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JAMAICA.

CONTENTS:

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REPORT

OF THE

DIRECTOR OF PUBLIC GARDENS AND PLANTATIONS,

JAMAICA,

FOR THE YEAR ENDED 31ST MARCH, 1892.

CONTENTS.

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REPORT OF THE DIRECTOR OF PUBLIC GARDENS AND PLANTATIONS, JAMAICA, FOR THE YEAR ENDED 31st MARCH, 1892.

The two main divisions under which work in a Colonial Botanical Department may be classed are, first, the supply of plants yielding products new to the agriculture of the colony, or of a better kind, or such as are not readily obtainable otherwise,—involving experimental and nursery grounds in such situations as are suitable; secondly, the providing of information regarding the kind of soil, climate, &c., fitted for the plants, their proper cultivation and preparation for the markets. The second division is most economically and effectively carried on by means of printed matter combined with correspondence; but practical demonstrations of methods in the Gardens are advisable whenever they can be carried out. Both divisions imply considerable correspondence with persons in other countries as well as a complete Herbarium and a good Library.

Castleton Garden.

During the past 12½ years from the time that Mr. Morris was first made Director to 31st March 1892, about 220,000 plants have been distributed from Castleton, besides seeds which would produce at least as many plants. This gives an average for a year of 17,600 plants, and includes those sent to Hope for distribution from that centre.

Of those plants, about half the number were such as may be termed strictly "Economic," such as cocoa, nutmeg, cloves, cinnamon, Liberian coffee, vanilla, oranges, East Indian mangoes, cardamom, cola.

The remainder were palms, roses, ferns, orchids, and miscellaneous trees and shrubs, among which are included timber trees.

I stated in my Report for the year 1887-88 that although it was not the mission of a Botanic Garden to undertake the work of a Horticultural Establishment, and supply the public with ornamental plants, I thought it right to do as much as possible in that direction, so long as there was no probability of interfering with private enterprise.

But the danger of interfering with trade seems remote, and the demands on the part of the public are positive and are increasing. There has been an annual demand for some 8,000 or 10,000 ornamental plants, and even more than the Department can supply with its present means. The question may sometimes arise, is the Government right in fostering this demand; is it a legitimate one,—is some great end served by the necessary expenditure, and the attention to the numberless details that it implies?

It appears to me that the question only needs to be stated for all intelligent persons to answer it in the affirmative. Bacon recognizes a love for gardening as an index of a nation's advance in civilization, and without doubt it is an important factor in rendering that advance more easy and more certain. He says (Essay 46), "God Almighty first planted a Garden, and indeed it is the purest of human pleasures. It is the greatest refreshment to the spirits of man, without which buildings and places are but gross handyworks; and a man shall ever see, that where ages grow to civility and elegancy men come to build stately, sooner than to garden finely; as if gardening were the greater perfection."

The plants, cuttings and seeds,—both economic and ornamental,—from Castleton as well as from the other Gardens, are distributed all over the Island by means of the Coastal Steamer, the Railway, and the Post Office.

The increase in the variety of cultural products, and the humanizing influence of ornamental plants are matters of appreciation in every part of the country from the mountain to the sea coast. Every person who obtains plants and grows them, from the sugar planter who makes trial of different varieties of cane, to the small settler who grows a nutmeg plant, is making experiments which are of direct benefit to himself and indirectly to his neighbours and to the district.

Parochial, or other local associations can do a great deal to help the work by meeting periodically to discuss all matters connected with agriculture. The sympathy felt between those engaged in kindred pursuits, the feeling of rivalry aroused to attain better results, the mutual aid obtained by interchanging ideas, are all most valuable in the improvement of agriculture. He who undertakes the laborious task of starting such an association in his own district, though he may find few at first to join him, yet by perserverance with even only one or two sympathisers will eventually meet with his reward. Such an association and this Department can render mutual assistance to each other in many ways with results that will be of general benefit to the whole Island.

