

KEW
REPORIS







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REPORT
ON
THE PROGRESS AND CONDITION
OF
THE ROYAL GARDENS AT KEW,
During the Year 1876.



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REPORT

ON

THE PROGRESS AND CONDITION

OF

THE ROYAL GARDENS AT KEW,

During the Year 1876.

Royal Gardens, Kew, January 1, 1877.

SIR,

THE number of visitors to the Royal Gardens exhibits a considerable falling off as compared with last year, being just below 600,000 (596,865). This is the smallest number since 1872. A comparison of the figures given in the Appendix will show that the diminution in the whole attendance is largely accounted for by the diminution in the months of May and June, during the former of which cold and easterly winds prevailed. On the 7th of August the Royal Gardens were visited by 64,163 persons, the largest number which has ever been recorded for any one day.

During the past year the assemblage on Kew Green on all public holidays of large crowds of persons, who do not appear to visit the gardens, has become a difficulty of considerable magnitude. Men with articles of different kinds for sale, music, games, &c. have been, of course, attracted by the concourse, and the whole green has had on these occasions the aspect of a fair. Two facts lead me to bring the rapid development of this state of things under the notice of the Board. The Green is scheduled under the Parks Regulation Act of 1872, and as regards general control has been placed under my authority. In the next place, and this is perhaps the most serious consideration, the excitement

which naturally arises in large crowds of persons bent upon amusement, and with nothing else to engage their attention, has shown a tendency to spread amongst those who visit the gardens, where it can only lead to grave difficulty and annoyance to quietly disposed visitors. With the assistance of additional police, possessed of the necessary tact and experience, matters were very materially ameliorated during last summer, and I am in hopes that the evil, when once checked, will not require further attention.

In my report for last year (p. 5) I drew the attention of the First Commissioner to the rapidly progressing decay of the beautiful Eyot in the Thames immediately above Kew Bridge, and upon which the beauty of this part of the river entirely depends. Owing to the gradual encroachment of new suburbs upon the ground in this neighbourhood, formerly used for market gardens, very large tracts of osier beds, over which the high tides formerly spread themselves unimpeded, have been embanked. The tidal water is now apparently driven farther up the river, and the consequent inundations of low-lying places has become an evil which formerly was but little felt. One result must be the complete destruction of the Eyot above alluded to, which is known locally under the

name of Mattingshawe. Not merely is the soil, which is often entirely covered at high tide, being gradually washed away, but the trees, many of which no doubt have reached their prime, are being one by one undermined and uprooted. The present process of destruction without some active intervention is inevitable. I feel sure that when complete, and the view of the town of Brentford, with the gas works and goods station of the Great Western Railway replaces one of the most beautiful compositions of wood and water to be found on the lower Thames, the regret felt by the public at the loss will be very great.

In the latter part of 1875 complaints were made as to the quality of the water supplied to the drinking fountains and residences. At the request of the Board, Major F. Bolton, water examiner to the Local Government Board, made a visit of inspection to the Gardens. The following is the substance of his report:—

The intake of the water is from the River Thames at a point situate in Kew Gardens, immediately opposite Sion House. From the river the water flows into the lake (which is used as a subsiding reservoir) of about five acres area, whence it is passed through a small filter-bed. It is then pumped up into reservoirs in Richmond Park, and from here supplies the gardens and official residences at Kew, as well as drinking fountains in the gardens, Pembroke Lodge and the White Lodge are also supplied with water from these reservoirs. The intake of water opposite Sion House for any except garden purposes is probably illegal, inasmuch as the Metropolis Water Act, 1852, prohibits any corporation taking water for domestic use below Teddington Lock. The water (at the time of examination) was very foul and strongly charged

with sewage matter, from which the present filter-beds had proved quite inadequate to free it, and from which, indeed, no system of filtration would suffice to purify water so charged.

In accordance with this report the Treasury sanctioned (Jan. 8, 1876) the expenditure of 960*l.* for laying mains from the Southwark and Vauxhall Company's service to the residences, drinking fountains, and museums in the Royal Gardens, and an annual sum of 250*l.* in payment of the Company's charges for the supply.

The lessons given to the young gardeners in the evening, in chemistry, meteorology, structural, systematic, and economic botany, and upon which the attendance is voluntary, continue to give satisfactory results.

BOTANIC GARDENS.

The further re-arrangement of the plants in the **Palm House** was proceeded with in the course of last spring, and may now be regarded as practically completed. A great improvement has been obtained in the general effect. As mentioned in my report of last year, it has been found necessary to cut down nearly all the large palms on the north side of the transept, and plant out others in their place. The following are the more important changes:—

Arenga saccharifera cut down and replaced by *Sabal glaucescens*. *Livistona inermis* (*L. australis*), Bot. Mag. 6274, cut down and replaced by *Phoenix dactylifera*. *Sabal glaucescens* transplanted and replaced by *Astrocaryum rostratum*. *Acrocomia sclerocarpa* cut down and replaced by *Thrinax aculeata*. *Sabal umbraculifera* cut down and replaced by *Livistona chinensis*. *Veitchia Canterburyana* transplanted and replaced by *Ceroxylon andicola*. *Phytelephas macrocarpa* removed and replaced by *Attalea*

Cohune. *Areca alba* cut down and replaced by "*Euterpe pisinera*."

A selection of the larger tropical ferns, aroids, *Marantaceae*, &c. have been planted in the beds under the palms, which have hitherto been quite bare. They now are covered with an undergrowth of singular picturesqueness and luxuriance. The gigantic screw pines (*Pandani*) which are such a conspicuous feature in the north wing are rapidly becoming too large for the positions they occupy, and as it is impossible to give them more space they will have to be cut down in the course of one or two years at the farthest.

I must again urge the desirability of a reform in the heating apparatus of this house, as detailed in my last year's report, as a measure of economy even more than of efficiency. With the exception of the immense improvement in both heating power and reduced consumption of fuel, obtained by bringing the flues up through the roof of the wings instead of conducting them underground to the shaft near the Richmond Road, no material improvement has been introduced into this building since its construction nearly 30 years ago. The re-arrangement of the staircases leading to the gallery, proposed in my last report, has been reported upon by the Board's works' department, and unfortunately proves to be impracticable. Some means of draining off the moisture due to condensation which accumulates on the gallery floors during the winter is however urgently needed.

In the **Aroid House** (No. 1) the superb Tropical Tree-fern (*Cyathea Princeps*) having outgrown suitable dimensions, was with great reluctance on my part, taken down in the course of the summer, and replaced by a smaller specimen from the Tropical Fern House.

The whole collection of Aroids has been very carefully revised, and

a catalogue prepared by Mr. Brown, second assistant in the Herbarium. It comprises upwards of 300 species, and should eventually be printed for distribution to other botanical establishments. The whole collection of Calami (Rattan canes) is now also arranged in this house, the moist heat of which suits them better than the Palm House.

The **Fern Houses** (Nos. 2 and 3) retain their pre-eminence, whether for the number of species in cultivation or the health and vigour of the plants, but the constant humid temperature necessary to their growth so damages the painted woodwork of the houses that they are under frequent repair. I am strongly of opinion, that seeing how much shade fern houses require, the side walls should be of brick up to the eaves, with large side sashes, and that the woodwork of both roof and sashes should be of some of the durable colonial woods, as the Jarrah of West Australia, which would probably not require internal painting.

The species of *Cheilanthes* in the Cool Fern House, which have proved very impatient of pot culture, have been planted on a broad side shelf covered with stones, potsherds, and soil well drained below, and promise to do well under this treatment. Many of the smaller ferns in the same house, which, when in small pots, were watered either too much or too little, have been similarly accommodated with obvious success.

The number of species and varieties of ferns in the Royal Gardens is now upwards of 1,000.

The labour and expense of keeping up both the interest and beauty of the **Ornamental Conservatory** (No. 4) throughout the year, by a mixture of commoner with the rarer ornamental plants, is a subject to which I have, especially of late, devoted a considerable amount of attention. It has occurred to me, that as re-

gards the common plants of merely decorative interest, of which it is desired to display a fair quantity as affording a very great gratification to many visitors, it might be more economical and satisfactory to buy than to raise them ourselves. Within recent years the cultivation of certain kinds has become a speciality with suburban nurserymen, who raise and supply the London trade with them by tens of thousands, and at a comparatively trifling cost per pot. The number of each kind required for this house at any one time is comparatively small, and the material labour, skill, space, and attention, &c. that these few require would almost suffice to raise double the quantity or more. Under these circumstances, I believe it might be to our advantage to devote our attention to the cultivation of the rarer sorts alone and to purchase the commoner.

The **Succulent House** (No. 5), which is by far the most interesting in the garden in respect of the magnificent collection of plants of grotesque habit and singular form, has also been re-arranged, and some of the large duplicate Euphorbias, Aloes, and Cacti removed to the Palm House. Several of the largest Agaves and Fourcroyas (commonly called American Aloes) have flowered during the past summer, and the flowering stems rising to a considerable height were allowed to pass through the roof, presenting a striking and singular appearance.

The collection of **Economic Plants** has been carefully revised, extended, and entirely re-arranged. It is now probably one of the most complete series of medicinal and useful plants ever brought together. The nomenclature has been checked and a manuscript catalogue prepared.

The following plants of especial botanical interest, amongst others of less importance, have flowered

during the past year in the Royal Gardens:—

Agave dealbata, Lem.

„ *ensiformis*, Hort.

„ *micracantha*, Salin. Dyck.

„ *Sartorii*, K. Koch; Bot. Mag. 6292.

Albica juncifolia, Bak., n. sp.

Anthericum Gerrardi, Bak., n. sp.

Bongardia Rauwolfii, C. A. M., Bot. Mag., 6244.

Chlorophytum arundinaceum, Bak., n. sp.

Dasyliroon glaucophyllum,

Hook.; Bot. Mag. 5041.

Fourcroya gigantea, Vent.

Fritillaria recurva, Benth.; Bot. Mag. 6264.

Gasteria dicta, N. Br., n. sp.

Mesembryanthemum vittatum, N. Br., n. sp.
„ *ficiforme*, Haw.

Moricandia sonchifolia, Hook. f.; Bot. Mag. 6243.

Oxalis enneaphylla, Cav.; Bot. Mag. 6256 (from rhizomes sent to Kew from the Falklands by Mr. Moseley, Naturalist of H.M.S. "Challenger.")

Stapelia Sarpedon, N. Br., n. sp.
„ *varians* var. *adnata*, N. Br.

Telfairia occidentalis, Hook. f.; Bot. Mag. 6272.

Thamnocalamus Falconeri, Hook. f. (erroneously known in gardens as *Arundinaria falcata*, Nees).

Tulipa Hageri, Heldr.; Bot. Mag. 6242.

Tupistra macrostigma, Bak.; Bot. Mag. 6280.

Turraea obtusifolia, Hochst.; Bot. Mag. 6267.

Xanthisma texanum, D. C.; Bot. Mag. 6275.

I may take this opportunity of noting that a well known stove foliage plant of gardens, *Theophrasta imperialis*, Linden proves from the examination of specimens in fruit sent to us by M. Glazion, to be a species

of *Chrysophyllum* belonging to a different natural family *Sapotaceæ*.

ARBORETUM (IN THE PLEASURE GROUNDS).

The digging of young plantations, trenching for new ones, and removal of dead and dying trees continues to absorb much of the labour of this department.

