemileia vastatrix*, and the
energetic attempts which have been
made to check them by the dis-
covery and application of remedial
agents, have been followed at Kew
with deep interest, and have in-
volved much correspondence. I re-
gret to add, from intelligence re-
cently received, that the island of
Java, in which, at the end of March
of the present year, it made its
appearance simultaneously in several
distant spots, must be added to the
list of countries afflicted with this
pest.

The early history of the *Hemileia*
has been sufficiently detailed in the
Kew Report for 1876, pp. 18-20.
The investigations of the Rev. R.
Abbey, which were referred to as in
progress, have been communicated
to the Linnean Society and pub-
lished in its journal (vol. xvii.,
pp. 173-184). They, doubtless,
leave points on which further re-
search is desirable, and possibly
others which are susceptible of cor-
rection; but we are so far indebted
to the Rev. R. Abbey for the first
detailed account of the life, history,
and morphology of this most im-
portant organism.

Copies of the plates which accom-
panied Mr. Abbey's paper are dis-
tributed with this report, and will







be intelligible with the following descriptive references.

PLATE XIII.

1. Portion of leaf (half natural size) with disease spots. These are at first pale, afterwards becoming orange-coloured, and covered on the under surface with a bright yellow, then orange-coloured dust. The dark spot in the centre is due to the presence of another but unimportant fungus, a black *Aspergillus*.

2. Portion of cuticle of under surface of leaf viewed from outside, showing stomata and clusters of sporangia (which contain the spores), the aggregate of which forms the dust above mentioned $\times 150$.

3. Portion of cuticle of under surface of leaf viewed from inside, showing mycelial filaments connected with dark bodies, which exteriorly bear the sporangia $\times 150$.

4. Dark body extricated from the leaf; it bears a cluster of sporangia above, and has the mycelical filaments attached to it below $\times 200$.

5, 6, 7. Mycelium from the interior of a "diseased" coffee leaf $\times 350$.

8, 9. Clusters of sporangia, from which the ripe individuals have been separated by washing $\times 400$.

10, 11, 12. Figures showing structures (possibly some parasitic organism) found on sporangia clusters from Sumatra $\times 250$.

PLATE XIV.

1, 2. Sporangia with stalk detached $\times 800$.

3. Sporangium with contained spores $\times 800$.

4, 5, 6, 7, 8. Spores with and without attached fragments of sporangia $\times 1,000$.

9, 10. Spores germinating within a sporangium $\times 600$.

11, 12, 13. Spores germinating $\times 1,000$.

14, 15. Mycelium produced by germinating spores $\times 500$.

16, 19. Mycelium with immature conidial fruit; 16×700 ; 19×500 .

17, 18. Mycelium with granulated protoplasm; 17×700 ; 18×1000 .

20. Mature conidial fruit $\times 1,000$.

21. Conidium germinating $\times 1000$.

The disease has also been studied in Ceylon by Mr. Morris, Assistant Director of the Royal Botanic Gardens, Peradeniya, from the practical point of view of finding some means of combating its attacks. Mr. Morris was eventually detached entirely to this duty, with the permission of the Government and the approval of Dr. Thwaites. The following is a brief summary of his results:—The *Hemileia* is, of course, propagated from year to year by spores which, if Mr. Abbay is correct, are contained in the sporangia forming the orange-coloured dust on the under surface of the leaves of diseased plants. These sporangia become detached, and are powdered over the leaves, twigs, branches, and stems of the coffee plants, and on the ground beneath. They are also blown about by the wind, but, except this is very strong, are probably not carried to any very great distance.

The spores germinate and produce the filamentous or thread-like mycelium described by Mr. Abbay. Mr. Morris found that in infected plantations, although invisible to the naked eye, it could be shown by the microscope that in what may be called its *first stage*, the filaments of the *Hemileia*, covered—however little this might be suspected—the ground and every part of the stems, branches, and leaves of the coffee trees growing upon it. It continues generally in this stage from December to March. During this period, besides the vigorous growth of the mycelial filaments, the fungus possibly multiplies itself by the forma-

tion of reproductive bodies called conidia, which are detached from the filaments, and germinate and grow precisely in the same manner as spores.

The second stage begins where the filaments enter the stomata on the under surface of the leaves. They now assume a thicker, more branched, and coral-like aspect as they ramify amongst the loosely packed intercellular tissue of the interior of the leaves. The ends of the branches of the mycelium come in contact with individual cells, tap their contents, and progressively destroy them, feeding on their contents.

This continues till the last or third stage is reached. The filaments having reached maturity once more, push their way through the stomata and produce on the outside the clusters of orange-coloured kidney-shaped sporangia.

Mr. Morris has clearly shown that it is only in the first stage, when the *Hemileia* is purely external in its mode of life, and has inflicted little or no injury upon the coffee plants, that it can be advantageously attacked. To the extent to which the mycelium can be destroyed in this stage without interfering with the health of the coffee plant will be proportioned the alleviation of the further and injurious stages of the disease and its chance of perpetuation to another season. The most important of the numerous remedies which have been proposed may be briefly noticed.

1. *Mr. Wall's method of Fumigation.*—Mr. Morris finds that “the fumes of burning sulphur, whether applied by the aid of umbrellas or in the open field, have invariably had an injurious effect upon the trees, and, by causing them to shed their leaves, have aggravated the disease they were intended to cure.” What is still

more conclusive with regard to this method is that “fumigation has not in the least degree diminished the amount of leaf disease.”

2. *Mr. Northmore's Salt-water Treatment.*—Mr. Morris has found that neither sea-water nor solutions of sea-salt have any effect in killing the *Hemileia*.

3. *Mr. Morris' Sulphur-lime System.*—Mr. Morris writes:—“I have obtained very important results with a mixture of sulphur and coral-lime in the proportion of one to three. The action of the sulphur seems to be much quickened and the cost reduced to almost a third. In addition to this, no special blower is required, for a coolly supplied with the mixture in a bag can powder the tree very effectually by hand, and the smallest quantity of the powder deposited on the under side of the leaves is sufficient to destroy the filaments very thoroughly. The planters can now treat the whole of their estates in a week or 10 days, and at a cost not exceeding 50s. per acre. I cannot hope to see anything more satisfactory than this. The coral-lime used, which must be unslaked, will prove a valuable dressing to the soil, and thus the leaf-disease specific, pure and simple, viz., the sulphur will cost only 20s. to 25s. per acre.”

Cyprus.—The occupation of this Island by the British Government led to much information, especially with regard to the forests, being sought from this establishment. The amelioration of the swamps, which it was hoped might be effected by planting *Eucalyptus*, was also eagerly desired, and some mistakes were perhaps made in the laudable wish to effect something with as little delay as possible. My suggestion that an Indian forest

officer should be sent to the Island to survey and report on the existing forests, and the best mode of utilising and preserving them, was adopted, and Deputy-Conservator Wild, who was detached to this service, has sent home an excellent report. Packets of seeds of *Eucalyptus*, and other trees and shrubs likely to be useful, have been procured and sent out to Cyprus from Kew.

Dragon's Blood of Africa.—

This drug, which now only rarely finds its way into commerce, has been known in medicine from the earliest historical times. Under the name of Cinnabar its African origin is mentioned by Dioscorides, and it is recorded by a writer attributed to the first century as the production of the Island of Socotra.

Till quite recently nothing has been known as to its history. Dr. Hildebrandt, however, discovered in Somaliland a *Dracena*, which yielded Dragon's Blood. The specimen of this plant in the Kew Herbarium consists unfortunately of nothing more than an inflorescence; it has, however, afforded Mr. Baker sufficient data for the description of the plant as a new species under the name of *Dracena schizantha* (Journal of Botany, 1871, p. 77). Hildebrandt himself speaks of it as having a habit resembling that of *D. Draco* (Berlin, Monatschr. des Gartenb., 1878, p. 313). A species closely resembling the latter, but quite distinct from *D. schizantha*, is the plant found in Nubia, and imperfectly described by Kotschy and Peyritsch under the name of *Dracena Ombet*. There can be little doubt that this would supply Dragon's Blood no less than the well-known Dragon's tree of the Canaries.

We possess now at Kew a fine young living plant of the *Dracena* which yields the Dragon's Blood of Socotra. For this we are indebted

to Mr. W. Wykeham Perry, of H.M.S. Undaunted, which during the past year was stationed at Aden. The want of definite information about the Socotra plant which is pointed out in the Admiralty Manual of Scientific Inquiry attracted Mr. Wykeham Perry's notice, and with the aid of Captain Hunter, Assistant-Resident at Aden, he obtained for us a fine specimen which had been brought from Socotra, as well as the Myrrh and Frankincense plants to be hereafter referred to.

Mr. Baker identifies the Socotra *Dracena* (having made a special study of the genus) with *D. Ombet*. But in the absence of flowers the identification cannot be regarded as final, and the plant might even turn out to be the same as that of Somaliland.

Mr. Wykeham Perry obtained the following information respecting it from Captain Hunter:—

"The tree grows only at an elevation of about 1,500 feet above the sea. The natives of Socotra state that the tree is dioecious; that the male and female plants grow at a distance from each other; that the fruit is a berry in clusters, and that the plants of both sexes yield gums.

"The difference in the appearance of the two trees consists in the presence or absence of short stumpy branches from which the head of spiky leaves springs. It is not until the tree is a few years old that any difference in growth appears. In the male tree the branches appear to be thrown out to an unlimited extent. In the female there are no branches at all, but the stem is sometimes forked. It grows to the height of 20 feet, and somewhat resembles a mushroom in appearance.

"To obtain the drug called Dra-

"gon's Blood the bark is scraped,
 "and after 15 or 20 days the gum
 "exudes and is collected in March.
 "It is chiefly exported from Aden
 "to Bombay, where it is used by
 "the goldsmiths."

I learn from Captain Burton that a similar, if not the same, *Dracena* abounds in parts of Arabia visited by him [see Proceed. R. Geogr. Soc.], and this corroborates the older statements of Welstead to the same effect.