The great importance of Castleton as a Botanic Garden over the other Gardens, may be estimated from the fact that there are some plants such as vanilla, which will only grow naturally there, and that there are others, such as roses, which can only there be successfully propagated. Castleton must therefore always be the great propagating centre.

It is scarcely necessary to say anything in Jamaica about the importance generally of Botanic Gardens, for the need for them has been continuously recognized for more than 100 years. The value

of those existing in Jamaica, Trinidad, and Demerara, is so evident that lately Botanic Gardens have been started in Antigua, Dominica, Montserrat, and St. Kitts, Nevis, amongst the Leeward Islands, under the direction of Mr. C. A. Barber, a Cambridge Botanist; in Grenada, St. Lucia, and St. Vincent amongst the Windward Islands; and still more recently in British Honduras.

The same movement is also going on in other parts of the world; for instance, Botanic Gardens have lately been established in Lagos, and the Gold Coast on the west coast of Africa.

Botanic Gardens in the Tropics do the work on the plant side, of Agricultural Departments in temperate climates. They are in themselves experimental stations; and are much more efficient in introducing new cultural products, and in distributing plants and imparting useful information than most Agricultural Departments.

The whole of the Botanic Gardens in the British Empire are more or less in communication with one another, exchanging seeds, publications, &c., and all look up to the Royal Gardens at Kew as to their head for advice and assistance. Imperial Federation is already in existence as regards the Botanic Gardens and their work. If any special variety of a plant, or any new culture comes into notice, information and plants are sought sometimes directly from the local gardens, sometimes through Kew as the Botanic Gardens' "Clearing House." The Director of Kew Gardens has at his disposal the services of experts in every branch of botanical enquiry,and is always most willing to aid Colonial Gardens in every way. Any intricate question that arises in chemistry, in diseases of plants, in insect pests, in the value of products, &c., can be determined by reference to Kew. Colonial Gardens are therefore not isolated, but are branches of an Agricultural Department as wide as the British Empire itself.

Mr. E. Campbell is still acting as Superintendent of Castleton. Some portions of the year have been so dry that many plants have suffered and some have died. During the year 145.35 inches of rain fell, which is 35 inches more than the average; but in July there were only 2.09 inches and during March only 1.92 inches. The heaviest rainfall was in May with 18.17 inches, and in October with 32.84 inches.

Some portions of the borders have received a layer of fresh soil and manure. Old plants have been removed and the vacancies filled up. All the borders have had an occasional forking besides frequent hoeing. A great deal of pruning has been done, and in some places thinning has been necessary. Portions of the walks have been regravelled where it was absolutely necessary. The various lawns have been attended to, and the plantations of cacao and Liberian coffee have been billed out at intervals. The two large Casuarina trees at the entrance gate have been removed, to make room for the Cohune Palms. Special attention has been paid to nursery work, and a constant supply has been forwarded to Hope Gardens.

A new walk has been formed by the river, the former jungle having been cleared away. There will be room in this portion of the grounds for several native economic plants not hitherto grown in the garden.

The following are the numbers of plants sold direct from the Garden :—

Nutmegs, 991; other economic plants, 958; miscellaneous trees and shrubs, 1,306; roses, 683; palms, 328; Total, 4,266.

The following plants have been sent to Hope for distribution :—

Economic plants, 1,055; miscellaneous trees and shrubs, 4,661; roses, 4,344; palms, 1,340; crotons, 662; ferns, 433; Total, 12,495.

Thus the whole number of plants distributed from Castleton is 16,761.

Seeds to the amount of 93 packets have been collected in the Gardens, and forwarded for growing at Hope, and for distribution to other Botanic Gardens; also 178 cacao pods.

For the purpose of training the boys at the Industrial School, Hope, in the curing of cocoa, 4,500 cocoa pods were purchased and forwarded to Hope. This has entailed a good deal of extra work, as the settlers in the neighbourhood are not willing to sell their pods at prices offered, preferring to prepare it in their own manner, and sell it to the Produce Buyer.