The area skirting the boundary wall of the Richmond Road which as stated in my last report had been cleared of trees and trenched, has been replanted, evergreen oaks being copiously introduced to screen the houses which will in all probability soon be erected on the opposite side of the road. An additional area of about 100 yards in length extending in the direction of the Unicorn Gate has been treated in the same way.

The mound on which King William's Temple stands and the ground around it have been laid out. The top of the unsightly mound which projected across the Deodar avenue and that side of the Pagoda vista, and rose several feet higher than the basement of the Temple, and immediately in front of it, was the site of three magnificent elms. The desirability of preserving these had for many years prevented the mound itself being interfered with; one however was blown over some years ago, and the notorious brittleness of the limbs of large elms when laden

with leaves determined me to remove the others, as it was impossible to prevent the mound being used as a lounge by holiday makers. This has enabled me to give a more shapely aspect to the mound by removing the top and about 20 feet of the east part, as also to complete the row of Deodars, which is now continuous on both sides of the Pagoda vista. Both flanks have been planted with mixed shrubs and some Planes and Limes introduced to replace the elms. The ground on the west side of the mound has been lowered in front of the Temple to the level of the walk that extends to the west front of the Temperate House, and mounds have been raised round this area. The latter will be devoted to the classified collection of *Ericææ* and *Vacciniceæ* (Heaths, Andromedas, Vacciniums, Arbuti, Gaultherias, &c.)

Flagstaff Dell.—The old gravel pit having been laid out as described in my last report has been planted with the classified collection of shrubby *Polypetalæ* (*Thalamefloræ*). They comprise 56 genera and 500 species and varieties.

INTERCHANGE OF PLANTS AND SEEDS.

The receipts during the past year have been 6,033 plants of all kinds and 2,487 packets of seeds from 244 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 - -	3	591	1,047	1,231	884	138
Continent - -	—	74	162	161	323	22
Asia - - -	8	934	345	52	—	30
Africa - - -	2	119	203	—	—	13
America - -	11	640	300	518	735	30
Australia and New Zealand.	5	129	72	—	—	11
	29	2,487	2,129	1,962	1,942	244

Balsam of Copaiba.—Some well ripened seeds of the Para Copaiba ("*Copaifera multijuga*") have been brought by Mr. Cross from the forests of Para and germinated freely. The tree which produces it is described as gigantic, the trunk sometimes rising to a height of 80 feet before branching. The Para balsam, called *Copaiba blanca*, is chiefly sent to France, where it obtains the highest price of any. A single tree if tapped at the right season is said to yield about 84 imperial pints of balsam. Very little is known of the history or botanical characters of this plant, which has been only imperfectly described. It is greatly to be desired that this tree should be introduced into the East Indies.

Balsam of Peru.—This beautiful tree (*Myroxylon Perycira*) was introduced into Ceylon in 1861 by the exertions of the late eminent pharmacologist Daniel Hanbury. It has succeeded there admirably, and last year I received several parcels of seeds from Dr. Thwaites, which I have distributed to various tropical colonies. Dr. Thwaites speaks in warm terms of the beauty of its foliage and habit.

Chocolate.—This was introduced into Ceylon and samples were sent home in 1873. It is now being rapidly improved, and will unquestionably soon become an important article of trade with that island.

I have no further report of its prospects in the Terai district of the Sikkim Himalaya, which is, I fear, too dry for it in winter.

Cinchona Cultivation in St. Helena.—In my report for 1874, I pointed out that "the suitability of the soil and climate of that island for Cinchona cultivation has now been indisputably proved." It is a melancholy conclusion to the efforts made by Kew on behalf of this doubtless dispirited, but I am afraid I must add, spiritless colony, that

nothing has been done to utilise so easy a source of revenue. In a private letter recently received, I am informed, "up to within a few months since a man was paid by the colony to look after the Cinchona plants on Diana's Peak, but even he has been disestablished, and the plants are overgrown and almost hidden in ferns and dense undergrowth of native vegetation."

India-rubber.—On the 14th of June of last year, Mr. H. A. Wickham, a resident on the Amazons, who had been commissioned by the India Office to collect seeds of the *Hevea brasiliensis*, arrived in England with 70,000, obtained on the Rio Tapajos. In consequence of their retaining vitality for but a very short period, they were all sown the day after arrival, and, though not contained in pans, covered a space of over 300 square feet, closely packed together. About $3\frac{1}{4}$ per cent. germinated, some as early as the fourth day after sowing, and many in a few days reached a height of 18 inches. Upwards of 1,900 plants were transmitted, August 12, in 38 wardian cases made specially to accommodate the rapid growth of the seedlings, to Ceylon under charge of a gardener. Of the whole consignment 90 per cent. of the plants reached Dr. Thwaites in excellent condition, and they will remain in Ceylon for the present under an arrangement which I suggested between the Indian and Colonial offices, that the young plants which could not thrive in the climate of Calcutta or any of the more accessible gardens of continental India, should be nursed and established in Ceylon for subsequent transmission through the Indian gardens to Assam, Burma, and other hot damp provinces of India proper. I am happy to say that the plants are thriving under the management of Dr. Thwaites, who has obtained

the authority of his Government to establish a supplementary tropical garden at a lower elevation than Peradeniya (1,700 feet) for the more rapid multiplication of the *Hevea*, *Castilloa*, Chocolate and other plants that require a maximum of heat and moisture.

In addition to the principal consignment to Ceylon small parcels of *Hevea* plants were sent to the following places:—Africa (West Coast), Burma, Dominica, Jamaica, Java, Queensland, Singapore, and Trinidad. In the case of Singapore the result was unfortunate. Owing to the delay on the part of the India Office in paying the freight, the cases did not come into the hands of the Superintendent of the Botanic Gardens to whom they should have been consigned till the plants were nearly all dead.

A plant in cultivation in the Botanic Gardens of Regent's Park, London, of Buitenzorg (Java) and Mauritius, under the name of "*Hevea guyanensis*," proves from specimens transmitted to Kew by Mr. Horne to be entirely different, and is a species of *Manihot*, apparently *M. Glaziovii*, Muell. Arg., which is said to come from Rio Janeiro.

On November 21st, Mr. Robert Cross, who, in addition to the commission given to Mr. Wickham, had been sent to S. America to bring home live plants in the event of its proving impossible to transmit alive to this country the very perishable seeds, reached Kew with about 1,000 living young *Hevea* plants. The most promising of these have been retained at Kew during the winter, and a portion will be sent to India as soon as the weather permits.

The stock of *Castilloa elastica*, brought last year to Kew by Mr. Cross, has been propagated as rapidly as possible, and plants have already been distributed to Africa (West Coast), Ceylon, and Java. Dr.

Thwaites reports that of 31 plants transmitted to him 28 have arrived in perfect health and have thriven vigorously.

A plant to which I alluded in my last report, and which is to be found in some continental and English gardens under the name of *Castilloa elastica*, proves under cultivation at Kew (although possibly a species of *Castilloa*) to be certainly distinct from that plant both in the form of the leaves and in habit.

Along with the *Heveas* Mr. Cross brought seeds and plants of an undescribed rubber-tree which furnishes the "*Ceará scrap*" of the English market. The export of this has been reckoned at 1,100 tons annually. The botanical nature of the plant is at present uncertain, but it may possibly prove identical with *Manihot Glaziovii* already mentioned. It is at any rate perfectly different from *Hevea* and *Castilloa* in character, habit, and habitat. It grows in a climate with a marked dry season, amongst a scrubby vegetation, and has stout short branches and deciduous leaves. 41 of the imported stems have grown, and as many young plants have been obtained from these by cuttings. The seeds were raised with difficulty during the winter owing to the seedlings damping off soon after germination, a characteristic of plants of similar habit from similar climates; 14 plants, however, are growing from this source.

Ipecacuanha.—Dr. King reports that he fears this drug cannot be grown profitably so far north in India as Bengal; but that the secret of its successful propagation being now perfectly understood any quantity of seeds can be sent out. A quantity of the dried root has been prepared by Dr. King for use in the Medical College Hospital of Calcutta, and found to be quite as efficient as the best South American

drug. The disadvantage attributable to the extreme slowness of the growth of this plant, and hence small annual return of root wherever it has been cultivated, must be met by a greater extension of the cultivation, as to which there should be no difficulty, seeing that the plant is increased with astonishing facility by ordinary cuttings, root division, or by merely pegging a leaf to the earth.

Liberian Coffee.—The demands for this plant (first grown in this country at Kew in 1872), which has excited the expectations of coffee planters in all parts of the world to the highest degree, far exceed our means of supply. Now, however, that the function of this establishment in introducing the plant into the coffee-growing districts of India and our Colonies is amply fulfilled, and both the seed and plants are to be had from Mr. Bull, of Chelsea, and Messrs. James Irvine & Co., of Liverpool, as well as other firms, no further supply will be kept in Kew than suffices for exchange of specimens with other Botanic Gardens and correspondents. Mr. Hiern has examined the African species of the genus *Coffea* in preparing the *Rubiaceae* for the forthcoming third volume of the Flora of Tropical Africa. He has determined the claims of the Liberian coffee to be regarded as a distinct species, as was indeed the opinion of its scientific discoverer, Afzelius, and he has described it in the transactions of the Linnean Society [second series, Botany, I., p. 171, tab. xxiv.] under the name of *Coffea liberica*. I am indebted to Mr. Hiern for the opportunity of distributing with this report copies of the plate of the plant which he has published in his memoir.

I may enumerate as the most important recipients during the past year:—*Bombay, *Burma, *Cape of Good Hope, Dominica, Java,

Madras, Montserrat, *New Grenada, Queensland, Rio de Janeiro, *Trinidad. The places marked with an asterisk had not received it the previous year.

Amongst the numerous favourable notices of the plant which I have received I will content myself with quoting two from opposite sides of the world.

Dr. Thwaites (Ceylon) writes, under date 29th August 1876, "Some of the first plants of Liberian coffee you sent to me have become large bushes and are producing berries. These latter are of a large size, but they ripen very slowly, evidently from the want of a higher temperature, so I am distributing some plants in the low country and near the sea." In his report for 1875 he also expresses the opinion that though the plants have become affected with the leaf disease, they do not apparently suffer here [Peradeniya] from the *Hemileia* so severely as our ordinary coffee."

In the Malabar District of South India the Liberian coffee has also disappointed the expectations which its large and leathery foliage seemed to encourage of its capacity for resisting the *Hemileia*. Its more vigorous habit of growth may, however, enable it to bear without succumbing the ravages of this insidious parasitic mould.

Dr. Imray (Dominica) writes while this report is in preparation, "I am thoroughly convinced that the Liberian coffee will in time take the place of our native coffee, if I may so call it. I think you would be pleased were you to see my Liberian trees with their healthy vigorous branches and large dark green bright shining leaves. Many of the trees have blossomed and are still flowering, and a small crop of





"berries is coming on. The plant must evidently be very prolific. I count as many as 15 or 20 berries, even more, in the axils of the two opposite leaves. . . . It appears to me that the new species of coffee is peculiarly adapted to this island. So far as the temperature and rainfall are concerned, the climate approximates very closely to that of Liberia from whence the plant comes. If the cultivation of Liberian coffee is generally taken up in Dominica, as I think it will be, there is a future for this little country. There are thousands of acres of splendid coffee land that might be cultivated in this island with no fear of the 'white fly' before the eyes of the planter, for the Liberian tree bids defiance to its attacks. Indeed there is a very eligible field for settlers here with a little money in their pockets who wish to cultivate coffee. It might be pleasanter and more profitable in the long run to set their faces towards the west, instead of the 'far east.'"