Eagle-wood.—The Forest Report for British Burma for 1876-77 contains an interesting account of this singular product, the Akyaw of the Burmese and Kayu-garu of the Malays. It is obtained from the islands in the Mergui Archipelago, of which it is the only valuable article of forest produce. Akyaw has been described as consisting of "lumps of hardened scented resin found imbedded in the trunk." But it is clear that this is not exactly the true state of the case, as the hardened masses are always composed of a basis of more or less decayed wood, the tissues of which are infiltrated with the resin. It is found in all parts of the trunk of the tree, and most frequently in the alburnum, but only where decay following intentional or accidental injury has attacked it. By artificially injuring the growing tree in a systematic manner the yield might probably be increased. It is generally believed to be produced by *Aquilaria Agallochum*, Roxb., but the native collectors state that there are two kinds of trees which furnish the Akyaw, but that the substance from both is identical. The great bulk of that which is collected is sent to Penang and Singapore and shipped from thence to China, where small pieces are used for torches, incense, and medicine. In the islands of the Mergui Archipelago it is estimated that 8,000 trees are cut down every year,

and the extermination of the tree in all readily accessible places is only a question of time.

Eucalyptus.—The Inspector-General of Forests has forwarded to Kew for identification specimens of a species which grows well in the Changa Manga plantations in the Punjab. It proved to be *E. melanophloia*.

In Mauritius finds that *E. calophyllus* does particularly well, and has now raised 30,000 seedlings from seed produced in the island.

Frankincense.—Amongst the living plants sent to Kew from Aden by Mr. Wykeham Perry were several living examples, probably the first which have ever reached this country, of the species which produce the gum resin Olibanum or Frankincense. They were accompanied by a manuscript drawn up by Captain F. M. Hunter, Assistant-Resident at Aden. This contains a great deal of valuable information, which it is to be desired that Captain Hunter would publish in full. Notwithstanding the careful researches of Mr. Carter, Dr. Birdwood, and others, there is much evidently still to be done in the botanical determination of the plants which, as will be seen below, the native collectors of the gum discriminate.

According to Captain Hunter there are four distinct sources of the names which attach to the Olibanum of commerce:—

1. The Somali name of each kind of Olibanum yielding tree.
2. The Somali name of each kind of Olibanum.
3. The Arab name for each commercial sort of Olibanum after blending of the different kinds and reassortment.
4. The name derived from the place of export.

A further complication arises, according to Captain Hunter, from the fact that the Somal names vary

in different parts of the country east and west of the 47th meridian of longitude. He thinks there are in all five different kinds, as follows :—

W. Somali Names.	E. Somali Names.
1. Mohr Ad.	Mohr Laföd.
2. Mohr Madao.	Mohr Madao.
3. Mohr Dadbéd.	Mohr As.
4. Karåon.	Karåon.
5. Yegaar.	Yegaar.

1. *Mohr Laföd*.—Captain Hunter remarks that “it is not improbable that *Mohr Ad* and *Mohr Laföd* are the same. The gum of the latter is, however, obtained in strips, occasionally upwards of a foot long, but *Mohr Ad* is said never to yield such lengthened tears. *Laföd* is probably derived from the Arabic *lafeh*, plural *lafât*, strips (especially of a turban), the Somali giving a *d* sound to the feminine Arabic termination. *Ad* in Somali is an adjective root meaning white. The name is given either because the bark is light coloured or because the gum is whitish. Both the *Mohr Laföd* and *Mohr Ad* are described as growing on the coast range, especially near water-courses.”

Mohr Laföd has produced leaves at Kew. It would be premature, perhaps, to pronounce any definite opinion upon it in its present state, but it is probably a smooth-leaved form of *Boswellia Carterii*, Birdw. *Mohr Ad*, which reached Kew dead, is identified with *Boswellia Bhaudajiana*, Bdw., which may be itself an extreme form of *B. Carterii*.

2. *Madao*, Captain Hunter states, “is a Somali root meaning black. The name is either derived from the dark colour of the bark or because the gum of this variety becomes black on exposure to the air. This tree is comparatively rare, and its gum is not held in

“much estimation, as it is sticky, and when mixed with other varieties is apt to discolour them and afterwards injure their market value. *Mohr Madao* is referred to *Boswellia Carterii*, Bdw.

3. *Dadbéd* and *As* are supposed to be the same. “The tree is common near the sea. The gum is reddish in colour.” No specimens of this kind were sent to Kew, and absolutely nothing is known about them.

4. *Karåon*.—“This tree is alleged to be more rare, and to grow isolated on the tops of hills. The gum is held in little estimation, and is only mixed with the others to increase quantity and weight.” Nothing is known of this plant, and the specimens received at Kew have not grown.

5. *Yegaar*.—The gums of the four preceding kinds are all mixed together by the Somali to be subsequently divided into two qualities, the best of which is again assorted by the Arab traders. *Maeti* (which is the same thing as *Lubân Matti* of commerce) is the produce of the plant called *Yegaar*, which is known to botanists as *Boswellia frereana*, Bdw.; it is never assorted or mixed with the other kinds. Captain Hunter informs me that it is said not to grow westward of the 46th meridian of longitude. In Socotra there is a tree called by the natives *Amiru* which strongly resembles the *Yegaar*, and its gum is even more pungent. Nothing is known botanically of the *Amiru*.

Without drawing further upon Captain Hunter's valuable notes, it will be evident that much remains to be done to place our knowledge of Frankincense yielding trees upon a really satisfactory footing.

Captain Hunter also brought to this country a collection of authentic specimens of all the different kinds of Frankincense met with in com-

merce, with their distinctive names. Unfortunately, in the Custom-House examination all the contents of the several boxes got hopelessly mixed, and the collection was valueless for purposes of study.

Gutta-shea.—Shea butter is a vegetable fat, extracted by crushing and boiling from the seeds of *Butyrospermum Parkii*, a member of the family *Sapotaceae*. Since 1851 it has been brought to this country from Western Africa in gradually increasing quantities, and the annual import is now said to amount to from 300 to 500 tons. It is principally used for soap-making. It does not make a very good detergent soap, but it makes an excessively hard one, and is therefore useful for mixing with other kinds in manufacturing soaps for domestic purposes.

Mr. W. Henderson, of Glasgow, has sent to the Kew Museum a specimen of a substance which has attracted some attention, and to which he has given the name of Gutta-shea. It is present in Shea butter to the amount of '5 to '75 per cent. It appears to resemble in many respects gutta-percha, but is more brittle. It is insoluble in alcohol, a mixture of alcohol and ether, acids, and alkalies. It is slightly soluble in pure ether and ordinary animal and vegetable oils and fats. From the extremely small proportion in which it is present in Shea butter, its extraction would not be profitable. And regarded as a bye-product it does not appear to be suitable for any purpose to which gutta-percha itself is applied. The Kew Museum possesses a specimen of a substance akin to the latter in its properties which is yielded by the Shea butter tree. It is possible that the so-called Gutta-shea, which is present along with fatty matter in the seeds, may have some connexion with this.

India-rubber.—1. *Ficus elastica*.—The future supply of India-rubber being a matter of so much interest, it will be interesting to note Mr. Mann's operations in the cultivation of this important species in Assam, which are detailed in his report for 1876-77, received at Kew at the beginning of last year:—

"The planting of caoutchouc-trees has not as yet emerged altogether from the experimental stage, for although no doubt remains that the tree will grow most luxuriantly in the locality chosen, the different ways in which the young trees have been planted did not all succeed equally well. The plants planted in cane baskets in the forks of trees, although many of them are alive and healthy, remained stationary, or almost so. Many of the trees planted simply in the ground also did badly, and there is no doubt that Rubber-trees should not be planted in this way. The trees planted on low split stumps or in earthenware cylinders on low stumps of trees, on piles of wood put crossways and mixed with earth, and on small mounds of earth about 2 to 3 feet in height, have all done exceedingly well; all plants will in future be planted on mounds of earth, stumps, piles of wood, or whatever is most handy, raised about 3 feet from the ground."

Mr. Mann found that the best cuttings do not transplant so well as seedlings, and that raising plants from seed is the method of propagation which must be chiefly depended on.

In a subsequent report, which reached Kew at the close of last year, he gave further particulars of this enterprise, explaining, amongst other matters, that "drainage about the roots is insured by planting upon mounds." The total area under cultivation at Charduar was

572 acres, 112 acres additional having been cleared for planting.

2. *Fijian India-rubber*.—In the last Kew Report (pp. 31, 32) reference was made to two plants from Fiji which were said to produce rubber. One of these was identified with certainty as *Alstonia plumosa*. The other was referred with doubt to *Tabernaemontana pacifica*.

From ampler materials collected by Mr. Horne, the Director of the Botanic Garden, Mauritius, during his visit to Fiji, it appears that the plant described by Seeman under the latter name is probably not really itself distinct from *Alstonia plumosa*, and it is therefore not improbable that both the caoutchouc-yielding plants in Fiji belong to this species.

Two other species of *Alstonia* also yield caoutchouc. One of these is *A. scholaris* (see Journ. Soc. Arts, 1864, p. 30), which is widely distributed through the tropics of the old world. The other is *A. costulata*, a native of the Malayan archipelago, which is described by Main-
 "gray as "abounding in pure caout-
 "chouc."

3. *Hevea in British Guiana*.—Mr. Prestoe, Government botanist of Trinidad, whose mission to British Guiana has already been adverted to, informs me that he met with a species of *Hevea* at the penal settlement on the Mazaruni river. Mr. Prestoe writes to me :—"The
 "three plants you kindly sent me
 "last year enabled me to detect the
 "tree on two islands in the Esse-
 "quibo—of course at a distance.
 "I secured some 50 seedlings.
 "Darkness and the departure of
 "the steamer prevented my doing
 "more; but I have no doubt, from
 "what I saw, that this tree exists
 "in the forests of Guiana in un-
 "bounded plenty. Some of the
 "leading colonists knew of the
 "India-rubber being sometimes col-

"lected by the Indians, but I met
 "with no one who had any notion
 "of the tree producing it, the sup-
 "position being that it was pro-
 "duced by a species of large-leaved
 "*Ficus*."