The Superintendent has several times been out collecting plants for the Gardens and for the Herbarium, and has also dried several specimens of garden plants.

The nutmeg and the clove trees have borne heavy crops. The yield of one clove tree was estimated at half a bushel. The Liberian coffee is in vigorous health and bears plentifully.

The cocoa plantation is not in good soil, and would be all the better for a large quantity of manure, if the expenditure were possible. One of the trees known as ebony, (*Diospyros discolor*, Willd.) has produced fruit from which plants have been propagated. The Mangosteen (*Garcinia Mangostana*, Linn,) produced for the first time a good crop of fruit. The largest tree of *Eucalyptus citriodora* has made excellent growth, adding 12 feet to its height during the year.

Of ornamental trees, *Amherstia nobilis*, and *Mesua ferrea* have again flowered profusely, and a small number of seeds were produced, from which plants have been raised. *Ficus Vogelii* has made good growth, and *Wormia Burbidgei* is now a large shrub, and flowers profusely. The largest plant of the Cannon Ball tree *(Couroupita guianensis)* and the Litchi (*Nephelium Litchi*) have flowered for the first time but neither have matured fruit. The following palms have flowered for the first time :—*Caryota Blancoi, Arenga saccharifera, Ptychosperma gracilis, Verschaffeltia splendida,* but no seed was formed. Two large specimens of palms have died, namely *Rhopalostylis Baueri,* and *Acanthoriza aculeata,*—the latter has been replaced by a small plant, but there are no duplicates of the former.

The Superintendent's house and out-offices have been painted on the outside, and the house now requires painting and papering inside.

The number of adult visitors, recorded in the Visitors' book is 592.

The elevation of the Garden is lower than Hope Garden, being 580 feet above sea level. The average rainfall is 110.01 inches, and the average mean temperature; 76.2° F.

Hill Garden.

The Cinchona Plantation was founded by Sir John Peter Grant. From the sale of bark, &c., the receipts have been nearly £17,000 which has more than repaid the expenditure on Cinchona planting. The experiment was of great promise for the Island, and if planting had been taken up 10 or 15 years earlier by private individuals the history of the enterprise in Jamaica would have been very different. Fortunes would have been made by those early in the field before the tremendous fall in the market value of bark, consequent on the vast extension of the cultivation in India, Ceylon, and Java.

However, the plantation involved the formation of a Garden at an elevation, contemplated by the Government in the beginning of the century,—a "European Garden," necessary for the full development of the resources of the Island.

The Superintendent at the Hill Garden is Mr. Wm. Harris.

The subject of fodder for the hill-country is engaging attention. Guinea grass (*Panicum maximum*) is not altogether as successful as in the lowlands. There is need also for experiment on pasture grasses. A grass from Northern India *(Pennisetum triflorum)* promises well as a substitute for guinea grass. In the Hill Garden it grows well, attaining a height of 3½ to 4 feet; it sends its roots deep into the soil, and is therefore scarcely affected by drought; while cattle and horses are fond of it. Application has been made to the Botanic Garden, Saharanpur, for seed for a more extended trial here, as well as in various spots in the Island. The Superintendent of the Saharanpur Gardens has already sent seed of the following grasses:—*Saccharum spontaneum, Pollinia eriopoda, Sorghum halapense, Cenchrus catharticus, Eleusine ægyptiaca, Setaria glauca, Panicum flavidum, Panicum sanguinale, Panicum ciliare, Eleusine flagellifera, Elionurus hirsutus, Andropogon annulatus,* and *Andropogon pertusus.* The following only have grown:—*Setaria glauca, Panicum flavidum, Panicum ciliare, Panicum sanguinale, Eleusine flagellifera, Elionurus hirsutus.* Experiments will be made during the next year in other grasses and clovers.