The suppression of this product generally in Dominica, which island once yielded the finest West India beans, has been the subject of correspondence with the Colonial Office. This led to the mission of Mr. Prestoe, the Government botanist of Trinidad, to Dominica with a view of reporting on the subject. Mr. Prestoe's report, which is in every way an admirable one, deals with all the vegetable products of the island in an exhaustive and most instructive manner, and in respect of coffee it shows that the cessation of its cultivation was not due to the larva of a small moth (*Cenostoma coffeelum*), which can be extirpated from a plantation with great ease, but to causes which are far more general, affecting the well-being of the whole island, and especially to

mismanagement on the part both of the Government and the colonists.

Mahogany.—Dr. King reports that the demand in India for seedlings of this timber tree continues to be larger than he can meet. Supplies of seed have been procured from Jamaica and forwarded to Calcutta.

Monstera deliciosa.—Mr. Bernays, Vice-President of the Queensland Acclimatisation Society, writes to me under date 27th April, "I am sure you will be gratified to learn that '*Monstera deliciosa*,' the first and only plant of which (as I believe) received in Australia was sent by you to this society, has proved itself to be well adapted to our climate. It has fruited this year with great success at Bowen Park, and is pronounced by the most competent judges to be, as its specific name indicates, a really delicious fruit."

Tea.—The establishment of tea plantations in Ceylon, which date from about 1868, and to which I alluded in my report for 1873, is now a proved success. Samples communicated to Kew have been pronounced by experienced brokers as of very excellent quality.

Trees and Shrubs for New Zealand.—Of the 6,000 trees and shrubs sent to the Botanic Garden of Wellington, New Zealand, partly in 12 Ward's cases and partly in ordinary cases and casks, the account on arrival was unfavourable, but this has since then been materially modified, the mortality not being nearly so great as the following statement would imply:—

Of the 414 plants in the Ward's cases "all but 88 have arrived alive, though many are in a doubtful condition." This is evidently owing to interference during the voyage, for whereas they left England in the best condition as to watering, on arrival "water above the pots" was

found in two of the cases, and the rest are all described as having been overwatered. The voyage had occupied three months and ten days. Of the rooted plants in the six casks many were found to be sweated and mouldy; others had been invaded by rats, and still others soaked by bilge-water, showing that the directions that had been given that they should be placed in a dry and airy part of the ship's hold had not been attended to. The recipients drew attention to the evident care which had been bestowed on their packing, and attributed the want of success to the length of time the plants had remained in the steamy hold of the ship.

Two boxes with cuttings of nearly 100 species of willows arrived in an equally bad state, not 10 plants having survived. Some had their ends covered with wax, others with clay, the latter arrived in the best condition. All had rooted throughout their length, and would have arrived alive had the voyage been of ordinary duration.

A superintendent (Prof. Duthie, M.A., F.L.S.) has been appointed by the Indian Government on my recommendation for the Government Gardens of Saharunpore, in

the N. W. Provinces. This garden, under the superintendence of Royle, Falconer, and Jameson, has not only rendered most important services to India, but has been the means of introducing nearly all the Western Himalayan plants now cultivated in Europe.

A propagator (Mr. Dunstan) has been sent out from the Royal Gardens to the Botanic Gardens at Cape Town.

I regret to record the death of Arthur Freeman, who went from Kew to accompany Mr. L. A. Lucas in an expedition to Central Africa, and by whom he was not long survived. It is a satisfaction to me to record that in his letters to me Mr. Lucas expressed his warm regard and admiration for Freeman, who was to him all that a man could be desired to be, even under the trying conditions of their travels.

A supply of plants for the Art Schools and for the examinations in botany of the Science and Art Department have been regularly furnished.

The following is a statement of the packets of seeds and plants sent out during the past year, and included in 342 consignments:—

—	Ward's Cases.	Packets of Seeds.	Stove and Greenhouse Plants.	Herbaceous Plants.	Trees and Shrubs.	Number of Recipients.
Britain - -	—	950	6,815	1,091	822	93
Continent - -	—	391	683	85	—	17
Asia - - -	50	244	2,702	—	—	14
Africa - - -	7	198	264	—	133	10
America - -	10	876	636	—	27	19
Australia and New Zealand.	5	695	670	3	6,498	11
	72	3,354	11,770	1,179	7,480	164

The principal contributors of seeds and plants are enumerated below :—

I. Britain.

The usual exchanges have been made with the Botanic Gardens of Belfast, Birmingham, Chelsea, Edinburgh, Hull, Glasnevin, and Oxford; with the Royal Horticultural Society, Chiswick; with the Royal Botanic Society, Regent's Park; also with the principal nurserymen, especially with Messrs. Backhouse and Son of York, Barr and Sugden, Bull of Chelsea, Dickson and Sons of Chester, Dickson and Turnbull of Perth, Green of Reigate, Henderson of St. John's Wood, Herbst of Richmond, Jackson and Son of Kingston, Kinmont of Canterbury, J. and C. Lee of Hammersmith, Little and Ballantyne of Carlisle, Low of Clapton, New Plant and Bulb Co. of Colchester, Osborn of Fulham, Parker of Tooting, Paul of Waltham, Rollison and Sons of Tooting, Sanders and Co. of St. Albans, Smith of Worcester, Stuart and Mien of Kelso, Thompson of Ipswich, Veitch and Sons of Chelsea, Ware of Tottenham, Williams of Holloway, Wills of Kensington.

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

Ash, Linnington; large plant of *Cyathea Dregei*, tubers *Sander-sonia*.

Ashton, Lieut.-Col.; seeds (*Anchusa capensis*).

Atkins, J.; *Mamillaria senilis*, *Silene Hookeri*, and other herbaceous plants and seeds.

Bailey, C.; *Carex ornithopoda*.

Balfour, Dr. I. B.; Bourbon fern spores, seeds, palms, &c.

Barnard, Major; bulbs of *Trichonema Columnæ*, *Herminium Monorchis*, *Pinguicula*, &c.

Boyle, H.; *Anætochilus intermedius*.

Broome, C. E.; *Asplenium Pettrarchæ*, *Cheilanthes odora*, and herbaceous plants.

Bushell, Dr.; seeds of *Bæa hygrometrica* and *Moricandia sonchifolia*.

Cave, Right Honble. Stephen; seeds of *Casuarina*, sp. and *Nelumbium speciosum* from the Nile.

Clarke, C. B.; seeds of *Mahonia nepalensis*.

Clarke, Lieut.-Col. T.; *Phædranassa rubro-viridis*, Cotton seeds.

Cooper, W. S.; *Echeveria gibbiflora* (type), *Gasteria planifolia*, &c.

Crewe, Rev. Harpur; many choice *Croci*, herbaceous plants, and bulbs.

Danford, Mrs.; *Xiphion Danfordiæ* and other new and choice bulbs from the Cilician Taurus.

Ducat, Miss; seeds of *Sebaea*, sp., new.

Duthie, J. F.; *Orchis apifera* and *O. ustulata*.

Elwes, H.; collection of orchids from India, also *Arisæmas*, *Amorphophallus*, *Curcumas*, *Hedychiums* (with *Æginetia*), choice lilies, bulbous and herbaceous collections, *Smilacina oleracea*, seeds of *Sarcodes sanguinea*, *Darlingtonia californica*, &c.

Farrer, T. H.; sods of *Calluna*, *Pyrethrum uliginosum*.

Foreign Office; seeds of the Mesquit Beans (*Prosopis pubescens* and *P. juliflora*), *Balsamocarpum brevifolium*.

Fraser, P. N.; *Aerides Wightianum*, *Notholena lanuginosa*, *Platycerium Wallichii*.

Frere, G. E.; plant of *Pyrus domestica*, seeds of *Myrsine variabilis*.

Grant, Col. J. A.; corms of *Gla-diolus* and tubers of *Lissochilus*, seeds of *Hyphæne*, n. sp., and *Mimosa*, sp., from Central Africa.

Green, C. B.; *Cypripedium niveum*, *Oncidium Batemannianum*,

Vanda cærulescens, and other choice orchids, *Tydaea*, *Scilla campanulata alba*.

Henry, J. A. ; *Campanula Haydogenensis*, hybrid *Primula*, choice miscellaneous plants.

Holmes, E. M. ; seeds of *Cucumis Colocynthis*, *Aplopappus discoidea*, *Ferula alliacea*, rare British plants, rhizome of *Kæmpferia Galanga*.

Hooker, Miss ; collection of Engadin seeds and plants, including white *Pinguicula* and *Artemisia mutellina*.

Hopwood, J. C. ; *Tillandsia usneoides*.

Howard, J. E. ; *Cinchona Calisaya*, var. *anglica* and others.

India Office ; seeds of Burmese Cardamoms (*Anomum xanthioides* ?), plants of *Hevea brasiliensis*, plants and seeds of Ceará scrap rubber tree, seeds of *Copaifera*, sp., seeds of *Bambusa spinosa*.

James, B. ; *Phajus grandifolius*, seeds of *Capsicum*, &c.

Jones, Winslow ; seeds *Yucca*, sp. Colorado, *Argemone mexicana*.

Kellock, Dr. ; large specimen of *Dracæna Draco*.

Lawson, Rev. W. L. ; *Adiantum cuneatum*, var. and British ferns.

Lloyd, Capt. ; seeds of Cashmere Plane tree.

Macleay, Sir G. ; *Alsophila australis*, *Æschynanthus Roxburghii* ; *Crinum*, spp. and other bulbs, seeds of a creeping Palm, Lagos W. Africa, and many other African seeds.

Masters, Dr. Maxwell T. ; seeds and cuttings of yellow fruited *Solanum Dulcamara*.

Maude, W. ; *Nephrodium velutinum* and other N. Z. ferns.

Maw, G. ; valuable consignments of new and rare *Croci*, *Narcissi* *Fritillarias*, and herbaceous plants ; seeds of *Drosophyllum*.

Moggridge, M. T. ; seeds Jujubier (*Stryax officinale*).

Moseley, H. N. ; seeds from Magellan Straits and Terra del Fuego, rhizomes *Oxalis enneaphylla* (figured in Bot. Mag. 6,256), Palm from Juan Fernandez, *Trichomanes* from Juan Fernandez.

Munby, E. and Miss ; *Boucerosia Munbyana*, many spp. of *Oxalis* *Narcissus* and *Crocus*.

Nevill, Lady D. ; collection of Gleichenias and other choice ferns, *Darlingtonias*, *Droseras*, and *Stangeria*.

Pool, W. ; collection of Madagascarcar seeds.

Ramel, Mons. ; seeds *Eucalyptus colosseæ*.

Rawson, Rev. A. ; seeds, a new ? Cape *Moræa*.

Ricardo-Seaver, Major ; tree ferns from Brazil.

Ricci, J. H. de ; *Piper methysticum* (Kava) from Fiji.

Routledge, Thos. ; seeds of several Bamboos, plants used in paper-making.

Samuelson, Jas. ; seeds *Raphia*, sp. Liberia.

Saunders, W. W. ; many choice herbaceous plants and bulbs.

Smith, J. P. G. ; *Tacsonia manicata*.

Sowerby, W. ; *Rheum Emodi*, two large plants of *Castilleja elastica*, *Manihot Glaziovii* Muell. Arg., *Cyanophyllum speciosum*, *C. magnificum*.