Mr. Prestoe forwarded leaves of the *Hevea* collected by him. It is identical with a plant collected in British Guiana by Dr. Hancock, and is probably *Hevea pauciflora*. It is remarkable that the existence and uses of so important a plant in the forests of British Guiana should have so long remained in oblivion, and Mr. Prestoe's detecting it during his brief visit to the colony is an instance of the services which botanical science in the hands of an energetic official can render to colonial industry. The matter is of the more importance since the exportation from the colony of Gum Balata, which at one time attracted considerable attention, has now almost ceased.

4. *Liberian Rubber*.—Mr. Thomas Christy has introduced a new rubber plant to this country from Liberia, which we succeeded in identifying at Kew with *Urostigma Vogelii*, a species first collected at Grand Bassa by Vogel, and described in the Niger Flora. It belongs to the same family as the fig. The rubber is made up into balls about the size of a large orange. It is valued in the London market at 1s. 6d. per lb., and if sent home cleaner would command a higher price.

5. *Malayan and African Rubbers*.—These products have the point in common that they are produced by nearly allied, though distinct, climbers belonging, like *Alstonia* referred to above, to the natural family *Apocynaceae*. Much information about them, accompanied by specimens and sketches, has been received at Kew from Mr. Murton, Superintendent of the Botanical Garden, at Singapore,

Mr. Burbidge, during his travels in Borneo for Messrs. Veitch, Mr. W. H. Treacher, the Administrator of Labuan, and Dr. Kirk, Her Majesty's Consul-General at Zanzibar. The complete study and examination of these materials has not yet been completed, and the results will be given in the next Kew Report.

Madagascar Baobab.—Some seeds imported into Liverpool in considerable quantity from S. W. Madagascar were identified with some difficulty as those of a Baobab, and I have little doubt that they are those of the tree described by Baillon as *Adansonia madagascariensis*, but of which the Kew Herbarium possesses no specimens. The Rev. J. Richardson, in the interesting account of his journey to St. Augustine's Bay, printed at the Mission Press at Antananarivo, describes in the following terms an individual which he met with of this curious species:—

"On the banks of a stream we saw the most ugly specimen of a tree that I have ever beheld."
"It is a Baobab (*bontóna*) tree."
"The height of the trunk is about 12 or 14 feet, while its diameter, about 6 feet from the base, is 22 feet; its branches are most insignificantly small. It looked like a fat two gallon bottle, the neck of which had been knocked off, and a few birch twigs placed there instead!"

Myrrh.—"It must be confessed," remarks Hanbury (*Pharmacographia*, p. 125), "that the botany of the Myrrh trees is still encompassed with uncertainty." It was, therefore, with peculiar interest that a complete set of the plants yielding the several kinds of Myrrh known in eastern commerce were received at Kew from Mr. W. Wykeham Perry, who obtained them from Capt. Hunter at Aden.

These plants were in a living but

leafless state when they reached Kew. Being mostly destitute of roots, which could not be readily extricated from the stoney soil in which they originally grew, only few of them are likely to survive, and they have, therefore, not yielded all the information which they would undoubtedly have afforded had they grown and flowered. The following notes will, however, show that they have added something to our knowledge.

1. *Myrrh proper.*—Mr. Wykeham Perry sent two large plants of the kinds which yield true Myrrh. They have lived, as he hoped would be the case, to reach England, but having no roots can hardly be expected to survive or put out any growth. They had before their last journey made others of many weeks without earth, and had sprouted after being placed in sand in Capt. Hunter's garden. One came from the Somali Coast near the 47th meridian of longitude. Its gum is called by the Arabs *môr*, by the Somal *mulmul*, and by Indians *Arabol*. The tree itself is called *Didthin* by the Somal. The same plant was collected by Hildebrandt in Somali land in 1873; it has been identified by him with the *Balsamodendron Myrrha* of Nees von Esenbeck, who collected it at Ghizan, on the Arabian coast of the Red Sea (see Trimen, *Pharma. Journ.*, 3rd ser., vol. ix., pp. 893-894). The other specimen was sent as "the true Myrrh tree of Arabia." It came from the hills in the Fadhlî district, some 60 miles from Aden. "It was believed to be the same species as the Somali plant." This may be so, but it is wanting in the excessive spininess of *B. Myrrha*, and a small flowering branch previously received from Mr. Wykeham Perry appeared to agree with *B. Opobalsamum*, Kth., found in Abyssinia by Schweinfurth,

and which is believed to be identical with the *B. Ehrenbergianum*, Berg, from the Arabian coast of the Red Sea. According to Hanbury, *B. Opobalsamum* is a Myrrh-yielding plant, and if it affords the Myrrh of Southern Arabia, that would account for the difference of quality which is found in Arabian Myrrh as compared with the African, which is doubtless the produce of *B. Myrrha*. It will be obvious that good dried herbarium specimens of Myrrh-yielding plants are still a desideratum to botanical science.

2. *Bésabol*.—"This drug," says Hanbury (l. c., p. 129), "is of African origin, but of the plant which yields it nothing is known." Mr. Wykeham Perry has sent us two specimens of it, and these fortunately have produced abundance of foliage. They cannot be botanically identified with any certainty at present, if indeed the species be not hitherto undescribed. It, however, is evidently allied to *Balsamodendron Kataf*, Kth., a species first described by Forskal under the name of *Amyris Kataf*. He had only seen it in Arabia in a cultivated state.

Mr. Wykeham Perry informs me that the plant sent by him is called by the Somali *Hádi*, and its gum *Habaz Hádi*; it is purchased almost entirely by Indian merchants for export to Bombay, and is by them called *Bésabol*. It is found only in the centre of the Somali promontory, and not in Arabia at all. Forskal relates that the gum of *Balsamodendron Kataf* is used by Arab women for washing their hair, which is precisely the purpose for which that next to be mentioned is employed in Somaliland.

3. *Hodthai*.—This is a plant (*Balsamodendron Playfairii*, HK. f.) of which the Kew Herbarium possesses excellent specimens, for which it is indebted to Col. Play-

fair, who collected them on the Somali coast. The use of this gum is said to be confined to the Somal themselves, who use it, as stated above, as a hair detersive.

Orange-fly of Queensland.—

We have received through the Colonial Office specimens of "a fly which attacks the oranges, lemons, and peaches, and causes great damage in the orchards. It is not found in very dry weather, but as soon as rain sets in it becomes plentiful and very destructive. Moths afterwards use the opening made to suck the juice of the fruit." Mr. McLachlan having examined the specimens, reports that it is allied to, but probably distinct from, the genus *Ceratitis*, known as destructive to oranges in Madeira.

Pai-ch'ha as a Substitute for

Boxwood.—In the Gardeners' Chronicle for April 20, 1878, Mr. Jean van Volxem has drawn attention to a Chinese wood largely in use at Ningpo for wood-carving, and which he considers suitable for engraving purposes as a substitute for boxwood. Mr. W. M. Cooper, Her Majesty's Consul at Ningpo, has obligingly furnished me with the following information upon the subject:—"The tree and wood are common here; it is known as 'Pai-ch'ha (literally white tea or camellia). The Chinese language is a bad one for nomenclature, and the compound of two words has a different meaning to their primitives. The wood in universal use for book-blocks, wood-engravings, seals, &c. is that of the pear-tree, of which large quantities are grown in Shangtung, and Shan-se especially. 'Pai-ch'ha is sometimes used as an indifferent substitute. 'Pai-ch'ha' is a very white wood of fine fibre, without apparent grain, and cuts easily, is well suited for carved

" frames, cabinets, caskets, &c., of
 " which large quantities are manu-
 " factured here for export. The
 " tree itself resembles somewhat
 " the *Stillingia*, but has a rougher
 " bark, larger and thinner leaves,
 " which are serrated at the edge,
 " more delicate twigs, and is
 " deciduous."

" Boxwood is known as Huang-
 " zang (literally yellow poplar).
 " In the south of this province and
 " Fuk-kien boxwood is grown
 " principally for native furniture
 " and export to Japan. It is
 " prized on account of its dura-
 " bility and freedom from warping ;
 " it is sold by weight at prices
 " varying from $3\frac{1}{2}$ to 6 dollars (of
 " 3s. 10d.) per picul of 133 lbs.
 " English."

Mr. Cooper sent fruits of the
 Pai-ch'ha, which proved to be those
 of an undescribed species of *Enony-*
mus.

Paper Materials.—1. *Bam-*
boo.—The possibility of utilising
 profitably the young stems of bamboo
 as a paper material is still attract-
 ing—mainly owing to the untiring
 enthusiasm of the well known paper-
 maker Mr. Routledge—a good deal
 of attention both in the East and
 West Indies. The excellence of the
 paper which can be made from it
 is not contested, and I am informed
 that there are some special technical
 merits about bamboo paper-stock
 which in the eyes of the manufac-
 turer make it particularly desirable.
 There is no reason to suppose that
 these are peculiar to the particular
 species of bamboo, *Bambusa vul-*
garis, which, originally a native of
 Tropical Asia, is now widely culti-
 vated throughout the tropics of both
 hemispheres. They are, no doubt,
 shared, more or less, by all the
 members of this family of arbores-
 cent grasses, which are far more
 numerous and distinct than is
 generally supposed by those who are

not botanists. The species of *Guadua*
 in Tropical America are therefore
 quite as suitable for Mr. Routledge's
 experiments as the species of *Bam-*
busa and *Dendrocalamus* of the
 East Indies.

The point which at present has
 to be settled is whether bamboo
 forests and plantations can be so
 managed as to yield year by year
 a regular supply of young stems
 suitable for the paper-maker's pur-
 pose. The further question then
 arises whether this can be done at
 an expense which will leave the
 manufacturer a working profit.
 The importance of the first point
 has already been pointed out in
 former reports, and has been clearly
 insisted upon by Dr. Brandis in his
 instructions to the Indian Forest
 Department:—"A method of treat-
 " ment must, if possible, be dis-
 " covered by which a plantation or
 " natural forest of bamboos may
 " be made to yield a succession of
 " complete crops of young shoots
 " throughout the year. Our pre-
 " sent experience is that a large
 " proportion of old stems is required
 " in a bamboo clump to produce
 " full-sized shoots.
 " Under ordinary circumstances, if
 " bamboo clumps are cut over in
 " the forest, all mature stems being
 " cut down at one time, the result
 " is a crop of slender stems." Dr.
 King has stated the same fact in
 his report on the Calcutta Gardens,
 published last year (July 10, 1878):
 " It is pretty well known that bam-
 " boo clumps, if entirely cut down,
 " yield for several years but few
 " and small succulent shoots, and,
 " in fact, not unfrequently die."