In 1887, a few plants of the following trees were planted out in the St. Helen's field: *Pinus Massoniana, Cupressus macrocarpa, Thuja* sp., and *Podocarpus coriaceus.* Of these *Pinus Massoniana* has grown to an average height of 27 feet with a girth of 1 foot 9 inches at one foot from the ground. This tree, the Chinese Pine Tree, is the one which has been so extensively planted in afforestation of the bare hills of Hong Kong. Mr. Chas. Ford, the Superintendent of the Botanical Department, states in a late Report—"The plantations already made are composed chiefly of the common pine,—a tree which was found to be the best kind to commence the work of afforestation with. It is better suited to the varied conditions under which it had to grow here than other trees yet tried, and its management being simpler than that of many other trees rendered it possible to deal with it in vast numbers,—about half a million trees being added yearly,—with a staff that in the early days consisted of raw coolies only." Von Mueller says that, "the wood is durable, and, when well seasoned is much employed as material for tea-boxes." This tree would be a valuable one for forest purposes in Jamaica, where the primary object is to cover denuded surfaces.

Cupressus macrocarpa, Californian cypress, averages 28 feet in height with a girth of 2 feet. This is one of the fastest growing of all Conifers. It is a beautiful shade tree, and in California, attains a height of 150 feet, and a circumference of 9 feet. *Thuja sp.* has attained a height of 15 feet. *Podocarpus coriaceus,* the Yacca, has grown to a height of 7½ feet. The wood is highly prized by Cabinet makers. It does not grow with anything like the rapidity of the Cape Yacca (*Podocarpus elongatus*).

Onion seed of the following kinds from Carter's were sown the last week of November, 1891, and transplanted into prepared beds in the first week of March, 1892:—Danver's Yellow, Carter's Holborn, Queen, Banbury, Tennis Ball, Golden Rossa, Golden Globe, Red Mammoth, White Emperor, Tripoli, Strasburg. As the soil is very poor, the beds into which they were transplanted, were well manured, and afterwards top-dressed. The plants were strong and healthy, but only the following show signs of bulbing:—Queen, Carter's Holborn, Golden Rossa, Tripoli, White Emperor, Golden Globe.

A large part of the Experimental Garden has been taken up with experiments on peas, and the results are published from time to time in the Bulletin. The experiments are not yet complete. Messrs Jas. Carter & Co., have supplied the seed free of cost, Part of the crop was sold to Messrs Aston Gardner, and part kept as seed for planting again, and for distribution.

Strawberry seed obtained from the Royal Gardens, Kew, was sown in October, 1891. The varieties were the following:—Royal Hautbois, Countess, White Alpine, Red Alpine, Dr. Hogg, Triomphe d'Orleans, Lucas, and President. The last named did not germinate, but a large number of plants of the rest were raised, and distributed to applicants in various parts of the Island. A bed of each kind has also been planted in the Garden. In February of this year seeds of the following kinds were received from Kew:—President, Waterloo, Hautbois, Vicomtesse Héricart du Thury, Crescent Seedling, Sir Charles Napier, and one kind without name. Only a few plants each of the following, however, appeared:—Crescent Seedling, Sir Charles Napier, and Vicomtesse Héricart du Thury.

Peach trees to the number of 400 were received from Mr. John B. Beach, Nurseryman, Melbourne,

Florida, in March. They were of the following varieties:—Red Ceylon, Reeve's Mammoth, Bidwell's Early, Bidwell's Late, and Angel. Two plants of each kind have been put out in the Garden, and the remainder distributed to applicants in various parts of the Island. The old Peach trees are in a very healthy condition, but all the fruit dropped early, the reason being probably that the trenches were not filled in soon enough after wintering. Compelling fruit trees of a temperate climate to winter, is a process which requires watching in order to acquire experience for complete success.

A few fruit trees of various kinds presented by Mrs. Frank were not showing progress, and having examined the roots it was found that they were not penetrating into the bed of clay which forms the subsoil. It was probably on this account that fruit trees have not succeeded here before. They have been transplanted into holes dug 4 feet every way, and filled with good soil. If the trees are kept topped low, say to 5 feet it is possible that even in this poor soil, they may thrive. Fruit Gardeners in Europe, and especially in Belgium grow very large sized pears and other fruit by keeping the trees cut quite low.