Spottiswoode, W. ; *Bouvardia longiflora*.

Trail, Dr. J. W. H. ; British plants.

Walker, Mrs. M. C. ; *Ainsliea Walkeri*, Bot. Mag. 6,225.

Williamson, Prof. ; *Calanthe Veitchii*, *Dionæa*.

Young, Liston ; *Peristeria*.
Zagury, Isaac ; seeds *Parinarium*, sp.

II. Continent.

Agardh, Dr. G. J., Lund ; plants and seeds *Nymphaea alba*, var. *rosea*.

Booth & Sohn, Hamburg; collection of trees and shrubs.

* Decaisne, Prof. J., Paris; large collections of herbaceous, stove, greenhouse, and succulent plants.

Godefroy-Lebeuf, A., Paris; *Masdevallia Estradae*, seeds, roots, *Thapsia garganica*.

Goeze, Dr. E., Lisbon; various choice bulbs and seeds.

Groves, H., Florence; choice species tulips and other bulbs and seeds.

Haage and Schmidt, Erfurt; stems of *Xerophyta retinervis*, plants of *Dracaena* from Comoro Islands.

Henriques, J. A., Coimbra; collection of bulbs and orchids.

Layard, Right Hon. A. H., Madrid; Acorns of *Quercus pseudo-coccifera* from Tarragona.

Leichtlin, Max., Baden-Baden; *Acidanthera bicolor* and other choice bulbs, *Eremurus robustus*, many choice herbaceous plants.

Linden, J., Ghent; collection of new and choice palms and other plants.

Loury, C., Persan; collection of choice Queensland plants, *Xanthoceras sorbifolia*, *Bromeliaceae*, set of hybrid *Echeverias*, &c.

Meyer, E., Carlsruhe; collection of rare plants, *Liebigia speciosa*, *Spathicarpa platyspatha*, &c.

Naudin, Ch., Collioure; seeds of Gobo (*Arctium edule*) from Japan, and *Carduus altissimus*.

Regel, Dr., St. Petersburg; bulbs of *Fritillaria pallidiflora*, *Lycoris Sewerzowi* and others.

Reichenbach, Dr., Hamburg; bulbs of *Allium atropurpureum*.

Russow, Dr. E., Erlangen; choice herbaceous plants, *Leontice altaica*, &c.

Van Houtte, L., Ghent; collection of trees and shrubs.

Van Volxem, J., Brussels; collection of trees and shrubs.

III. Asia.

The Indian Government; the Botanic Gardens of Calcutta, Ceylon, Buitenzorg, and Saharunpore; the Government Gardens of Hong Kong.

Aitchison, Dr.; seeds of *Pinus Gerardiana*, rhizomes of *Iris*, and seeds of herbaceous plants.

Beddome, Lieut.-Col.; seeds of *Beesha travancorica*, *Lastrea scabrosa*, and orchids.

Berkeley, Major; orchids from Matheran, India.

Bourke, Walter M.; *Cheilanthes argentea*, var. *chrysophylla*.

Bridgeford, Capt.; box of *Liliums* from Japan.

Gammie, J.; seeds *Decaisnea*, Cucurbits, &c., plants of *Pleione Hookeriana*, &c.

Hance, Dr. H. F.; seeds *Melodorum*, sp., *Pterocarya stenoptera*, *Symplocos decora*.

Jamie, R.; *Renanthera Lowii*, Ward's case *Garcinia Hanburyi*.

Murton, H.; Wardian cases of *Garcinia Mangostana*, *Durio zibethinus*, *Lansium domesticum*, *Cynometra cauliflora*, Horn Plantain, &c.

Ricketts, G. T.; spores of *Onychium auratum*, &c.

Scott, J.; collection of poppy seeds.

Woodrow, G. M.; seeds and boxes of orchids, *Jatropha nana*, &c.

IV. Africa.

The Botanic Gardens of Natal and Mauritius.

Atherstone, Dr.; seeds of *Gardenia Thunbergii*, *Encephalartos*, &c.

Barber, Mrs. M. E.; *Stapelias*, *Hæmanthus* and other bulbs.

Barkly, H.E. Sir H.; valuable collections of *Stapelias*, choice collection of other succulents, *Welwitschia* stems and seeds.

Bennett, G. B.; seeds *Acanthosicyos* (*Naras*), *Leucadendron*, &c., tubers of *Disa*.

Calvert, H. H. ; seeds of *Luffa* *egyptiaca* and *Nicotiana rustica*.

Cordukes, S. ; seeds of *Buddleia* *salvifolia* and others.

Kirk, Dr. ; seeds of *Solanum*, sp., plants of *Stapelia* sp. *Modecca* sp., and *Sterculia* sp. ; from Zanzibar.

Mac Owan, Prof. ; seeds *Solanum* *Planiti*, *Stapelia*, sp., and *Androcymbium punctatum*.

Wilson, J. ; choice Cape bulbs.

Wollaston, T. V. ; seeds from St. Helena.

V. New World.

The Botanic Gardens of Cambridge, Chicago, Jamaica, Trinidad, Washington, and the Department of Agriculture, Washington.

Austin, Mrs. R. M. ; plants and seeds of *Darlingtonia*, rare and choice ferns, lilies, collection of seeds, including *Sarcodes sanguinea*.

Capanema, Dr. ; Ward's case of *Cephaelis*, seeds of *Copernicia*, &c. Engelmann, Dr. ; seeds *Yucca brevifolia*.

Goldsmith, W. T. ; box of *Sarracenia purpurea*, *Cypripedium spectabile*, *Epigaea*, *Taxus canadensis*, and seeds of various plants.

Graham, H.E. Cyril ; Ward's case of miscellaneous plants.

Lefroy, H.E. Major-General ; seeds of *Bauhinia Vahlia*.

Leybold, Dr. Federico ; collection of Chilian seeds.

Lippincott, James L. ; seeds *Cercocarpus parvifolius*, and of herbaceous plants.

Miller, Sievers, and Co. ; *Echinocactus cylindraceus* and other new succulents, choice bulbs, seeds *Coniferae*, and of new and choice palms.

Munro, General ; seeds *Attalea Cohune* and *Thrinax barbadensis*.

Nation, W. ; collection of new, rare, and choice bulbs and tubers.

Robinson, H.E., Governor ; seeds *Casalpinia coriaria*.

Rumbold, H.E. H. ; pods of

Casalpinia (*Balsamocarpon*) *brevifolia* (Algarrobo of Chili).

Sturtevant, E. D. ; box of *Calopogon pulchellus*, *Cypripediums*, *Nymphaea odorata* and *Sarracenia flava*.

Taplin, J. ; seeds of *Nepenthes Hookeri*.

Torrens, Major-General ; seeds *Thrinax barbadensis*.

Trent, Mrs. ; *Nymphaea flava*.

Wickham, H. A. ; Coffee from the Amazons, seeds of *Caryocar brasiliensis*, orchids.

VI. Australia and New Zealand.

The Botanic Gardens of Brisbane, Melbourne, and Sydney.

Bernays, L. A. ; seeds of *Kentia Wendlandiana*, *Araucaria Cunninghamii*, and *A. Bidwillii*, &c.

Enys, John D. ; seeds of *Ranunculus Lyallii*.

Forster, Hon. Wm. ; seeds of *Hakea*, &c.

Hartman, Carl ; *Dendrobium Hartmannii*, *D. Mortii*, *Sarcocylis* sp., and *Polypodium Brownii*.

Maxwell, G. ; seeds from St. George's Sound.

Mueller, Baron von ; seeds of *Hakea*, *Leucadendron*, *Boronia megastigma*, *Scirpodendron costatum*, *Cycas Cairnsiana*.

Thozet, A. ; seeds *Macrozamia Perowskiana*, &c.

OFFICIAL CORRESPONDENCE.

The communications, letters, and inquiries addressed to this establishment during the past year from Government offices at home, in India, and the Colonies, as well as from private individuals in all parts of the world, have been unusually numerous. This part of the work of Kew is fast becoming a distinct department, and already absorbs a large part of the time of the Assistant Director in giving it attention. I select from an immense list of

topics which have come under our attention during the past year the following as of some general interest :—

African Oil Palm for Labuan.

—A correspondence has taken place with the Colonial Office on the subject of the introduction of the *Elais guineensis* from the West Coast of Africa into the Island of Labuan. The great simplicity in the extraction of the oil, whether by mere expression (as in Old Calabar) or by boiling, and the value of the kernels as a further source of oil and feeding stuff when imported into this country, appears to make this an industry extremely well adapted for Labuan and adjacent islands. I have taken steps to obtain seeds from Africa and also detailed information as to the methods of preparation.

Balsamocarpon brevifolium.

—Our attention having been drawn to a new tanning material known as the Algarrobo of Chili, which appears to be of very high commercial value and far superior to Divi-Divi, a quantity of the pods (the part of the plant used) was obtained from Chili by the intervention of H.E. H. Rumbold, Her Majesty's Minister at Santiago. It was distributed immediately to the following places as likely to prove suitable for its growth :—Adelaide, Bahamas, Barbadoes, Bermuda, Brisbane, Cape of Good Hope, Gunesh Khind (Bombay), Lahore, Melbourne, Natal, W. Australia.

Burmese Cardamoms. — A sample of these seeds was sent to Kew by the India Office for identification. Burmese Cardamoms fetch a low price in the market compared with Malabar Cardamoms, and it was supposed that this might be due to the intermixture of the seeds of this plant with those of a spurious kind. It was, however, quite certain from their microscopic structure that the seeds sent were not those of *Elet-*

taria Cardamomum, and it was not improbable that they might belong to *Amomum xanthioides*, the wild Cardamom of Siam, but about which scarcely anything is known. In this, as in so many other cases, the materials sent to Kew for an opinion were from a botanical point of view lamentably insufficient, and this was in this particular instance the more to be regretted, because a scientific department like the Indian Forest Service might easily obtain such a series of specimens for transmission to England as would enable the whole history of the Burmese Cardamom, which at present is very unsatisfactorily known, to be entirely cleared up.

Castor Oil in Bahamas.—A correspondence has taken place with the Colonial Office on the subject of the cultivation of the castor oil plant in the Bahamas. Governor Robinson states that "the castor oil plant grows here as a weed, but "no endeavour yet has ever been "made to express the oil. Thousands of gallons might be exported "from here annually." A supply of the best castor oil seed was obtained from Calcutta and forwarded to the Bahamas. Governor Robinson now reports : "The yield of this "variety of the castor oil plant is, "we should say, fully three times "greater than that commonly found "amongst us, the heads and the "beans themselves being very much "larger than those produced by the "native variety. As the East India "plant can be cultivated quite as "easily and readily as our own, "and as it possesses such a marked "superiority in the matter of yield, "we hope to see it speedily and "widely introduced into the colony, "so as to supersede the indigenous "kind altogether."

Charcoal for Gunpowder.—

The large consumption of dog wood for this purpose of late years in Europe has produced a scarcity of

this material. The Royal Gunpowder Factory at Waltham Abbey appears to have drawn its supplies of *Rhamnus Frangula* wood from Germany, though it might be grown in England on the coppice system with the greatest ease. A substitute has, however, been proposed to it, and a specimen of the wood was sent to Kew for identification. It was determined to be Hornbeam (*Carpinus Betulus*), which has been, at any rate formerly, employed for gunpowder manufacture at Berne.