In British Burma the stems of
 bamboo are applied to an immense
 number of useful purposes, and the
 practice of obtaining a supply of
 stems without destroying the clumps
 appears to be well understood. Dr.
 Ribbentrop, the Conservator of

Forests, reports :—"The bamboo jungles near villages on the Pegu chouring prove that constant cutting does not materially affect the reproduction, and cutting them down within a couple of feet from the ground maintains a perfectly unimpaired action of the roots, as may be observed on the bamboo hedges in Rangoon. At the same time, a bamboo plantation cannot be kept indefinitely without restocking. This has been the case with the artificial plantations of *Dendrocalamus Brandisii* in Burma, the original stocks of which die after about 60 or 70 years; others would be doubtless shorter lived. The *Dendrocalamus Brandisii* plantations in Burma are kept up by interplanting with new stocks."

The Rev. C. Parish, the well known botanist, who has long resided in Burma, is of opinion that when the bamboo is well established it may be cut annually. "The shoots should not all be cut every year, for if this were done the root-stock would die; only about half the clump should be cut yearly."

If a regular supply of the stems suitable for paper making can be organised, there seems no reason to doubt there being a more than abundant area of supply. Dr. Brandis states :—"It will interest you to learn that there are about 1,800 square miles of almost pure bamboo forest in the Arrakan division of British Burma, within a moderate distance from the coast, and all accessible by navigable streams." The latter is a point of great importance, as the carriage of the bamboo stems is one of the practical difficulties in utilising the material. Mr. Routledge points out that to compete with other materials, it cannot, on account of its bulky nature "possibly be imported from

"the tropics in its raw or natural condition, or even if crushed and dried." It must be made into stock—"a fibrous or tow-like condition, which will enable it to be baled up under hydraulic pressure, occupying no more space than cotton or jute, and thus delivered to the paper maker ready for bleaching and converting into paper."

It of course remains to be seen if this can be done at a remunerative cost. Dr. Schlich, the Conservator of Forests in Bengal, is decidedly of opinion that it cannot. He states :—"Experiments recently made in the Central Provinces, where labour is cheap, prove that it will cost twice as much to produce the paper-stock than paper manufacturers are willing to pay for it, and this, irrespective of the original price of the bamboos."

Mr. Thomson, the late superintendent of the Cinchona plantations in Jamaica, is very sanguine as to the success of the project in the West Indies. He wrote to me August 23rd of last year :—"Some two thousand tons of bamboo were cut and shipped to America from a limited area (within a few miles) four years ago; much of this was cut from the same stools twice in three years, and I have lately seen acres of these bamboos that were cut *en masse* four years ago quite as luxuriant in every respect as other clumps that are never cut."

He further wrote to Mr. Routledge :—"It is well known that generally crops of bamboo shoots are only produced after heavy rains, a fall of from 15 to 30 inches; such rains usually occur two or three times a year in Jamaica; the time young shoots take to spring from the ground up to about 25 feet (they are at this height in a fit condition for the paper-makers' requirements),

"after such rains averages five weeks. Irrigation would produce constant action at the roots, and there can be no doubt that by the process of cutting, several crops a year may be secured, indeed a continuous succession of cropping could be assured by systematic cultivation and irrigation."

The subject is so important, and one in which success is so much to be desired, that I have not hesitated to represent it at some length, and in its most favourable light.

The discovery of a new paper-material is a subject which excites the most lively interest. It is one on which we are continually responding to inquiries, and it is useful to record here the history of various substances which have been proposed (and specimens of which are deposited in the Kew Museum) in order to save the trouble of renewed investigations about them in the future.

Some disappointment, I think, may be prevented by giving currency to the following remarks by Mr. Routledge upon the general subject, the commercial side of which no one is more fitted to discuss:

"It is only the exceedingly low cost of freight from Spain and Algeria (due to exceptional circumstances) which has enabled *Esparto* to become as it were naturalised in the paper trade; . . . none of the cereal straws, seeds, or grasses can be economically imported into this country, even with their low normal cost, due to the heavy freight and carriage charges, and having regard to the quality of paper they would produce. . . . It may be assumed, therefore, that although some of these fibres may possibly be used for paper-making in the countries where they grow, it will not pay to bring them to this country."

2. *Baobab*.—This was referred to in my Report for 1876 as a desirable subject for experimental cultivation in India. Dr. King now reports very unfavourably of its prospects:

"Such plants as enjoy the shade of a large tree in the neighbourhood of the plantation continue to look very fairly healthy, but those that stand in the open look very sickly. . . . Considering, moreover, the comparatively slow growth of the species (a tree of 20 years old grown in the open girths about $3\frac{1}{2}$ feet at the base, and is about 15 feet high), I am driven to the conclusion that *Baobab* is not likely to afford in India a sufficiently cheap paper fibre."

This seems conclusive. I am informed, however, that the *Baobab* coppices well, sending up numerous shoots of 10 to 12 feet in a year. It is suggested, therefore, that if the trees once get to a fair size they might be coppiced annually, after the manner of osiers. But, of course, if *Bamboo* succeeds it is not worth while expending any trouble on *Baobab*.

3. *Californian "Cactus"*.—In the Kew Report for 1877 reference was made (pp. 36, 37) to a paper material known under this name in commerce, the botanical identity of which however was doubtful, owing to the want of adequate materials for determination. The specimens of the stems, which are the part used in the manufacture, suggested that they might belong to a *Dasy-lirion* or *Beaucarnea*. The nature of the plant has now been cleared up, and it proves to be a species of the well known genus *Yucca*, various other representatives of which are cultivated in gardens, and the habit of which is very similar to that of the genera mentioned above. It is the *Yucca brevifolia* of Engelmann (notes on the genus *Yucca*, p. 47). In California it has been identified,

but incorrectly, with the *Yucca Draconis*, originally described by Linnaeus. The plant forms forests in the Mohave desert; the Southern Pacific Railway runs through them for several miles, and "the growth extends south for some 300 miles." The trees must be of great age, and should the manufacture of paper from them be commercially successful, one of the most singular pieces of vegetation will no doubt be utilised off the face of the earth.

4. *Eriophorum comosum*.—This plant is well known in North-western India, where, under the name of *bhabar-ghas*, it is largely used as a material for ropes. It was submitted by Dr. King to Mr. Routledge, who writes to us:—"A small quantity of bleach brings it up to a good colour. The ultimate fibre is very fine and delicate, rather more so than esparto, and of about the same strength; the yield, however, is 42 per cent. somewhat less. I think I may venture to say it will make a quality of paper equal to esparto."

Two other grasses, *Imperata cylindrica* and *Saccharum spontaneum*, were also reported upon by Mr. Routledge, but they were inferior to the *Eriophorum*. "I do not consider," he says, "that it would pay commercially to attempt to treat any one of these fibrous materials for conversion into stock for European use, although very possibly, if procurable in abundance and at cheap rates, they might be employed for paper-making locally with advantage."

5. *Molinia carulea*.—This well known British grass has been brought forward as a paper material by Mr. Craig Christie. Mr. Routledge states:—"Without testing this on a practical scale, and making some paper from it, I cannot

"report definitely, but it appears to me to equal low class esparto at least." The supply would, however, be very limited, and the cost of collecting no doubt considerable.

6. *Trinidad Spear-grass*.—Samples of this grass (*Andropogon condensatum*) were sent over to this country by Mr. Prestoe, who believed that it would come very near esparto for paper-making. Mr. Routledge, however, feels himself unable to endorse that opinion.

7. *Typha latifolia*.—Samples of this plant, which is widely distributed over the northern hemisphere, have been sent to this country from different quarters. The yield of fibre is very low, only 28 per cent.; "it is also very difficult to bleach, and loses most of its strength when subjected to that process."

Perak.—The resources of this almost unknown and entirely undeveloped area of the Malay peninsula have during the past year attracted some attention in Ceylon, where land for planting is now said to be difficult to obtain on remunerative terms. Perak has been visited by Mr. Handyside, a Ceylon planter, who has formed a high opinion of the capabilities of the country. The papers which have been communicated to me on the subject include a report from this gentleman, printed in the Singapore Daily Times of October 23 of last year, from which I extract a few paragraphs.

"Anyone entering Perak the usual way, viz. by Laroot, will be disappointed with the soil, especially on the plains, for the first 20 miles inland. It is poor for agricultural purposes, but rich in tin. * *

"On nearing the capital, Kwala Kangsa, 23 miles from Laroot, the soil, and I may say climate, improves very much; from white sand it gradually turns into a rich brown alluvial, especially on approaching the banks of the Perak River, on

" both sides of which sugar, tobacco,
 " tapioca, cacao, cocoa nuts, Liberian
 " coffee, cardamoms, paddy, maize,
 " &c. could be grown to pay well *
 " * * * Good as the soil is here,
 " it cannot compare with the rich
 " limestone chocolate coloured land
 " of the Kinta, Epan, Gaping, and
 " Kampar districts, some 20 miles
 " further east. I have seen nothing
 " like it in Ceylon for depth or
 " quantity. A great portion of it is
 " still in virgin forest; in some parts
 " of which I saw the cardamom of
 " commerce flowering under shade.
 " * * *

" Before coming to Perak I was
 " of opinion that, being near the
 " equator, coffee would need a higher
 " elevation than Ceylon; since then
 " I have seen reason to alter it. The
 " monsoons are not so well defined;
 " the rain is better distributed
 " throughout the year, but there are
 " generally a few dry months be-
 " tween January and March. I now
 " think that coffee can be success-
 " fully grown at from 500 to 800
 " feet lower than in Ceylon in the
 " open. * * *

" The coffee-trees growing under
 " shade at a few hundred feet have
 " a rich dark green foliage and very
 " healthy appearance. * * *
 " The Liberian kind at Taiping
 " looks very healthy." [The plants
 " were received from Singapore, to
 " which place they had been trans-
 " mitted from Kew.]