The Jamaica Plum (*Cyphomandra betacea*) is a fruit of great promise for export, as it will keep well for a month, the skin being tough and thick. It is a very pleasant fruit, besides being useful for the liver. A large quantity of seeds has already been distributed, and the plantation is being extended here. It has been found that cuttings produce fruit much sooner than seedlings, —in about 9 months, and that the plants are not so high and are more bushy. Plants raised from cuttings appear therefore to be better adapted to windy situations.

The work of propagating has been attended to, and a large number of plants raised from seeds and cuttings. The north-west corner of the Experimental Garden was trenched to a depth of about two feet; all large stones, roots, &c., removed, the ground thoroughly manured, and then laid out in beds—18 in number—4 feet 6 inches wide, with pathways 2 feet wide between them. Strawberry plants from Kew have been planted in the beds, and the pathways with the grasses from Saharanpur. In the flower garden, the beds and borders have been kept in good order, and throughout the year there has been a good display of annual and other flowering plants. The annuals that have succeeded best are Dianthus, Antirrhinum, Phlox, Petunia, Godetia, Aster, Schizanthus, Zinnia and Silene. The following also made a good show in beds and borders:—Geranium, Gladiolus, Dahlia, Fuchsia, Heliotropium, Bouvardia.

A number of large plants of *Jasminum revolutum, Cestrum aurantiacum, Acanthus mollis, Agapanthus umbellatus, Plumbago capensis, Melaleuca squarrosa,* &c. that had become too large, were lifted, and replanted either in the Arboretum, or in the lower flower garden.

In the plant house all through the year there was a good show of flowers; Cineraria, Geranium, Fuchsia, Primula, Freesia, Carnation, Petunia, Hippeastrum, Amaryllis, Orchids, &c. In the Fern house all the ferns were repotted, and the filmy fern cases were replenished, with blocks of fresh plants from the woods.

Slugs give great trouble in the houses, and constant watchfulness is necessary to prevent seedlings and tender plants from being destroyed. They are trapped by hundreds by placing cabbage leaves at night on the stages, which attract these pests, and allow them to be collected easily in the mornings.

Large numbers of plants were sent down to two Horticultural Shows, one held in April, 1891, and the other in January, 1892, both held in the Exhibition Building. Those from the Hill Garden that attracted most attention were, Cinerarias, Pelargoniums, Carnations, Heliotropes, Asters and Petunias.

The number of plants sold during the year is 786.

The roads and fences have been repaired throughout, and some new fencing erected to keep the stock from straying into provision grounds.

Mr. Cradwick, while Superintendent, planted out on the steep road-side banks a great number of a Cape Iris (*Marica cærulea*) to try whether it would bind the soil, and prevent slipping. There has scarcely been time yet to test the experiment satisfactorily. Plants of the Mexican Daisy (*Erigeron mucronatum*) were also put out.

The buildings are all in fairly good order, but some repairs will be necessary during the ensuing financial year.

The elevation of the Gardens is 4,900 feet, the mean temperature 63° F., and the average rainfall 105 57 inches.

Hope Gardens.

The whole area at Hope may be conveniently divided for the purpose of reference into 5 portions, namely:—

	Ac.	Ro.	Po.
(A.) The area north of the conduit, containing the nursery, sugar canes, and other economic plants, about 72 acres;	71	3	38
(B.) The area on the left of the entrance gate, between the conduit and Hope Lane, about 28 acres;	27	0	19
(C.) The area on the right of the entrance gate, in wood and bush surrounding 10 acres occupied by Small Settlers, about 38 acres;	38	1	21
(D.) The area on which the Industrial School has been built, abutting on the Camp of Isolation, about 54 acres;	54	0	8
(E.) Land handed over by the Water Works Commissioners with the buildings about 21 acres;	20	3	16
making a total of about 212 acres;	212	1	22

When it was decided by the Legislative Council in 1886 to make a Botanic Garden at Hope, there were only some 23 acres fairly clean, viz. :—

	Ac.	Ro.	Po.
Sugar cane experimental ground	1	3	19
Pinery	0	1	14
Economic plants and fruit	2	0	36
Garden and Nursery	1	2	32
Teak Plantation	7	0	0
Guinea grass pasture	10	2	0
Total ...	23	2	21

About 28 acres (C) have been left in wood, and I do not propose that this portion shall at present be touched.