Chicle Gum.—A protracted correspondence has been carried on with the Colonial and Foreign Offices with reference to a gum known in New York (where it was used for chewing), under the above name, which it was supposed might be valuable for telegraphic purposes. It was confused in some way with another very obscure product known as *Monesia*, which is used in medicine, and which appears to be derived from the Brazilian *Lucuma glycyphllum*. Chicle gum, on the other hand, comes from Mexico, and is produced, according to our most recent information, by *Achras Sapota*. A specimen sent to Kew was submitted to Messrs. Siemens Brothers, and they reported that in "mixing with india-rubber it made the latter too brittle, and therefore cannot improve the quality of the rubber if intended for the insulation of cable wires."

"Cocoa-nut Disease" of Demerara.—Great destruction has been wrought in the cocals of Demerara by the larvæ of a small beetle (*Passalus tridens*) which completely destroy the soft tissues of the interior of the stems, and eventually of course inevitably kill the trees. It is difficult to prescribe any remedy except "stamping out" by burning the infected trees as soon as they show symptoms of the larvæ being at work.

Coffee Disease.—In my last

Report I stated that Dr. Thwaites, the Director of the Botanic Gardens, Peradeniya, Ceylon, had drawn up a series of questions on this subject which have been addressed to the various coffee-growing countries and colonies. All the replies and information that are likely to be received in answer to this inquiry having now come to hand, I have thought it would be most useful to summarise the results in the present Report as likely to give them the widest circulation.

According to the replies no disease, or at any rate none with the characteristic peculiarities of the *Hemileia*, occurs in any of the following seats of coffee cultivation:—Angola, Bahia, Bermuda, Carthagena, Cayenne, Costa Rica, Grenada, Gold Coast, Guiana (British), Jamaica, Java, Madeira, Mauritius, Nicaragua, Reunion, St. Helena, Sierra Leone, Trinidad.

In the following places from which replies have been sent coffee is not grown:—Barbados, Buenos Ayres, Honduras (British), Leeward Islands (except Dominica), St. Vincent, Surinam, Zanzibar. With respect to the remainder, the information received may be conveniently summed up under the following heads:—

1. *Hemileia vastatrix* ("Leaf blight") of Ceylon and Southern India and associated diseases.
2. *Cemistoma coffeellum* ("Coffee fly") of the Antilles and Brazil and associated diseases.
3. "Borer."
4. "Coffee bug."
5. "Canker" and other vague diseases attributable to climatic causes.

The reports received bearing on these several heads are perhaps not as complete in information as might have been both expected and desired.

In the light, however, of knowledge derived from other sources

they have proved to possess considerable interest. In some cases the statements have been of a very hypothetical nature, as to give one instance where a S. American reporter expresses the opinion that the Ceylon disease—the vegetable origin of which is unequivocally known—is “propagated by myriads of diminutive insects.”

I cannot refrain from calling particular attention to the fact that whereas in British Guiana coffee was once largely cultivated, especially in the county of Berbice, it is now “imported.”

1. *Hemileia vastatrix*. — The “Leaf disease” is a scourge of quite recent origin. In May 1869 a few coffee plants were noticed in Ceylon to be attacked by a fungus upon the leaves. In July following two or three acres of coffee plant were found to show it. After this its progress was quite extraordinary, and in 1872 it was to be found in nearly all, if not all, the estates in the island. It also soon spread to Southern India, and though Java is at present free from it, I learn while this Report is in preparation that it has made its appearance in Sumatra. I have, however, found no satisfactory evidence of its existence in other parts of the world than the islands and countries contiguous to the Indian Ocean. I conclude therefore that it is at present a local or endemic parasite, which, however, unless measures are taken to prevent the introduction of coffee plants from infected countries into others at present free from it, may be expected to spread eventually wherever coffee is cultivated. The fungus, which is allied to the Moulds, was first described by our distinguished English fungologist, the Rev. M. J. Berkeley, in the *Gardeners' Chronicle* for 1869 (p. 1157, with a woodcut), and subsequently in the *Journal of the Lin-*

nean Society (Botany, vol. xiv., p. 93, pl. 3, fig. 10). A short account also appeared in the *Quarterly Journal of Microscopical Science* (1873, pp. 79–81). It is probably indigenous to Ceylon, and has only assumed the proportions of a scourge because it has found the constitution of the coffee plant suited to it.

The conditions under which economic plants are grown in large areas are of course extremely favourable for the rapid extension and development of parasitic plants and insects. When these have only native plants in small quantities to prey upon they pass unnoticed, and their appearance on a large scale is one of the penalties which man must expect to pay for such an enormous disturbance of natural conditions as is implied in replacing a tropical forest of the most varied and mixed vegetation by a plantation of some single economic plant. In temperate countries exactly similar phenomena are exhibited by the rapid spread of the potato fungus, the vine louse (*Phylloxera*), and the potato beetle from the western side of America, first to the eastern, and then at any rate, in the case of the two former, and no doubt eventually in the case of the latter, to the Old World.

Mr. Berkeley's examination of the *Hemileia* was made from dried coffee leaves transmitted to this country. A first essential is a more adequate study of the fungus than such specimens could afford, especially in all the details of its life history, from germination to fructification. Some progress in this latter task has been made by Dr. Thwaites, with the co-operation of the Rev. R. Abbay, Fellow of Wadham College, Oxford, who was attached to the Eclipse Expedition, and remained some time afterwards in Ceylon for the benefit of his health. Mr. Abbay's observations, though imperfect, are a first step towards a more accurate know-

ledge of the subject, and will, I hope, shortly be published.

The mycelium, or vegetative part of the *Hemileia* penetrates the tissues of the leaves of the coffee plant, where it is out of the reach of any agent such as sulphur (whether applied in powder, as is so successfully done with hop mildew, or—as suggested by Mr. George Wall—by fumigation). Moreover, the detailed treatment of the trees in a large plantation by any remedy of the kind would be practically impossible. I fear that the “leaf disease” is a trouble with which the planters for the future will have always to reckon. As with our own potato disease, they must rest their hopes on the likelihood of its proving intermittent, and bear, as best they may, the constant loss of a certain per-centage in every year, with occasionally the loss of an entire crop. At the same time, every precaution should be made to destroy all the infected leaves by burning, and even, when more certain knowledge is arrived at, to boldly sacrifice the foliage of trees on the first symptoms of the malady, so as to prevent the fungus ripening a fresh crop of spores.

In Mysore another disease appears also to be rather prevalent, which is produced by a fungus distinct from the *Hemileia*. This is known as the “leaf-rot,” or Kole-roga. It has been described by Dr. M. C. Cooke under the name of *Pellicularia Kole-roga* (Gardeners’ Chronicle, 1876, Feb. 19, p. 246; March 4, p. 308; Grevillea, 1876, vol. iv., pp. 116, 134–135). From a report by Dr. Cooke, issued by the India Office, it appears that the *Pellicularia* “makes its appearance about July, when the leaves of the trees affected by it get covered with a slimy gelatinous matter, and turning black drop off, the berries likewise rot and fall in clusters.” It is estimated that nearly one quarter of the

crop each year is lost by this plague. The collection and burning of the dead leaves will in this case also have to be persevered with. As suggested by Dr. Cooke, the fungus being external in its growth, is likely to be materially checked by the application of sulphur.

A somewhat similar disease to the *Pellicularia*, but described in too vague a manner to speak definitely upon, seems to have occurred in 1864 in Jamaica, the leaves of the coffee plants being covered “with a white substance of a glutinous nature.”

As I have stated in an earlier portion of this Report, the Liberian coffee has not proved exempt from the attacks of the *Hemileia* in India and Ceylon. Mr. G. A. Cruwell, who has visited Liberia, believes that it is affected with the *Hemileia* in its native country. Specimens sent to Kew by him are pronounced by Mr. Berkeley not to be affected by the Ceylon leaf disease, but to owe their discolouration to some other cause.

2. *Cemistoma coffeelum*.—A disease has for many years been known to exist in the island of Dominica, and also to a large extent in Brazil. This was characterised by the appearance of large discoloured blotches upon the leaves, leading eventually to their decay and fall, and so seriously impairing the health of the trees. Various theories, mostly of a purely *à priori* character, were started to explain the cause, but competent investigation has placed the true explanation beyond a shadow of a doubt. The leaves are destroyed by the larvæ of a minute but very prolific moth. They live between the two surfaces of the leaves, and gradually consume the intermediate cellular tissues. The moth is, in fact, a member of the same genus as that which mines the leaves of the laburnum in our gardens. This insect is said to lessen the coffee crop in Brazil by at least one fifth. The

little pest has been found in the Antilles, island of Martinique, province of Rio Janeiro, and over the whole coffee region of Brazil. According to an enclosure in Mr. Acting Consul Austin's despatch to the Foreign Office, it is of comparatively recent introduction into Brazil:—

"In 1854, or soon after, the Imperial Government, desirous of introducing several species of coffee amongst us, advantageously cultivated in other parts of the world, committed the error of importing plants instead of seeds, and thus we had here coffee trees grown in Ceylon, Martinique, Bourbon, &c., it being quite possible that in this manner the germ of the coffee disease was imported." This is also the opinion of Mr. B. Pickman Mann, who has reported in the most admirable manner upon the whole subject to the Brazilian Government (*see American Naturalist*, 1872, June and July). I may also call attention to a similar transference, from the Old to the New World, of the moth which injures the sugar cane, and which is referred to below. Those interested in the matter should procure and study Mr. Mann's report. The only plan of radically dealing with this pest is to destroy the injured leaves while the coffee-fly is still in the larval state. Mr. Mann remarks:—"If the leaves were picked at such a time as to take the greatest number of larvæ when they were about two weeks old, it would not be difficult to select them, as the size of the blotches would make them very noticeable. I find that the expense would be more than met by the next year's crop."

Mr. Consul Pauli has sent from Puerto Rico leaves which are affected with the *Cemiosoma* in its most characteristic manner. The disease appears to do little injury in this island, and no particular attention is paid to it.

In Venezuela a disease occurs which is known by the name of "Candelillo," and which is also, according to information supplied by Mr. E. T. C. Middleton, Her Majesty's Minister at Caracas, identical with the "mancha de hierro," or "iron-stain." Dr. Ernst, however, believes them to be different, and attributes the latter to the *Cemiosoma*. The specimens forwarded to this country by Mr. Middleton of the iron-stain are, however, at once distinguishable from the ravages of the *Cemiosoma*. The leaves have been submitted to the Rev. M. J. Berkeley, who reports that they are affected by a minute fungus, a *De-pazea*, for which he proposes the specific name of *maculosa*. It has fusiform spores, .0008 in. long, and containing about seven nuclei. In Venezuela coffee appears to suffer little, comparatively speaking, from maladies of any kind.

Mr. Bunch, Her Majesty's Minister at Bogota, has forwarded some leaves affected with blotches apparently identical with those from Caracas. This is apparently a rare malady. He has accompanied these with the following description, drawn up by Senor Saenz, Professor of Botany in the University of Bogota:—"It consists of circular or elliptical blotches of an ochreish yellow colour, in which are to be observed hard knots in the centre, round which are formed concentric bands. These salient knots are to be easily distinguished on each side of the leaf, but on one side only are to be found small fungi of a yellow colour (orange), formed of a very delicate pedicule, crowned by a small sheaf of fibres, in which are an abundance of oval corpuscles of a darker colour, approaching to green, and of .003 of a millimetre in diameter."