" Having been pretty well all over
 " the country and studied its climate
 " and resources, I consider that I am
 " under the mark when I say that
 " there are on the hills of Perak
 " 500,000 acres (considerably more
 " than in cultivation on Ceylon hills)
 " suitable for the cultivation of
 " coffee, tea, and probably cin-
 " chona, not to speak of all the low
 " country products."

Rain-tree. — At the close of
 1877 a paragraph went the round
 of the papers describing, on the

authority of the United States Con-
 sul at Loreto, a tree existing in the
 forests near Moyobamba in Northern
 Peru. — "The tree is stated to ab-
 " sorb and condense [the humidity
 " of the atmosphere with astonish-
 " ing energy, and it is said that the
 " water may frequently be seen to
 " ooze from the trunk and fall in
 " rain from its branches in such
 " quantity that the ground beneath
 " is converted into a perfect swamp.
 " The tree is said to possess this
 " property in the highest degree
 " during the summer season prin-
 " cipally, when the rivers are low
 " and water is scarce, and the
 " Consul, therefore, suggests that
 " the tree should be planted in the
 " arid regions of Peru for the benefit
 " of the farmers there."

This singular story led to many
 applications to Kew, amongst others,
 from the India Office on behalf of
 the Agri-Horticultural Society of
 Madras and from the Société Eco-
 nomico-agraria of Malta.

Professor Ernst, of the University
 of Caracas, had already published a
 very similar account in the "*Botanische Zeitung*" (1876, pp. 35, 36).
 The tree observed was *Pithecolobium*
Saman. Professor Ernst states:—
 " In the month of April the young
 " leaves are still delicate and trans-
 " parent. During the whole day a
 " fine spray of rain is to be noticed
 " under the tree, even in the driest
 " air, so that the strongly tinted
 " iron-clay soil is distinctly moist.
 " The phenomenon diminishes with
 " the development of the leaves,
 " and ceases when they are fully
 " grown." Professor Ernst attri-
 " butes the "rain" to secretion from
 glands on the foot-stalk of the leaf
 on which drops of liquid are found,
 which are rapidly renewed on being
 removed with blotting paper.

Mr. Spruce, the well-known South
 American traveller, has, however,
 obligingly supplied us with an expla-
 nation which appears quite complete

as far as the original Moyobamba rain-tree is concerned. He writes :—

“The *Tamia-caspi*, or rain-tree, of the Eastern Peruvian Andes is not a myth, but a fact, although not exactly in the way popular rumour has lately presented it. I first witnessed the phenomenon in September 1855 when residing at Taramoto (lat. $6\frac{1}{2}^{\circ}$ S., long. $76^{\circ} 20'$ W.), a town or large village a few days eastward of Moyobamba. A little after 7 o'clock we came under a lowish spreading tree, from which, with a perfectly clear sky overhead, a smart rain was falling. A glance upwards showed a multitude of cicadas sucking the juices of the tender young branches and leaves, and squirting forth slender streams of limpid fluid. My two Peruvians were already familiar with the phenomenon, and they knew very well that almost any tree, when in a state to afford food to the nearly omnivorous cicada, might become (*pro tem.*) a *Tamia-caspi* or rain-tree. This particular tree was evidently, from its foliage, an *Acacia*. Among the trees on which I have seen cicadas feed is one closely allied to the *Acacias*, the beautiful *Pithecolobium Saman*. Another leguminous tree visited by cicadas is *Andira inermis*, and there are many more of the same and other families which I cannot specify. Although I never heard the name *Tamia-caspi* applied to any particular kind of tree during a residence of two years in the region where it is now said to be a speciality, it is quite possible that in the space of 21 years that have elapsed since I left Eastern Peru that name may have been given to some tree with a greater drip than ordinary; but I expect the cicada will still be found responsible for ‘the moisture pouring from the leaves and branches

“ ‘in an abundant shower,’ the same “ as it was in my time.”

This and other information was communicated to “Nature” by the Assistant Director (28th February 1878, pp. 349, 350). So much is reproduced here for the information of correspondents of Kew, many of whom continue to make inquiries upon the subject.

Professor Ernst is still of opinion that in Venezuela the *Pithecolobium Saman* produces a rainy mist without the intervention of insects. In Jamaica and India the occurrence has not, however, been observed.

In the early part of the last century a similar story was placed on record, and is to be found in “A Journey Overland from the Gulf of Honduras” by John Cockburn (London, 1735, pp. 40-42).

“Near the mountains of Vera Paz (Guatemala) we came out on a large plain where were numbers of fine deer, and in the middle stood a tree of unusual size spreading its branches over a vast compass of ground. We had perceived at some distance off the ground about it to be wet, at which we began to be somewhat surprised, as well knowing there had no rain fallen for near six months past. At last, to our great amazement, we saw water dropping, or, as it were, distilling fast from the end of every leaf.”

South African Bamboo. —

During the past year Commandant J. H. Bowker sent to Kew a sample of the Bamboos which he informs us are found mostly on the northern slopes of the high mountain range dividing the east and west watershed of South Africa, and mostly on the most exposed sites.” A paragraph extracted from the Natal Mercury having gone the round of the English papers, we received several inquiries about these Bamboos, and it may be useful to place

on record the information we possess on the subject.

The plant is, doubtless, the *Arundinaria tessellata*, Munro, which has been long known to botanists, though singularly enough it has never been seen in the flowering state, and its true genus is, therefore, somewhat conjectural. General Munro remarks [Trans. Linn. Soc., vol. xxvi, p. 31] that it has "a remarkable and unusual range of elevation, from 500 to 6,500 feet above the sea." A whole district of South Africa is called "Bambusbergen" after it. Mr. Bowker writes:—"The bamboos are much used by the natives for spear handles, house-building, fences, and gates to sheepfolds, &c. They can be got from 3 feet to 25 in length, and in any quantity. I have used a rod made from it for many years past and found it superior in spring and strength to any other I could get. I think they could be turned to account as coach-whip handles, umbrella handles, walking sticks, &c.; the root grows into almost every shape, and could be cut into handles of different patterns."

The samples sent by Mr. Bowker were obligingly reported upon by Mr. Henry Howell, a wholesale merchant of such articles. The result is not very favourable, for which the character of the samples was possibly partly to blame. Mr. Howell writes:—"I have made a thorough inspection of the South African bamboos, and my opinion is that the canes which are regularly imported from China are far superior in every respect. It is, of course, impossible to judge of the larger and more perfect canes, as the only samples we have are very small, very short, and of very indifferent growth. I have some Chinese bamboos in my warehouse about 20 feet long, gradually tapering from about

" $1\frac{1}{2}$ in. diameter to $\frac{1}{4}$ in. at the point, and I should think nothing could surpass them in their adaptability for fishing rods, for which they are greatly used. The South African canes, unless far superior to the samples sent, would have no place in the market in competition with the Chinese. It is a pity the roots were not left on the bamboos, as possibly they may have had a character which would enable us to manipulate them to suit the taste of umbrella dealers. If you should have any specimens longer and larger than the ones in question I might be able to give a more definite opinion, but my impression is that if a large quantity of them (like the specimens) were offered in the market they would not find purchasers at anything like a remunerative price."

Sugar-cane disease.—In the Kew Report for 1877 the history of the various insect pests which had proved so injurious to the sugar-cane in Queensland was given in some detail.

During the past year a further correspondence has taken place upon the subject between this establishment and the Colonial Office, and a large series of specimens, carefully selected and sent over to this country in various preservative fluids by Mr. J. T. Staiger, F.L.S., Government Analytical Chemist, has been received for examination.

It appears now to be placed beyond question that the "rust" is due to the punctures of a minute acarid which exists upon the diseased cane in myriads. The exact scientific determination of this parasite would be, as I am informed by Mr. McLachlan, F.R.S., who has again most obligingly assisted us in this matter, a point requiring research of some difficulty. Mr. McLachlan states, however, that "the creature looks very like a *Tyroglyphus*."

"*glyphus*, but the habits do not
"altogether accord with those of
"that genus."

I am glad to state that the treatment with lime suggested by Dr. Bancroft, and that with carbolic acid recommended in the Kew Report for 1877 (p. 38), promises to be quite effectual in keeping this pest under control. Mr. MacKay reports to the Legislative Council of Queensland the result of experiments upon diseased canes subjected to the following treatment directed by Dr. Bancroft, which I quote here as likely to be efficacious in other Colonies:—"1. Clean the joints
"entirely from all trash as carefully
"as possible. 2. Immerse for
"twenty-four hours in water and
"carbolic acid at a temperature to
"bear the hand—1 lb. of acid to 50
"gallons of water. 3. Make milk
"of lime—2 lbs. of lime to 1 gallon
"of water; immerse the plants in
"this for a few minutes. 4. Lift
"out and spread in the sun, turning
"them over to dry for one day
"before planting.

"Out of twenty-four different
"varieties of cane so treated, I am
"glad to say that all except two
"have come up sound and healthy,
"and the two are but lightly
"touched with the disease, a few
"spots only showing on the outer
"ends of the leaves, while the heart
"of the cane is quite green and
"healthy. The old stools or roots,
"from which were taken the plants
"so treated have all come up dis-
"eased; some of them died out, so
"that there can be no doubt that
"the mixture had its effect."

The *pou blanc* or *pou à poche*
blanche referred to in pp. 38, 39, of
Kew Report for 1877, is reported
upon by Mr. McLachlan from the
specimens sent to Kew during last
year as "no doubt the same as the
"well-known Mauritian pest"
(*Icerya sacchari*).

N 438.

Vegetable-ivory substitutes.