The remainder has been cleared, leaving a few trees here and there; the bush has been billed down over and over again, and besides, about 70 acres were planted in corn, in order that the cultivation of the ground might provide opportunity for a more thorough eradication of weeds. The constant turning over of the ground, whilst hoeing the weeds does the soil good; it also allows the stones to be picked out and the surface to be gradually levelled.

This plan is very thorough, and leads to the best results in the shortest time. But it is a very expensive process, and, owing to the want of funds, it had to be abandoned in the early part of the year. In consequence of having then a very heavy expenditure and of the necessity of keeping within the vote, there was not sufficient money avilable for the remainder of the year to keep the Garden in decent order.

Without an enlarged grant, all that can be done is to proceed very gradually, hoeing, levelling, picking stones, and laying down Bahama grass over small portions at a time, planting out trees, shrubs, &c., in defined portions of the area,—keeping the original purpose steadily in view, namely, to form a Geographical Garden with patches of economic plants here and there, the intervening spaces being covered with Bahama grass (Cynodon Dactylon.)

The portion (B) on the left of the entrance gate was cleared of bush and trees, and planted with Guinea corn, but it is impossible to continue to keep it clean with the present vote. According to my original design it was intended in this area to form collections of economic plants, such as medicinal plants, fibre plants, brought together for comparative study.

The Sisal Hemp plantation is to be considered as an undertaking quite apart from the regular work of the garden. It had its origin in the fact that it was impossible to get plants from their native country, Yucatan, or from Bahamas, owing to the prohibition of any export; to the desire of many planters in Jamaica to obtain plants in large and small quantities; and to the willingness of the Government to aid the industry, and meet the wishes of planters in every possible manner.

In the first place, 23,000 plants were imported from Turks Island for a plantation at Hope. These were intended, not for distribution, but to be grown to afford material for experiment with machinery when the leaves are fully ripe,—to determine whether when grown on soil like that of the Liguanea plains, the fibre is of good marketable quality and of fair percentage,—and to supply suckers in abundance for future distribution.

Very many of these plants were found on arrival to be so young that they had not survived the close packing to which they had been subjected. Mr. Stoddart, who had had experience in Yucatan in the management of Sisal Hemp, and had written a pamphlet on the subject which was published by the Jamaica Government, was engaged for some weeks in starting the plantation.

The area (D) on which the Industrial School buildings were erected, was chosen as having the the most suitable soil for planting. It was necessary to cut down trees, dig out the stumps, and several times clear the bush. The whole area had to be strongly fenced, and even so for some time watchmen were on guard night and day to prevent damage being done by stray cattle, trampling down the plants and eating the young tender shoots.

Numerous applications having been received for plants, 100,000 were obtained from Messrs. Reasoner, Bros., from Florida. Delay, however, occurred in forwarding the last portion of the number and several planters refused to take the plants which they had already ordered. These where therefore planted at Hope in nurseries, and some afterwards transferred to the permanent plantation, which consists now of about 47 acres, with 28,000 plants.

The transfer of Mr. Cradwick to Hope and Mr. Harris to the Hill Garden, took place at the end of September, 1891, in consequence of the ill-health of the latter.

A nursery has been formed a few yards back from the drive. The plants on sale have been arranged there in groups such as trees, shrubs, palms, roses. The paths between the groups have been

covered with gravel, so that visitors can walk amongst the plants even after rain. A road six chains long, has been made from the drive to the back of the nursery, to enable carts to remove plants readily for distribution. Four beds for propagation by cuttings have been formed, each 60 feet long. A road has also been made from the nursery into the bush on other side of the conduit so that all the rubbish may be carted out of the garden.