3. "Borer."—In all tropical countries trees of all kinds (the coconut palm mentioned above is an additional example) are peculiarly liable to the ravages of various wood-eating beetles. Coffee is no exception, and the reports from various countries mention "borers," no doubt different in every case, with which the cultivator has to contend. They are peculiarly met with where the plantations are new clearings, and an important means of extirpating them is the systematic clearance of any decaying or other wood which they can use as a refuge.

They are mentioned from the West Coast of Africa, Sierra Leone, Liberia, and Gold Coast; they are also occasionally troublesome in Jamaica. It is in S. India, however, that they work harm on the largest scale, and for an account of the *Xylotrechus quadrupes*, which is the "borer" of that country, I must refer to Dr. Bidie's report on its ravages, published in 1869.

4. "Coffee Bug."—While "borers" attack the roots and stems of coffee trees in hot countries, various species of *Coccidæ* suck the juices of the young twigs and leaves. Under the names of "blight," "bug," and "scale," these are mentioned in the reports from Gold Coast, Hawaii, Madeira, and Trinidad. In the latter case they are noted as being accompanied (as is often the case when they attack the orange) by "sooty-blight," a fungus (*Capnodium*, sp.), which covers the leaves with a dark incrustation. The coffee bug of Ceylon (*Lecanium Caffæ*) was once a source of considerable injury to the coffee estates of that island. It is described in Emerson Tennent's Natural History of Ceylon, pp. 436-441. As in other countries, in the face of careful cultivation it appears to have ceased to give annoyance.

5. "Canker."—Coffee, for some imperfectly understood reason, has

has apparently failed to hold its ground in Natal. It is subject to a "bark disease," which is thus described by Mr. C. T. Saner:—"The first symptom of the disease is the withering of a small tertiary or secondary branch; on further examination it will be found that the bark, under the primary branches, is decayed and blue-mouldy; the blue mould extends downwards gradually over the whole stem, killing the tree in a few months. . . . A tree once attacked never recovers. . . . All soils and situations seem alike liable to the disease; the trees seem about to begin to suffer when about six years old. The area of land under coffee has been already much reduced, the crop having already proved unremunerative; the sugar cane is gradually but surely supplanting the coffee tree."

Here, of course, the mould is the proximate cause of death, but the ultimate cause is evidently, from the fact of its appearing when the trees are at the age of six years, due to some unfavourable external condition. The opinion of experienced persons in the colony is so entirely at variance as to what these may be that I am indisposed to express any myself. The collapse of coffee-growing is by some attributed to neglect of cultivation, by others to unsuitability of climate, and last of all to want of depth of subsoil, as shown by the small height attained by the native arboreous vegetation.

In Jamaica "canker" is also spoken of as a source of constant loss of about one per cent. per annum of the coffee trees. Its effects increase with age and are attributed to the roots penetrating to uncongenial soil. Local "blights" also occur, which are attributed to sudden climatic changes.

In Java, a fungus attacks the trunks giving them "a white appear-

ance," and produces death in all the plants above.

Eucalyptus.—Hopes still appear to be cherished that the Blue Gum of Tasmania (*E. Globulus*) will succeed in the plains of India, and in other tropical countries. This expectation has hitherto, as might have been expected, in every case led to disappointment. A paper by Dr. Brandis "on the cultivation of " the different species of *Eucalyptus* " in Northern India" issued by the Indian Government, will no doubt be held conclusive as far as that country is concerned. Dr. Brandis remarks "it seems to be acknowledged that in the open country " in the plains of North India " Stations are improved and become " more healthy by the planting of " trees. If this is admitted, then " obviously the object desired is " gained in the shortest time by " planting those species which grow " most rapidly." *Eucalypti* are probably not better adapted for this purpose than other quick growing trees, but have the merit of producing very hard timber. Two species which have succeeded well at Lucknow, have been sent to Kew for identification. They appeared to be *Eucalyptus rostrata*, Schlecht., and *E. resinifera*, Sm. Other species from the hotter parts of Australia would probably be equally available.

Gutta-percha.—Literally nothing is known as to the botanical history of the commercial varieties of gutta-percha. Several kinds of different qualities and even exhibiting different properties are imported into England, and are in immense request, especially in telegraph cable manufactories, but neither the plants which produce them nor the localities in which they are produced are approximately known.

Inquiry has been made of us with respect to a gum indifferently

known as Pulo-percha, Susu-toko, Pulo-secci, of which small quantities find their way to the London market, and which would be valuable for admixture with other gums for telegraphic purposes. Notwithstanding careful inquiry amongst our correspondents in the Straits Settlements we have failed in tracing its history in any way.

I attach great importance to the prompt investigation of gutta-percha-yielding plants. There is reason to believe that they are very local and restricted in their geographical occurrence. The collection of products of this kind for commercial purposes is shown by experience to inevitably lead to the destruction of the trees producing them, since these are recklessly destroyed, and never replaced. It is not merely, therefore, a matter of scientific interest to ascertain the exact nature of gutta-percha-yielding trees, but it is the first step in securing the perpetuation of the supply. The botanical investigation of a product or plant simply means getting such complete knowledge about it as to leave no difficulty in the way of recognising it at any time without uncertainty.

Liberian Coffee.—A strong desire being evinced in Ceylon to ascertain the conditions under which Liberian coffee is cultivated, in the expectation that it may be successfully grown at a lower elevation than the ordinary coffee, I had inquiries made both in Liberia and on the Gold Coast, the result of which was communicated to the Ceylon Government. I extract the following statement from the report from Monrovia, as likely to be of more general interest :—

"The Liberian coffee grows equally well in the immediate neighbourhood of the sea, and at considerable distances from it. Under like conditions of soil and cultivation trees near the seashore

in Monrovia are about the same as those at Careysburg, and other places 30 miles distant. The wild coffee from which the cultivated comes, is found at even still greater distance in the interior. Our nearest trees are 100 yards from the sea. At Bassa and Sinon, we are told, trees grow well still nearer the sea."

"Lowest temperature observed at Monrovia near the sea 62° Fahrenheit at 7 o'clock a.m. in the morning of the month of January during the prevalence of the Harmattan winds. Highest temperature observed, 91° Fahrenheit. These are exceptional cases. The general temperature ranges from 72° to 87° in the shade. In the country at the farthest point where coffee is cultivated by the settlers, there is a difference of one to two degrees lower, owing principally to the rise of the land. Along the coast the coffee tree thrives at only a few feet (say 10) above sea level; at Careysburg and at Mount Coffee it succeeds as well at an elevation of 550 feet.

Melons from Turkestan.—

Dr. King forwarded to the Royal Gardens a collection of seeds of the best kinds of melons grown at Kashgar. These were distributed partly to M. Naudin, the well known monographer of the *Cucurbitaceæ* at Collioure, in the S. of France, partly to the Royal Horticultural Society at Chiswick. Seeds from kinds which proved the best have been again distributed to several of the best melon-growers in England. They are at any rate likely to give rise to new strains, even if not of themselves of sufficient value for actual horticultural use.

Paper-materials.—A great demand exists amongst paper manufacturers for abundant and cheap materials for the manufacture of paper. Esparto grass (*Lygeum Spartum*) when originally introduced for this purpose from Spain

was treated with undeserved neglect. Its place is now almost entirely taken by the Alfa of N. Africa (*Macrochloa tenacissima*), and both command a high and rising price, while the supply is steadily decreasing. The success of these materials has led to a variety of other vegetable products being brought into notice for the same purpose. Many of these have been sent to Kew for identification, whilst the merits of some have been experimentally tested by T. Routledge, Esq. of the Ford Works, Sunderland.

The following are some of the materials which have come under our notice:—

1. *Bamboo*.—This appears to be only really available for paper making when in a young state. The experience, however, of all persons acquainted with tropical vegetation establishes conclusively that cutting the young stems is the most effectual method of destroying the plants. The only possible plan of obtaining paper-material from this source is to cultivate it in the same manner as is pursued for the sugar-cane, replanting after cutting the crop. Whether under these conditions, and considering the time that would be required before the plants would be mature, the material would allow the paper-maker a profit is extremely doubtful. Added to this, the large amount of water in the young stems would render it necessary to crush and press them in the country where they were grown, and send the "stock" only to this country.

2. *Baobab*.—Paper manufacturers speak with one consent of the magnificent qualities of the bark of this tree. The only drawback to its use is the apparent impossibility of introducing it into the English market in sufficiently large quantities to make it commercially important. Notwithstanding what is stated of

the slowness of its growth, I am still of opinion that more might be done in promoting its cultivation in India and other tropical countries.

3. *Fimbristylis spadicea*.—This was the only plant capable of identification out of three proposed paper-materials sent from Vera Cruz. Mr. Routledge thinks they may make "a fair paper."

4. *Heliconia Bihai*.—This is a large Scitamineous plant indigenous in Jamaica and Trinidad and probably to be procured in considerable quantities. It had been brought under the notice of Mr. Routledge, who was supplied with specimens of the fibre from the museums of the Royal Gardens. He reported that it would "make fair paper."

5. *Lepidosperma gladiatum*.—Paper has been manufactured from this in Australia. It is not considered very promising.

6. *Phragmites communis*.—This well known British reed has been imported from Majorca as a paper material. I have no information as to its practical value; it is probably not great.

7. *Uniola virgata*.—A material from Jamaica which we had very great trouble in accurately determining, ultimately proved to be this locally abundant, but otherwise little known grass. Mr. Routledge reports upon it:—

"Altogether the bulky nature of the grass would preclude its coming to England in its raw condition, it might '*faute de mieux*' be made into stock in Jamaica. It is not so good for paper-making as esparto, but if esparto should fail either from scarcity or other causes, it might be something to fall back upon."

Poisonous grass in Kashmir.

—Dr. Aitchison has sent specimens of a grass poisonous to cattle in Kashmir. It proves to be *Stipa sibirica*, and it is possible that its injurious

effects are due rather to the mechanical irritation produced by fragments of the awns than from any noxious principle contained in it. A closely allied species of *Stipa* has been described by Dr. Hance as producing somewhat similar effects in Thibet (Journal of Botany 1876, pp. 210-212).

Sugar-cane.—Inquiries have been addressed to me respecting an enormous and apparently little known variety of the sugar-cane, called the "Elephant Cane of Cochin China," which has been stated to reach a height of 11 feet and a diameter of 7 inches in six months. At my suggestion the Superintendent of the Botanic Garden at Singapore has obtained from Cochin China plants of this cane which he has succeeded in establishing. I am also indebted to M. Pierre, Director of the Botanic Garden at Saigon, for the following information, which I think may prove interesting to sugar-growers in British colonies:—

"This variety is only cultivated for eating or chewing. I do not think it would prove a good sugar producing cane But varieties, especially in the case of sugar-canes, often improve by change of climate. Perhaps this might have the good fortune to succeed better elsewhere. The dimensions as to diameter and height which this variety attains, depends on the length of time during which its growth continues. It requires in a good soil two years to reach 10 feet in height. After five or six years, it may reach 16 to 32 feet; such specimens may be seen near native houses, where it is allowed to grow undisturbed as an ornamental plant. In the province of Mytcho this variety is cultivated in humid alluvial soils on a considerable scale, but simply for sale in the bazaars and for chewing. It has the peculiarity of possessing a very brittle epidermal layer, so that instead of

becoming pressed out and giving up its juice when passed through the wooden mills employed here, it breaks up into small fragments."