—The palm whose seeds are used instead of ivory for a variety of small carved articles is a native of Central America and New Grenada. The consumption of them in this country, as well as in France and other parts of the Continent, is now believed to be enormous. The imports into Britain are stated to be worth £100,000 a year, and Birmingham is said to consume as much as a ton weight in a single day. The necessary result is that an eager demand has sprung up for new sources of supply of a similar material. The true vegetable-ivory palm being limited to a restricted district of the new world is not available elsewhere. But other hard-seeded palms will doubtless be tried, and the following have already come under our notice:

1. *Hyphane kernels*. — These have been imported into Liverpool from S.W. Madagascar as a substitute for vegetable-ivory, for which they seem little fitted. They appear to be yielded by *Hyphane crinita*, with which Dr. Kirk identifies *H. natalensis* and *H. petersiana*. It is described as "a low palm bearing
"nuts with a sweetish rind, tasting
"like the locust bean, carob, or St.
"John's bread, and from which a
"spirit is distilled." The extension of this genus of palms, so characteristic of the flora of tropical Africa into Madagascar, is not less interesting than the presence of the *Adansonia* already mentioned.

2. *Raphia seeds*. — The seeds of a palm which agree closely with those of *Raphia Hookeri* have been imported into Liverpool to be crushed as an oil-stuff. The quantity obtainable was, however, too small for this purpose, and the importer proposed to use the nuts for carving, for which they probably proved too soft, besides wanting uniformity of texture. They were stated to come from

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Liberia under the name of Taqua nuts. This is a name belonging to the true Ivory-nuts of S. America (*Phytelephas macrocarpa*), which is now likely to be applied indiscriminately to any palm seed hard enough to be carved.

3. *Sagus seeds*.—The seeds of another palm appear within the last year to have found their way into commerce in considerable quantity from the Friendly Islands as a vegetable-ivory substitute. This is the *Sagus amicarum*, Wendl., the seeds of which have the shape and dimensions of a medium sized apple. The resemblance is still more complete if the core has been supposed to be scooped out by an opening at the bottom, the seeds of this *Sagus* having a considerable hollow cavity in the centre.

Amongst the collections of the Challenger expedition Mr. Moseley sent home seeds of another species of *Sagus* from San Christoval, one of the Admiralty Island group. This is probably a distinct species from *S. amicarum*, the surface of the seeds being marked by rounded ribs running longitudinally from the central depression on the upper surface, while the opening into the internal hollow cavity is almost closed up.

The Fiji Islands which intervene between the Solomon and Friendly groups contain yet a third species of *Sagus*, the *S. vitiensis*, Seem., the seeds of which are yet smaller than either of those mentioned above. Whether they have been tried as a vegetable-ivory substitute I am unable to say.

MUSEUMS.

The revision of the collections in No. 1 Museum has been completed, as well as that of the *Graminaceae* in Museum No. 2. A large number of economic objects which had deteriorated by time and exposure

to light and air have been withdrawn, and in many cases replaced by fresh specimens, due to the liberality of donors whose names are given below.

Notwithstanding the most careful weeding of the collections, the space for their display is still far too small, and an increase of the accommodation in both Museums No. 1 and 2 is urgently required. In the former case it is hoped that this may be obtained by the erection of a new staircase, in the latter by an extension at the west end.

As in former years, the duplicates have been distributed to kindred institutions at home and abroad.

In No. 3 Museum a stand with a number of swing-frames has been placed, in which a large collection of views of the Royal Gardens in earlier stages of their history have been placed, and also a series of photographs of various colonial gardens. The latter collection we should be very glad to extend and render more complete.

I defer to my next Report a notice of the magnificent collection of forest produce received from the Government of India, and which is in process of unpacking and arrangement while this Report is in preparation.

The principal objects received during the past year have been :—

Bancroft, Dr. J. : samples of Pituri (*Anthocercis Hopwoodii*), and Goa powder (*Andira Araroba*).

Barlee, H. E., Governor; fruits and flowers of *Pachira aquatica*.

Bremner, A. W., & Co.; ten samples of leaf-tobacco of commerce.

Burbidge, F. W.; samples of rubber and stems of rubber-yielding plants of Borneo; leaves of *Curculigo latifolia*, affording a fibre, and native instruments used in weaving the same; cigarette wrappers, made of leaves of *Nipa fruticans*; cigarettes wrapped in leaves of Banana;

fruits of *Scorodoprasum borneense*, and other specimens.

Chantre, C.; numerous specimens of gums, resins, drugs, and other vegetable products.

Christy, T.; a large series of Japanese drugs of vegetable origin, and sample of rubber from *Urostigma Vogelii*.

Church, Prof. A. H.; fine samples of beet-root sugars and specimens of French leaf tobaccos.

Corbyn, Stacey, & Co.; samples of Chaumugra oil (*Gynocardia odorata*).

Cox, Brothers, Messrs., Dundee; series illustrating the uses and manufacture of jute.

Cross, R.; sample of best soft Columbian Cinchona bark from banks of Caqueta river, and specimens of plant producing the same.

Curtiss and Harvey, Messrs.; samples of willow and alder wood, and charcoal made from same used in the manufacture of gunpowder.

Duthie, J. F.; photographic views in Botanic Gardens, Saharunpore, and seeds and fruits of Indian economic plants.

Dyer, W. T. T.; hat made of *Juncus effusus* in China, and worn in Switzerland; sample of Crin Vegetal made in Algeria from *Chamaerops humilis*.

Fox, Major-Gen. Lane; drupe of a *Pandanus* used in Nicobar to brush the feet, and specimens of resinous wood (*Dipterocarpus*) used as torches.

French Government; collection of woods from French colonies.

Gardner, Messrs. Joseph, and Sons; shuttles as used in cotton spinning, made of Persian boxwood, American cornel (*Cornus florida*), and Persimmon (*Diospyros virginiana*).

Henderson and Sons, Messrs.; samples of Shea butter (*Butyrospermum Parkii*), Gutta shea, and soap made from Shea butter.

Howard, J. E.; fine collection of Cinchona barks and samples of Cinchona alkaloids.

Irving, James; spadix of *Elais guineensis* and portions of spadices of *Raphia* spp.

Keit, W.; cones of Natal Cycads.

Layard, E. C.; H.M. Consul, New Caledonia; small Kava bowl, dresses made of leaves of *Freyinetia* and cocoa-nut fibre, spear of palm wood from Kingmsmill Islands, and other articles.

Levisohn, L. J.; leaves, stem, and fruits of *Yucca baccata* from Los Vegas, New Mexico, used as soap.

Linseed Association (A. G. Kemp, Secretary); numerous samples of linseed, rapeseed, sesamum, &c.

Lockhart, Dr.; water bottles and other articles made of gourds, ornamented on the surface by growing them in moulds.

Maw, G.; fine specimens of maple sugar from Ontario.

Montserrat Association (per Joseph Sturge); samples of lime juice and lime juice biscuits.

Mueller, Baron Von; fruits of *Capparis Mitchellii*.

Murton, H. J.; samples of gutta-putih, gutta-taban, gutta-singgarip, &c., and specimens of the stems of the trees yielding them; also "golos" or knives used by the Malays in "ringing" or tapping the trees.

New South Wales, Government of; stems of *Dicksonia antarctica*, *Alsophila australis*, and *A. leichhardtiana*.

Reichenbach, Dr.; cones of *Picca erythrocarpa*, *P. chlorocarpa*, fruits of *Trapa verbanensis*, and *Sagrus amicarum*.

Roberts, Macbubbin, & Co., Messrs.; seeds of *Adansonia madagascariensis*, cloth made of fibre of *Raphia Ruffia*.

Routledge, Thos.; sections of the stem of *Yucca brevifolia*, and paper

made from the same; also samples of paper made from bamboo, &c.

Sargent, C. S.; specimens of cones, wood, and bark of various species of *Pinus* and *Abies*.

Siemens, Dr. C. W.; specimens of raw gutta-percha from Borneo, moulded by natives in the forms of animals.

Smith, C. Laver; numerous specimens of dye lichens.

Smith, W. Anderson; meal bag formerly used in the island of Lewis, made of *Juncus effusus*.

Turnbull & Co., Messrs.; series illustrating distinctive distillation of wood.

Wishart and Lloyd, Messrs.; samples of commercial tobaccos grown in the Fiji Islands.

PHYSIOLOGICAL LABORATORY.

During the past year the Jodrell Laboratory has been employed by Prof. Burdon Sanderson, F.R.S., in his continued researches on the electrical phenomenon of plants exhibiting spontaneous movements; by Prof. Church in studying albinism in plants; by the Rev. R. Abbay in working at the development on living coffee plants of *Hemileia vastatrix*; and by Mr. F. Darwin for observations on the physiology of leaves.

HERBARIUM.

The most considerable contribution to this department, and considering its importance in respect of the agricultural interests of this country, India, and the colonies, the most important of the kind, perhaps, ever contributed to such an institution as Kew, is the Mycological Collection of the Rev. M. J. Berkeley, F.R.S. For upwards of half a century Mr. Berkeley has been well known as the most accomplished and persevering student of the *Fungi*;

his labours and writings on the ravages which these plants inflict on our field-crops, gardens, orchards, vineyards, forests, &c. have benefited mankind, and greatly enlarged the domain of science; whilst his systematic and microscopical researches into their structure and the classification of the vast natural family to which they belong have been extended to species from every quarter of the globe. The herbarium in question contains type specimens of the microscopic and other vegetable parasites, whose effects have been known from time immemorial, but the nature of most of which has been determined only within the last half century; and it illustrates his numerous published contributions to the Journal of the Royal Horticultural Society, the Gardeners' Chronicle, Linnean Society's Journal and Transactions, and many other works of a like nature. As examples of the value to the country of Mr. Berkeley's labours, it needs only to allude to the potato, vine, hop, and onion diseases, upon which he has written valuable memoirs and suggested remedies that have earned for him the gratitude of his countrymen and the recognition of the Government.

Mr. Berkeley's herbarium is of great extent, in perfect order and preservation, and he is now occupied with its transference to Kew, to which it is presented.

The herbarium of the late N. J. Dalzell, Esq., of the Hon. East India Company's service, has been presented by his widow. As containing the type specimens of "The Bombay Flora," a work published by himself and the late Dr. Gibson, it is of special interest. It contains upwards of 1,200 species, and many duplicates; and its contents have been shared with the herbariums of the Botanical Gardens of Calcutta and Saharanpore.