The Sisal Hemp Plantation has been cleaned throughout, and the plants are all in good condition, growing freely, and now suckering. Constant attention has to be given to cleaning, as bush must be kept down, and even when the grass is long the suckers develop very slowly. The very small plants in the nursery about 10,000 in number, have been transplanted, and are ready for distribution. The growth of the plants put out has been very satisfactory,—those planted in 1890 then measuring from 6 inches to one foot, have now attained a height of from 3 feet to four feet 6 inches. Any one about to form a plantation, can inspect those at Hope, and receive instruction as to preparing the suckers for the nursery, planting out. proper distances, care of plants, &c.

The Pinery has been thrice cleaned and the plants, chiefly Ripley, are strong and healthy. There is, however, not much demand for suckers.

The sugar canes have had attention in the way of trashing and weeding, manuring, moulding and irrigating. Another piece of ground has been planted with tops of all the varieties, numbering over forty, under cultivation at these Gardens: as the old plants, having been ratooning for several years, were becoming exhausted. Some of the varieties are highly thought of by Sugar Planters who have tried them, whilst others are not considered worth growing in certain districts.

The cocoa trees have been pruned, manured, and otherwise attended to. The poorness of the soil, small rainfall, and consequent hot dry atmosphere at Hope are not favourable conditions for the satisfactory growth of this tree, and except in a few sheltered spots near the gutter which carries the waste water from the Water Works, its cultivation has not been attended with much success.

Nutmegs succeed fairly well at Hope as far as the growth of the tree is concerned, but the nuts produced are very small as compared with those grown at Bath.

Cinnamon (*Cinnamomum zeylanicum*) thrives remarkably well, and requires little attention.

Bhel fruit (*Ægle marmelos*) has produced fruit during the year. This tree is a native of the East Indies, Ceylon, &c. and belongs to the orange family. The fruit is considered nutritious, warm and cathartic. The rind of the unripe fruit possesses astringent properties on which account it is used in India in cases of dysentery and diarrhœa. Other portions of the plant are used for medicinal purposes.

The boys from the Industrial School have been at work in the garden, and have been employed in curing cocoa, pruning the trees, &c., under the charge of Mr. McNair. The Cocoa Dryer from St. Vincent has been experimented with, but has proved to be a failure.

Thirteen varieties of onion from Messrs. James Carter have been tried. The seed was sown in November, and transplanted at the end of January, but scarcely bulbed at all. Onions evidently require a moister atmosphere than that of the Liguanea plains.

The Plant House with glass roof is now given up chiefly to orchids. The upper shelves have been removed, and used to make a stand for growing pot plants, such as ferns. Several species of ferns have been planted under the stage. The orchids have all been removed from the various trees on which they had previously been hung, and placed in the orchid house. This will afford them protection from heavy rains, allowing each species to have rest in its proper season. There will also be no danger of any being overlooked and neglected just when they most require attention. Nearly all the Orchids have been repotted by the Superintendent himself, and all have been washed and properly cleaned, and the scale insect which was infesting many, especially the Cattleyas, has been carefully removed. The following orchids have flowered during the year:—Comparettia falcata, Phaius grandifolius, Cœlogyne flaccida, Broughtonia sanguinea, Oncidium tetrapetalum, Oncidium ampliatum, Oncidium Cebolleta, Epidendrum fragrans, Epidendrum cochleatum, Epidendrum Stamfordianum, Cattleya Gaskelliana, Stanhopea grandiflora, Odontoglossum Roezlii-album, Dendrobium bigibbum, Dendrobium Pierardii, Rodriguezia secunda.

Of other plants which flowered during the year the following may be mentioned:—

Bignonia magnifica, Brownea coccinea, Bignonia venusta, Aristolochia elegans, Grevillea robusta, Costus igneus.