In Demerara the sugar-canes have suffered from the ravages of the larva of a moth. Mr. McLachlan has been good enough to examine the specimens sent to this country, and he has little doubt that it is identical with the *Phalena saccharalis* of Fabricius, which is the same as the *Diatraea sacchari* of Guelding. The ravages of this insect in Mauritius, from which it has perhaps been introduced with canes into the West Indies, are referred to by Westwood in the Journal of the Linnean Society (Zoology, vol. i. pp. 102, 103). The cocoons are spun among the dead leaves of the plant; the best plan of extirpating the insect seems to be an organised system of burning the infested canes, as well as all loose rubbish and leaves in the plantation.

In Queensland the sugar-cane has suffered much from the attacks of a fungus or "rust." We have received numerous printed communications with respect to it, but from none of these does it clearly appear what the real nature of the fungus may be. This, at least, can probably be ascertained in this country without difficulty, and I am anxious to receive specimens, whether dried or preserved in spirit, which will enable this point to be solved.

Tobacco.—The manufacture of cigars in Jamaica, which, as stated in my Reports for 1871 and 1873, owe so much, if not everything, to the exertions of the late Governor, Sir John Peter Grant, in conjunction with this establishment, has already attained great importance; the supply which in former years sufficed only for consumption in the island, being now so great that a large sale is steadily maintained in London. I can only repeat what I

have urged in so many reports, that well-directed efforts on the part of West Indian colonists, especially if stimulated by such enlightened Governors as the one I have just mentioned, cannot fail to be remunerative.

Tobacco and cigars have also been sent to Kew for report by His Excellency William Robinson, the Governor of the Bahamas. Although not at present fulfilling the conditions necessary for being readily saleable in the English market the report obtained upon them was not without promise.

Our attention has been drawn to the precise nature of the well-known Lattakia tobacco. With the kind assistance of Mr. G. J. Eldridge, Her Majesty's Consul-General at Beyrout, and of Dr. Post, Professor of Botany in the Syrian Protestant College, it has been ascertained that the plant cultivated in the Lattakia district is not, as generally stated, identical with Turkish tobacco (*Nicotiana rustica*), but is a variety of *N. Tabacum*, while it owes its peculiar qualities to being exposed during the process of curing to the smoke of various species of oak-wood. A note on the subject has been communicated by Mr. Thiselton Dyer to the Journal of the Linnean Society (Botany, vol. xv., pp. 246-247).

At the request of His Excellency Sir W. Jervois, Governor of the Straits Settlements, seed of Lattakia, Maryland, Virginia, and Orinoco tobacco have been procured and forwarded to Singapore for cultivation in that colony. A similar collection has also been sent to the Governor of the Bahamas.

MUSEUMS.

In my last Report I adverted to the necessity of giving increased accommodation in Museum No. 2, in order to allow of a proper display of

specimens illustrating the Cryptogamic groups of plants. These are at present most meagerly illustrated from want of space. They are, however, objects of increasing interest to the large numbers of persons who make the study of some branch of natural history their recreation, and with whom our museums are extremely popular.

The whole of the museums are in a most crowded condition. No. 1 has long been waiting for the relief which throwing out the staircase at the back would give to it. No. 3 contains quite as many objects as there is room to properly display, having regard to the necessity of preserving proper thoroughfares on crowded days.

In order to provide accommodation for new objects, and also to more strictly define the scope of the collections, the Curator, with the aid of the Assistant Director, has commenced a systematic revision of the whole collections. For the future only one series will be maintained, and every specimen, whether structural or economic, will, as far as possible, be ranged in its systematic position. No separate collections of merely technological interest will be kept, and those already existing have been now broken up and distributed. A large number of duplicates and of other objects which on various grounds did not seem to be properly congruous with the object of the museums as illustrating structure and usefulness throughout the vegetable kingdom, have been as far as possible placed at the disposal of other Government institutions. Amongst these I may particularise the British Museum:—Botanical Department, Christy Collection, Library, Zoological Department; India Museum; Museum of Economic Geology; South Kensington Museum:—collection of Economic Entomology

and Food Collection Bethnal Green, Collection of Naval Models; Museum of Saint Thomas's Hospital; City Industrial Museum, Glasgow; University Museum, Cambridge. Jardin des Plantes, Paris. The work of revision necessarily requires great care, and will occupy a considerable time.

The collection of specimens illustrating vegetable teratology and pathology is steadily developing, and has been largely added to by gifts, especially from Miss Ormerod and Dr. Masters. It will soon require the entire space of the room in which it is at present placed.

Dr. Hugo Müller has published, in German, an exhaustive and most valuable treatise on paper materials amongst the reports of the Vienna Exhibition. Dr. Müller largely availed himself of the resources of the Kew museums during its preparation. It will no doubt long remain the standard authority on the subject, and I trust that a translation may be published for English use.

H.R.H. the Prince of Wales most graciously placed at our disposal the large collections of fruits, seeds, woods, &c. collected during his Indian tour. These specimens were materially enhanced in value for the purposes of our museums by H.R.H.'s expressly stipulating that we should be entirely free from any conditions in introducing the specimens into our arranged collections.

The other principal objects received during the year have been—

Aitchison, Dr.; plants of *Phetipæa Calotropidis* on *Calotropis procera*, and other vegetable products of Kashmir.

Barclay, Gray, and Lawrences, Messrs.; various samples of oil-cakes.

Calvert, H. H.; fruits of *Musa Takka*; caprificated fruits of *Ficus Sycomorus*, &c.

“Challenger,” expedition of

H.M.S.; various vegetable products collected during the voyage.

Christy, T.; "Tannometer," or instrument for testing the amount of tannin in various substances.

Colonial Office; samples of "Chicle" gum of Mexico (*Achras Sapota*), and Monesia resin (*Lucuma glycyphlaeum*) from Pernambuco.

Cross, R.; samples of fine Biscuit rubber from *Hevea brasiliensis*, of Ceara scrap rubber, and seeds of the latter.

Director, Assistant; specimens illustrating the economic application of the stems of *Arundo Donax*, and of the leaves of *Scirpus palustris*, and other vegetable products from Verona.

Eldridge, G. J., Her Majesty's Consul-General, Beyrout; authentic plant of Lattakia tobacco, and branch of oak (*Quercus Robur*, L. var.) used in curing the tobacco.

Hill, Walter; photographic views in the Botanic Garden, Brisbane.

Horne, J., Director, Botanic Garden, Mauritius; fruit-heads of *Pandanaceae*.

Jacob, W., Central Provinces, India; portion of trunk of "Dobein" (*Dalbergia paniculata*).

King, Dr., Calcutta; sample of amorphous mixed alkaloids of bark of *Cinchona succirubra*, as manufactured in British Sikkim, and sample of Ipecacuanha grown in British Sikkim.

Lindsay, Dr. Lauder; 12 samples of paper made from various plants.

Masters, Dr. M. T.; numerous examples illustrating vegetable morphology.

Moore, Dr., Glasnevin; pitchers of *Darlingtonia*, *Sarracenia* and *Nepenthes*.

Mueller, Baron Von; spadices and fruits of palms from Lord Howe's Island.

Ormerod, Miss E.; numerous specimens of British galls, and original

drawings of the same, natural size and magnified.

Powell, Rev. T.; specimen of *Mylitta australis*, gum of *Artocarpus incisa* and other products.

Prestoe, H.; collection of several varieties of fruits of *Theobroma Cacao*.

Parker, John; water-colour drawings of varieties of sugar-cane of Mauritius.

Robinson, H. E. Governor, Bahamas; bark and fruits of the Princewood tree (*Exostemma caribaeum*), used as a tonic in the West Indies, tobacco and cigars, grown and manufactured in the Bahamas.

Routledge, T.; various paper materials of vegetable origin, together with samples of paper made from the same.

Schomburgk, Dr.; a series of photographic views in the Botanic Garden, Adelaide.

Siemens, Messrs.; samples of various qualities gutta-percha, as known in the London market.

Smith, W. G.; magnified drawings of *Gladiolus*-disease (*Urocystis Gladioli*) and potato disease.

Trail, Dr. J. W. H.; various galls collected in Scotland.

Trevor-Clarke, Col.; a series of mounted specimens of cotton-pods.

Waterhouse, Capt.; 10 photographic views in the Botanic Gardens, Calcutta.

Wickham, H. A.; wood of the Para rubber tree (*Hevea brasiliensis*), wood of *Copaifera*, showing exudation of balsam of Capivi, butter from boiled fruits of *Caryocar brasiliensis*, and other Brazilian products.

Wilson, A. S.; a valuable series of Ergotised grasses.

PHYSIOLOGICAL LABORATORY.

The physiological laboratory, which the Royal Gardens owe to the munificence of T. J. Phillips Jodrell, Esq., M.A., and the commencement

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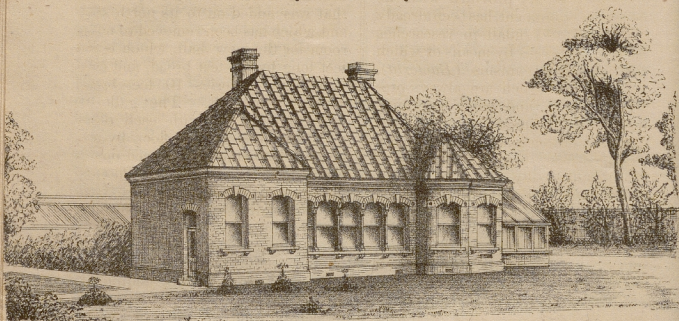
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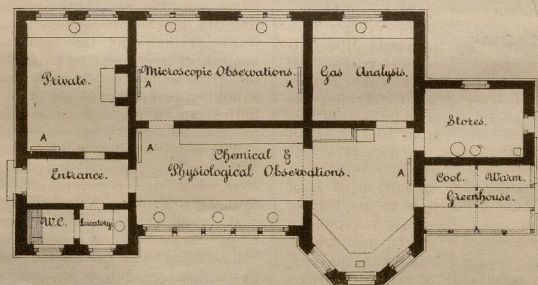
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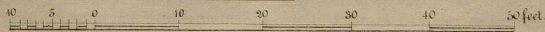
PERSPECTIVE VIEW.



GROUND PLAN.

A.A. Hot Water Coils.

Scale of feet.



Dangerfield & Bedford, Covent Garden.

of which I reported last year, has been completed, and though not as yet only partially provided with the necessary equipment, has been already used by Dr. Tyndall in researches on the conditions by means of which the minute organisms (*Bacteria*), the germs of which are always present in the air, and which determine putrefactive changes in infusions of organic substances, can be effectually excluded from them (Proceedings of the Royal Society, Jan. 18, 1877). I have the satisfaction of stating that the internal arrangements of the building, which were intrusted to the Assistant Director, have been pronounced by both English and continental authorities to be (considering the size) more convenient than those of any other establishment of the kind known to them.

Two other physiological researches have been carried on at Kew during the past year, although the laboratory was not sufficiently advanced to be available for them. Professor Burdon-Sanderson has continued his examination of the electrical phenomena of the leaf of Venus's Fly-trap, *Dionæa muscipula* (Proceedings of the Royal Society, Dec. 14, 1876), and Mr. S. H. Vines, Fellow of Christ's College, Cambridge, has studied the digestive ferment of *Nepenthes* (Journal of the Linnean Society, vol. xv., pp. 427-431).

I may also mention here that leaves of *Chamærops humilis* have been supplied to Dr. Hugo Müller, F.R.S., for the purposes of an investigation which has led to the detection in them of a peculiar sugar, Quercite, the occurrence of which in palms was altogether unknown.