M. E. Cosson, of Paris, has been a most liberal contributor to the Kew Herbarium for very many years. His gifts during the present year amount to nearly 2,000 species, chiefly from Southern Algeria, Morocco, and Eastern Persia, on the borders of Afghanistan, which latter, collected by the veteran botanist and traveller, Bunge, are of especial interest.

Other contributions of exceptional interest are Godefroy-Lebeuf's Cambodian plants; Welwitsch's Angolan, &c. (from the Portuguese Government); Post's Syrian; Burbridge's Bornean, presented by Messrs. Veitch, and containing a magnificent series of pitcher-plants; Hildebrandt's tropical E. African; and many Central African were from Dr. Kirk, Col. Grant, Mr. Wakefield, &c.

Mr. John Miers, F.R.S., the eminent South American traveller and botanist, has presented the duplicates of his extensive herbarium. It contains many types of his published plants of Chili, Brazil, and the Argentine Provinces.

M. Casimir De Candolle has presented a valuable set of tracings of drawings of *Aroideæ*, and Mr. W. Saunders, F.R.S., photographs of upwards of 70 species of Agave.

The very complete collection of cones and leaves of Pines belonging to Mr. George Gordon, late of the Royal Horticultural Society's Gardens, has been presented by the Director, and deposited, the cones in the Museum, and the foliage specimens in the Herbarium. It contains the type specimens of almost every species scribed in Gordon's Pinetum, a standard work amongst nurserymen and foresters, of which a second edition has lately appeared. He has also presented the late Dr. Burchell's collection of drawings of St. Helena plants, made in the beginning of the century, and many of the plants of

which are now all but or altogether extinct.

The following is a list of the names of the principal contributors to the Herbarium during 1878:—

Europe.

- Archangeli, Dr.; Italian (128).
 Beccari, Dr. (Herb. Mus. Florent.); Italian (181).
 Ball, J.; various (180).
 Brotherton, —; British (10).
 Church, Prof.; drawings of British ferns (13).
 Cosson, Dr. E.; Schur's European plants (590).
 Geheeb, A.; mosses (100).
 Godefroy-Lebeuf, A.; Portuguese (300).
 Groves, H.; Italian (112).
 Henriquez, J.; Portuguese (316).
 „ „; *Algae, Fungi*, and drawings (89).
 Jardin des Plantes, Paris; *Hepaticæ* (105).
 „ „; various (44).
 Massalongo, Prof.; Italian *Hepaticæ* (purchased, 70).
 Plowright, C. B.; British *Fungi* (purchased, 100).
 Rabenhorst, Dr. L.; *Algae* (purchased, 100).
 Société Dauphinoise; French (purchased, 530).
 Thuemen, Baron von; Mycotheca (purchased, 300).
 Todaro, Prof.; Palermo (4).
 Vize, J. L.; *Micro-Fungi* (purchased, 100).
 Wittrock and Nordstedt; *Algae* (purchased, 100).

Asia.

- Aitchison, Dr.; N.W. Indian (27).
 Brandis, Dr.; *Eucalypti* (cult.) (14).
 Burton, Capt.; Midian (272).
 Cosson, Dr. E.; Bunge's Persian plants (690).

Dalzell, Mrs. (Herbarium of N. J. Dalzell (1,297).

Davidson, Col., R.E.; N.W. Indian (41).

Godefroy-Lebeuf, A.; Cambodian, &c. (571).

Jamieson, Dr. G. H. T.; N. Indian (39).

Jardin des Plantes, Paris; Malayan and Polynesian (520).

King, Dr., of Calcutta; Kurz's Burmese plants (282).

" ; various Indian (84).

Macarthy, Rev. J.; Chinese (23).

Murton, H. J.; Malayan (62).

Perry, W. Wykeham, R.N.; Aden (94).

Post, Prof. G. E.; Syrian, &c. (780).

Preston, Rev. T. A.; Everard's Chinese and others (69).

Scheffer, Dr.; Malayan Archipelago (263).

Veitch, Messrs.; Burbidge's Bornean and Suluan (547).

" ; Marie's Chinese and Columbian (29).

Africa.

Balfour, Prof.; Buchanan's Tropical African (78).

Bolus, Harry; South African (87).

Cantly, N.; Mauritian *Fungi*.

Christy, T.; Liberian (6).

Cordukes, S.; Natal (12).

Cosson, Dr. E.; Marion's Atlantic (92).

" ; Letourneux's Egyptian (104).

" ; Moroccan (133).

Duthie, J. F.; Tropical African (9).

Grant, Col.; Wakefield's East African (142).

Hildebrandt, Dr.; Tropical African (purchased, 241).

Horne, J.; Mauritian *Fungi*.

Keit, N.; Natal mosses, &c. (32).

Kirk, Dr. J.; Bishop Steere's E. African (242).

Knobel, W.; S. African (27).

Macowan, Principal P.; S. African (36).

Monteiro, Mrs.; Delagoa Bay plants collected by the late J. T. Monteiro (8).

Oates, C. G.; S. African (30).

Perry, W. Wykeham, R.N.; Somali Land (14).

Phillips, R. E.; S.W. African (12).

Portugal, Government of; continuation of Welwitsch's collections (705).

Rehman, Dr.; Cape *Fungi* (purchased, 520).

Stone, General; Pfundt's Kordofan (500).

Whitehead, Rev. H.; St. Helena (6).

Wood, J. M.; Natal (133).

America.

North America and West Indies.

Austin, Mrs. R. M.; Californian (153).

Barlee, His Excellency F. P.; Honduras (13).

Brace, L. J. K.; Bahamas (135).

Cosson, Dr. E.; Mexican (373).

Curtiss, A. H.; Florida (purchased, 200).

Davenport, G. E.; Ferns of N. America (9).

Farlow, Eaton, & Anderson's American *Algæ* (50).

Fendler, —; Trinidad Ferns (purchased, 78).

Gray, Prof. A.; various N. American (337).

Jardin des Plantes, Paris; W. Indian (116).

Jenman, G.; Jamaica Ferns (120).

Murray, H. B.; St. Lucia Ferns (77).

Pringle, C. G.; Northern U. States (300).

Ravenel, —; N. American *Fungi* (purchased, 200).

South America.

Balansa, M.; Paraguay (purchased, 2,044).

Glaziou, A.; Brazilian (703).

Grisebach, Prof.; Argentine (710).

Lorentz, Dr.; Uruguay (purchased, 170).

Miers, J.; South America, various.

Veitch, Messrs.; Kalbreyer's New Grenada (303).

Australia and Polynesia.

Bennett, J. J., Executors of the late; continuation of R. Brown's Australian (1,400).

Cheeseman, T. F.; New Zealand (11).

Kirk, T.; New Zealand (26).

Powell, Rev. Thos.; Samoa (90).

Whitmee, Rev. T. J.; Polynesia (248).

It will be interesting to place on record here, as evidence of the continually growing interest of botanists in all parts of the world in the Kew Herbarium, the following statement of the total number of distinct contributions, large and small, made to it for each successive year since 1864.

1864	- 92	1872	- 188
1865	- 132	1873	- 186
1866	- 110	1874	- 182
1867	- 148	1875	- 181
1868	- 165	1876	- 193
1869	- 131	1877	- 202
1870	- 157	1878	- 237
1871	- 131		

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

"Flora of British India," by the Director, assisted by other botanists. Part V. continuing Vol. 2. has been published.

"Flora of Australia," by G. Bentham, F.R.S. The seventh and concluding volume has been published.

The conclusion of the Spicilegium Floræ Maroccanæ by John Ball, F.R.S., has been issued by the Linnean Society.

A second edition of the Student's Flora of the British Islands has been published by the Director.

Bentley and Trimen's Medicinal Plants, of which parts 28-36 have been published, contains numerous figures of plants figured from the Royal Gardens.

Mr. H. T. Elwes has published part 5 of his illustrated monograph of the genus *Lilium*.

Icones Plantarum, vol. xiii., pts. III. and IV., illustrating new and rare plants preserved in the Herbarium have been published.

The 104th volume of the Botanical Magazine has been published. A large proportion of the new and rare plants have flowered in the Royal Gardens.

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 1878, as compared with 1877.

	1877.	1878.
Total number on Sundays	291,487	267,113
Total number on weekdays	396,446	458,309
	<u>687,933</u>	<u>725,422</u>
Greatest monthly attendance (June)	-	140,342
Smallest monthly attendance (December)	-	4,736
Greatest weekday attendance (August 5th)	-	57,121
Smallest weekday attendance (December 16th)	-	28
Greatest Sunday attendance (May 12th)	-	16,600
Smallest Sunday attendance (December 22nd)	-	54

Number of Visitors in each month.

	1877.	1878.
January	6,062	10,134
February	9,811	14,017
March	24,915	24,338
April	56,839	110,440
May	107,882	81,426
June	120,575	140,342
July	95,746	109,357
August	155,647	134,360
September	68,418	57,491
October	23,136	30,587
November	9,935	8,194
December	8,996	4,736

APPENDIX II.

List of Bromeliaceae cultivated in the Royal Gardens, Kew.