HERBARIUM.

The new building for the accommodation of the Herbarium is in a very advanced state. It will consist of a hall attached to the back of the

present house. The whole of the latter will be preserved, except the drawing room, a single apartment that was added on to its north side, and which has been removed to make room for the new hall, which is 86 feet long by 40 feet broad, and contains two galleries 10 feet broad running round it. The galleries will communicate with each other and with the ground floor by two circular iron staircases placed one at each end of the building. On each floor there will be an entrance from the old building, closed by double iron fire-proof doors. The long sides of the building will be lighted with 48 windows, eight on each floor on each side. The cabinets for holding the specimens will be arranged in blocks 8 feet high, of two tiers projecting like buttresses between the windows on the ground floor and galleries, thus accommodating the greatest number of cabinets with the least loss of space, a very important consideration considering the extent of the collection and the time that would be otherwise lost in consulting it. At the present time the number of cabinets is upwards of 600, and the estimated number of specimens contained in the whole is now considerably over a million, reckoning as one all the individuals of the same plant from the same locality.

The whole building will be heated with hot water pipes. Water-mains charged at high pressure, sufficient to throw a jet more than the height of the whole building, will be carried to each floor. When complete the old building will be cleared out; as much as possible of its combustible fittings and woodwork removed, and the rooms arranged for the better accommodation of the library and of persons, besides the staff, engaged in the study of the collections.

Very extensive collections and contributions have been received

at the Herbarium (chiefly by gift) during the past year.

In accordance with the will of the late J. J. Bennett, F.R.S., keeper of the Botanical Department of the British Museum, the Australian Herbarium of his predecessor Robert Brown, made during Flinders's survey of the coasts of Australia, is being divided between the British Museum (which retains the first set), the Herbarium of the Royal Gardens, and that of the Edinburgh Botanic Garden. The first instalment of this valuable collection has been received and comprises nearly 900 species.

The Herbarium of the late Giles Munby has been presented by his daughters, and is of great extent and value, especially as regards the Algerian Flora, of which he was, after Shaw and Desfontaines, the first efficient explorer. This Herbarium is not only very extensive but is the authority for the only complete list of the Algerian Flora which has hitherto been published, of which three editions in all have appeared (1847, 1859, 1866), comprising descriptions of various new species.

Very considerable and important accessions continue to be derived from the herbarium formed by Baron von Mueller, in Victoria, which is transmitted to the Royal Gardens in furtherance of the "Flora Australiensis," with the permission to retain duplicates. There is certainly no part of the world of equal extent and possessing as much of interest as Australia, which has through the almost unaided exertions of one man been so successfully explored botanically as has this by Baron von Mueller.

H.R.H. the Prince of Wales has graciously presented the herbarium formed by his botanical collector (Mr. Mudd) during his visit to India.

The botanical collections of the

"Challenger" expedition made by Mr. Moseley have all been received at Kew, and have been for the most part arranged and distributed. Those received during the past year have been chiefly from Japan, the Society and Sandwich Islands, Juan Fernandez, Chili, and Patagonia.

The most important remaining contributions are especially noticed below under the different geographical headings. The figures in brackets denote the number of species received from each contributor.

Europe.

Baker, J. G.; critical sets of *Rosa*, *Rubus*, *Hieracium*, and *Mentha*.

Barcelli, M.; rare plants of Balearic Islands (6).

Berkeley, Rev. M. J.; collection of Sowerby's plates of fungi.

Cooke, M. C.; British fungi (purchased, 200).

Crombie, Rev. J. M.; British lichens (purchased, 100).

Gehçeb, A.; European mosses (100).

Henriques, J. A.; Portuguese plants (130).

Husnot, M.; French mosses (650).

Jaeggi, J.; Swiss alpine (27).

Leeds, E.; cultivated plants (782).

Lindsay, Dr. Lauder; Icelandic plants (173).

Phillips, W.; Elvellacei Britanici (purchased, 50).

Rabenhorst, Dr.; *Algæ* (purchased, 50).

Reinsch, Prof.; Microscopic *Algæ* (purchased, 227).

Sanio, Dr. Karl; European plants (21).

Thuemen, Baron; Mycotheca universalis (purchased, 300).

Trevelyan, Sir W. C., Bart.; Portuguese plants (381).

Other contributions were received from Burr, Higford; Darwel, Rev. L.; Eaton, Rev. A. E.; Elwes,

H. J.; Ellacombe, Rev. H. N.; Fisher, H. S.; Groves, H.; Inghald, P.; Jackson, B. D.; Leighton, Rev. W. A.; Ley, Rev. A.; Lucas, A. E.; Lyell, Mrs. H.; Masters, Dr.; Maw, G.; Purchas, Rev. W. H.

Asia.

Aitchison, Dr.; N.W. India (19).

Danford, Mrs.; spring plants of Cilician Taurus, including a new *Xiphion* and a new *Crocus*, described by Mr. Baker, Journal of Botany, 1876, pp. 265, 266 (20).

Dodgson, Col.; Sikkim and Khasia ferns (35).

Dickins, F. V.; Japan (400).

Floyer, E. Ascoghe; Persian Gulf (107).

Forbes, F. H.; China; novelties described by Mr. Hemsley, Journal of Botany, 1876, pp. 205, 210 (35).

Godefroy-Lebeuf, A.; Cambodian orchids.

Hance, Dr.; China, &c. (152).

Harrington, Prof.; Philippines and Formosa, collected by Prof. Steere; ferns described by Prof. Harrington in a paper communicated to the Linnean Society (170).

Parish, Rev. C.; very valuable specimens (including fruits) and drawings of Moulmein orchids (45).

Woodrow, G. M.; Bombay (20).

Other contributions have been received from Annesley, Capt., R.A. (Aden); Gammie, J.; Waterfield, W.; Levinge, H. C.; Hutchinson, Major; Thwaites, Dr.; Bushell, Dr. (Pekin); Franchet, A. (Japan).

Africa.

Barber, Mrs.; Diamond fields (50).

Barkly, H.E. Sir H. and Lady; Stapelias, &c. in spirits, and drawings.

Bolus, Harry; Cape of Good Hope (300).

Cosson, Dr.; Algeria (110).

Delville-Cordier, A.; cultivated Eucalypti of Algeria (39).

Eaton, Rev. A. E.; Lichens and Algæ of Cape of Good Hope; the former described by Rev. J. Crombie, Journal of Botany, 1876, pp. 18-21.

Geheeb, A.; mosses of Comoro Islands.

Hildebrandt, Dr.; Comoro Islands (purchased, 145).

Horne, J.; Mauritius (50).

Hurst, H. A.; Egypt (39).

Macowan, P.; South Africa chiefly Transkei (100 and drawings of Stapelias, &c.); the new bulbous plants described by Mr. Baker, Journal of Botany, 1876, pp. 181-184.

Pool, W.; Madagascar ferns (163); this collection included 27 new species described by Mr. Baker in the Journal of the Linnean Society, vol. xv., pp. 411-422.

Sanderson, J.; Gold-fields.

Other contributions were received from Calvert, H. H.; Kirk, Dr. (Zanzibar); Masters, Dr.; Ascherson, Dr.; Owsel, Miss (Madagascar).

America.

North.—Austen, Mrs.; California (157).

British Boundary Survey (46).

Gray, Prof. A.; miscellaneous (200).

Lefroy, H.E. Major-General; Bermuda (16).

Lippincott, T. S.; California (62).

South.—Glaziou, A.; further Brazilian collections which are of especial value, as the numbers are cited in the Flora of Brazil (560).

Higgins, Rev. H. N.; W. Indian Cryptogams (144).

Husnot, W.; W. Indian mosses (111).

Jenman, G. S.; Jamaica (43).

Sodi, Father P. L.; Ecuador ferns (422); a remarkably fine collection comprising 15 new species, which will be described by Mr. Baker in the Journal of Botany.

Trevelyan, Sir W. C., Bart; Brazil (39).

Australia.

Moore, Chas.; specimens belonging to the collection of timbers exhibited at Philadelphia.

Mueller, Baron von; various Australian plants (470).

Trevelyan, Sir W. C., Bart.; Australian plants (92).

Australasia.

Hector, Dr.; New Zealand (55).

Potts, T. H.; New Zealand (7).

Schomburgk, Dr.; New Caledonia (10).

Whitmee, Rev. S. J.; Samoa (274); the further novelties amongst the ferns are described by Mr. Baker, *Journal of Botany*, 1876, pp. 342-345.

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

The second part of the second volume of the "*Genera Plantarum*," by G. Bentham and the Director, has been published and concludes the Gamopetalous orders.

"*Flora of British India*," by the Director, assisted by other botanists. Part IV., commencing vol. ii., has been published.

The *Flora of Mauritius and the Seychelles* by Mr. Baker, First Assistant in the Herbarium, is nearly through the Press, and will be published early in the year.

"*Flora of Tropical Africa*," vol. iii., by the Keeper of the Herbarium and Mr. Hiern, is in the Press.

A catalogue of the *Flora of Mexico and Central America* is being prepared by Mr. Hemsley for Messrs. Salvin and Godman's work on the *Natural History of those countries*.

The collections formed by Dr. I. B. Balfour in the island of Rodriguez, when attached as naturalist to the Transit of Venus expedition to that island, have been prepared for publication in the *Philosophical Transactions*.

The collections formed by the Rev. A. E. Eaton in Kerguelen's Land, when attached as naturalist to the Transit of Venus expedition to that island, have been prepared by the Director and other botanists for publication in the *Philosophical Transactions*.

Dr. Trail has described his Amazonian palms in a series of papers which have appeared in the *Journal of Botany*.

Mr. John Ball has been preparing an illustrated memoir to appear in the *Journal of the Linnean Society*, on the plants collected by himself and the Director in Morocco.

Bentley and Trimen's *Medicinal Plants*, of which 15 parts are published, contain numerous plates of plants figured from the Royal Gardens.

Mr. Elwes has been elaborating a monograph of the genus *Lilium* with coloured plates of folio size.

A revision of the genera and species of *Anthericeae* and *Eriopermeae* by Mr. Baker, has appeared in the *Journal of the Linnean Society*.

Icones Plantarum, vol. xii., pt. 4, illustrating new or rare plants preserved in the Herbarium.

The 102nd volume of the "*Botanical Magazine*" by the Director has been published. A large proportion of the new and rare plants figured 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.

Number of Visitors in the year 1876, as compared with 1875.

	1875.	1876.
Total number on Sundays - - - -	303,192	278,581
Total number on weekdays - - - -	374,810	318,284
	<u>678,002</u>	<u>596,865</u>
Greatest monthly attendance (June) - - - -	-	152,312
Smallest monthly attendance (December) - - - -	-	5,055
Greatest weekday attendance (August 7th) - - - -	-	64,613
Smallest weekday attendance (December 7th) - - - -	-	18
Greatest Sunday attendance (June 25th) - - - -	-	21,424
Smallest Sunday attendance (March 12th) - - - -	-	94

Number of Visitors in each month.

	1875.	1876.
January - - - -	7,344	6,391
February - - - -	5,645	7,705
March - - - -	52,238	9,005
April - - - -	33,049	60,461
May - - - -	171,963	49,300
June - - - -	80,416	152,312
July - - - -	67,895	113,590
August - - - -	166,778	136,886
September - - - -	64,669	30,676
October - - - -	16,156	18,368
November - - - -	6,271	7,116
December - - - -	5,578	5,005

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