878. *Acanthostachys strobilacea*, Klotzsch.
 Brazil.
 7,113 *Æchmea aurantiaca*, Baker. Brazil.
 8,309 *Canistrum aurantiacum*, E. Morren.
 5,422 " *calyculata*, Baker. South America.
Hoplophytum calyculatum, E. Morren.
Macrochordium luteum, Regel.
 " *caelestis*, Baker. Brazil.
Hoplophytum caeleste, K. Koch.
 " *cœrulescens*, Baker. South America.
Lamprococcus cœrulescens, Regel.
 " *distichantha*, Lemaire. Paraguay and Brazil.
Billbergia polystachya, Paxton.
 " *fasciata*, Baker. South Brazil.
Billbergia fasciata, Lindl.
Billbergia rhodocyanea, Lemaire.
 " *glomerata*, Hook. Brazil.
Hohenbergia erythrostachys, A. Brong.
Pironmeava morreniana, Regel.
 " *legrelliana*, Baker. Tropical America.
Ortgiesia palliolata, E. Morren.
 " *Lindenii*, K. Koch. Brazil.
 " *Marie-reginae*, Wendl. Costa Rica.
 " *odora*, Baker. West Indies and Guiana.
Billbergia odora, Miquel.
 " *Ortgiesii*, Baker. Tropical America.
Ortgiesia tillandsioides, Regel.
 " *var. subexserta*, Regel.
 " *pineliana*, Baker. South Brazil.
Eclimostachys pineliana, A. Brong.
 " *Veitchii*, Baker. New Granada.
Chevaliera Veitchii, E. Morren.
 N 438.
- Ananassa sativa*, Lindl. Tropical America.
 " *var. bracteata*, Lindl.
 " *var. portiana*, K. Koch.
 " *macrodonates*, E. Morren. Tropical America.
Bromelia macrodosa, Hort.
Billbergia Brongniartii, Regel. Brazil.
Portea kermesina, A. Brong.
 " *Euphemia*, E. Morren. Brazil.
 " *horrida*, Regel. Brazil.
 " *iridifolia*, Lindl. Brazil.
 " *liboniana*, De Jonghe. Brazil.
 " *macrocalyx*, Hook. Brazil.
 " *Morelii*, A. Brong. Brazil.
 " *B. glymiana*, De Vriese.
B. pulcherrima, K. Koch.
B. Wetherillii, Hook.
 " *var. paucifolia*, Baker.
 " *nutans*, Wendl. Brazil.
 " *pallidescens*, K. Koch. Brazil.
B. pallida, Hort.
 " *portiana*, A. Brong. Brazil.
 " *pyramidalis*, Lindl. Brazil.
 " *var. bicolor*, Lindl.
 " *quesneliana*, A. Brong. Guiana.
Quesnelia rufa, Gaudich.
 " *speciosa*, Thunb. Brazil.
B. amana, Lindl.
 " *thyrsoidea*, Mart. Brazil.
 " *var. longifolia*, K. Koch.
 " *var. splendida*, Lemaire.
 " *vittata*, A. Brong. Brazil.
B. amabilis, Beer.
B. Leopoldi, K. Koch.
B. moreliana, Lemaire.
 " *var. macracantha*, Baker.
 " *zebrina*, Lindl. Brazil.
Helicodora zebrina, Lemaire.
Bromelia antiacantha, Bertol. Brazil.
B. Sceptum, Fenzl.
Agallostachys antiacantha, Beer.
 " *bicolor*, R. & P. Chili.
B. Joinvillei, Van Houtte.
B. pitcairniaefolia, K. Koch.

- Bromelia carnea*, Beer. Tropical America.
B. longifolia, Paxt. non Rudge.
Ruchia Elmeeti, Regel.
- Caraguata* lingulata, Lindl. Tropical America.
 " *Zahnii*, Hook fil. Central America.
- Catopsis nitida*, Hook. Tropical America.
Tillandsia nitida, Hook.
Tussacia nitida, Beer.
- Cryptanthus acaulis*, Beer. Brazil.
C. undulatus, Klotzsch.
Tillandsia acaulis, Lindl.
 " *var. purpureus*, Baker.
var. zonatus, Visiani.
 " *bivittatus*, Regel. South Brazil.
Billbergia bivittata, Hook.
- Disteganthus basilateralis*, Lemaire. Guiana.
- Dyckia brevifolia*, Baker. South Brazil.
D. sulphurea, K. Koch.
 " *frigida*, Hook fil. Brazil.
rariflora, Schultes fil. Brazil.
- Hechtia argentea*, Hort. Mexico.
 " *Gheisbreghtii*, Lemaire. Mexico.
glomerata, Zucc. Mexico.
- Karatas agavefolia*, E. Morren. Tropical America.
Bromelia agavefolia, A. Brong.
 " *Legrellae*, E. Morren. North Brazil.
 " *Plumieri*, E. Morren. Tropical America.
Bromelia Karatas, Linn.
 " *sphacelata*, Baker. Chili.
Bromelia sphacelata, R. & P.
Greigia sphacelata, Regel.
- Lamprocoeus fulgens*, Beer. Guiana.
Æchmea fulgens, A. Brong.
 " *var. discolor*, Beer.
Æchmea discolor, Hook.
 " *Weilbachii*, E. Morren. Tropical America.
Æchmea Weilbachii, F. Diebr.
L. Laurentianus, K. Koch.
- Macrochordium bromeliæfolium*, Beer. Tropical America.
M. strictum, Beer.
M. tinctorium, Beer.
- Nidularium amazonicum*, Linden and Morren. North Brazil.
 " *cruentum*, Regel. South Brazil.
Billbergia cruenta, Graham.
- Nidularium fulgens*, Lemaire. Brazil.
 " *Laurentii*, Regel. Brazil.
 " *Meyendorffii*, Regel. Brazil.
Billbergia olens, Hook.
Bromelia Caroline, Beer.
 " *purpureum*, Beer. Brazil.
 " *sarmentosum*, Regel. Brazil.
 " *Scheremetieffii*, Regel. Brazil.
 " *spectabile*, Moore. Brazil.
N. eximium, Hort.
 " *triste*, Regel. Brazil.
N. marmoratum, Regel.
- Piteairnia Altensteinii*, Lemaire. Columbia.
Puya Altensteinii, Klotzsch.
Puya undulatifolia, Hook.
 " *andreaana*, Linden. New Granada.
P. lepidota, Regel.
 " *angustifolia*, Ait. West Indies.
 " *aphelandraefolia*, Lemaire. Brazil.
Pepinia aphelandraefolia, André.
 " *australis*, K. Koch. Brazil.
P. rubicunda, K. Koch.
 " *bromeliæfolia*, L'Hérit. West Indies.
 " *cinnabarina*, A. Dietr. Brazil.
 " *Decaisnei*, K. Koch. Tropical America.
P. fulgens, Decaisne.
 " *echinata*, Hook. New Granada.
 " *ferruginea*, R. & P. Peruvian Andes.
P. asterotricha, Popp. and Endl.
Puya grandiflora, Hook.
 " *heterophylla*, Beer. Mexico and Columbia.
P. cernua, K. Koch and Bouché.
P. exscarpa, Hook.
 " *imbricata*, A. Brong. Mexico.
Neumannia imbricata, A. Brong.
 " *karwinskiana*, Schultes fil. Mexico and Columbia.
P. ringens, L., K. & O.
P. varciewicziana, Klotzsch.
 " *moritziana*, K. Koch. Guatemala.
 " *muscosa*, Mart. Brazil.
 " *odorata*, Regel. Tropical America.
Cochliopetalum Schuchii, Beer.
 " *paniculata*, R. & P. Peru.
P. excelsa, E. Morren.
 " *P. longifolia*, Hook.
 " *pumicea*, Lindl. Mexico.
Pepinia pumicea, A. Brong.

- Pitcairnia ramosa, Jacq. Tropical America.
P. furfuracea, Sims.
- " recurvata, K. Koch. Tropical America.
P. polyanthoides, A. Brong.
Puya recurvata, Scheidw.
- " staminea, Lodd. Brazil.
Cochliopetalum stamineum, Beer.
- " sulphurea, Andrews. West Indies.
- " tabulaeformis, E. Morren. Mexico.
- " undulata, Scheidw. Tropical America.
P. speciosissima, E. Morren.
- " xanthocalyx, Mart. Tropical America.
P. flavesceus, Baker.
- " zeyfolia, K. Koch. Guatemala.
Puya chilensis, Molina. Chili.
Pourretia coarctata, R. & P.
- " carulea, Miers. Chili.
P. Whytei, Hook.
- " floccosa, Regel. Southern Andes.
Pitcairnia floccosa, Regel.
Puya lanuginosa, Hort. non Schultes fil.
- Ronnbergia morreniana, Linden and André. New Granada.
- Tillandsia bulbosa, Sw. Tropical America.
- " corallina, K. Koch. Tropical America.
Encholirion corallinum, Linden.
- " Durahi, Visiani. South Brazil.
T. circinalis, Griseb.
- " Gardneri, Lindl. South Brazil.
Anoplophytum Rollisoni, E. Morren.
- " glaucophylla (Hook). New Granada.
Vriesea glaucophylla, Hook.
- " ionantha, Planch. Tropical America.
- " karwinskiana, Schultes fil. Mexico.
- " Lindeni, Regel. Ecuador and Peru.
T. hamaleana, E. Morren.
- " Malzinei, E. Morren. Mexico.
Vriesea Malzinei, E. Morren.

- Tillandsia polystachya, Linn. Tropical America.
- " regina, Bell. Brazil.
T. gigantea, Mart.
Vriesea glazioviana, Le-maire.
- " Saundersii, K. Koch. Brazil.
Encholirion Saundersii, Hort.
- " splendens, A. Brong. Guiana.
T. zebrina, Hort.
Vriesea speciosa, Hook.
- " streptophylla, Scheidw. Mexico.
- " stricta, Sw. Tropical America.
Anoplophytum strictum, Beer.
- " tenuifolia, Linn. Tropical America.
T. setacea, Sw.
- " usneoides, Linn. Tropical America.
- " xiphioides, Ker. Uruguay.
- " xiphostachys, Hook. Columbia.
Vriesea xiphostachys, Hook.

Doubtful plants, to which garden names have been given, but which are not yet known in flower, and of which therefore the genus is still uncertain:

- Ananassa bernstorffiana, Hort.
 " Medilonii, Hort.
 Billbergia elegans, Hort.
 " fascicularis, Hort.
 " formosa, Hort.
 " melanaecantha, Hort.
 " Wistii, Hort.
 Bromelia Acanga, Hort.
 " desmetiana, Hort.
 " Riguieri, Hort.
 Dyckia regalis, Hort.
 Hechtia glymeana, Hort.
 " longifolia, Hort.
 " Maclellani, Hort.
 Melinomia incarnata, Hort.
 " rubiginosa, Hort.
 Pitcairnia dasyliroides, Hort.
 Pourretia flexilis, Hort.
 " mexicana, Hort.
 Puya meridensis, Hort.
 Tillandsia porphyrantha, Hort.
 " tessellata, Hort.

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