Several improvements have been made in front of the Orchid House. The crotons in the beds at the side of the drive have been potted, and the beds have been turfed down, Bahama Grass being used. All the tree ferns have been brought together, and with small palms, Dracænas and other ornamental shrubs, have been grouped together under the large Divi Divi tree in front of the Orchid House. The paths have all been covered with fine gravel, and drains have been formed to carry off superfluous water. Tree-ferns require, not only copious waterings, but also that all the surroundings should be kept continually wet in order to provide the moist atmosphere so essential to their well being; their stems have also been bound thickly with moss which is kept moist.

The fernery is now in capital order. The design for the structure was kindly sent to me by my friend, Dr. Trimen, Director in Ceylon, It is a skeleton house, being made of railway iron, covered with wire netting, In the centre, under the dome, is a rockery seven feet square with a specimen of a tree fern (*Cyathea serra*) in the middle, its stem five feet high, covered with a curious leafless orchid

(*Dendrophylax funalis*). The four lateral rockeries are also seven feet square. Rockeries run round the whole of the inside of the walls, and are 129 feet in length. Several hundreds of ferns have been planted out in the interstices of the rocks. The upright iron posts are covered with the creepers, *Thunbergia Harrisii, Aristolochia elegans, Asparagus racemosus, Asparagus falcatus*, &c. Creepers are planted along the outside and these have now quite covered the house. They are the following :— *Tylophora asthmatica, Stigmaphyllon ciliatum, Bignonia venusta, Hoya carnosa, Argyreia sp. Thunbergia Harrisii, Thunbergia laurifolia, Asparagus falcatus, Asparagus racemosus, Passiflora quadrangularis, Clitoria Ternatea, Antigonon leptopus, Porana paniculata, Aristolochia elegans, Thunbergia alata vars.*

The stock of ornamental plants in pots has been increased by over 2,000. At the Horticultural Show held in the Exhibition Building 100 cartloads of plants were sent from Hope Gardens alone, the plants consisting of 60 large tree ferns, 30 large palms, about 50 large ornamental shrubs, and the rest small palms, ferns, and flowering plants.

In the old Rose-beds 53 young plants have been put in, to fill the vacancies caused by plants dying out.

The total length of tho roads is three miles, and parts of them have been badly infested with nut grass (Cyperus rotundus) and other weeds causing considerable expense in keeping them clean.

Some of the coolie labourers are allowed to have unused portions of the grounds for growing vegetables. They eradicate weeds infesting the soil by their careful, clean cultivation; and they save some expense on the roads by keeping those parts adjoining their plots in thorough order.

The gutter which takes the waste water from the Water Works has been cleaned throughout its entire length. The small pond which was made at the lower end of the gutter for the purpose of growing water lilies, is not at present answering its purpose, for when water is sent down the gutter, it fills the pond with rubbish and the water weed, *Chara*.

The buildings require repairs throughout. A cement ground gutter was recommended to carry off water on two sides of the Superintendent's house, but it has only been made on one side. Guttering and down pipes have been placed to catch the rain water on the roof. The walls of an old building have been roofed over to serve as a shed for buggy, &c. One half of the old boiling house was thoroughly overhauled, floored, and partitioned off into five servants' rooms. A latrine has also been erected near the nursery for the use of visitors. Three small stalls have been built.

The followiug are the numbers of plants sold during the year. :—

Nutmegs	...	20,978
Sisal Hemp	...	1,339
Pine Suckers	...	800
Cola	...	600
Oranges	...	257
Liberian Coffee	...	201
Mangoes	...	56
Cocoa	...	54
Cinnamon	...	22
Miscellaneous Fruit and Economic Plants	...	724
Crotons	...	2,035
Palms	...	1,578
Roses	...	1,418
Ferns	...	301
Orchids	...	90
Miscellaneous Trees and Shrubs	...	2,866
		33,319

also sugar canes, about 150 tops.

Plants have also been distributed free or in exchange to the number of 1,583.

The rainfall has amounted to 55.62 inches during the year; February was a dry month, only 0.88 inches having fallen, and March was even drier with 0.25 inches.

The elevation of the garden is 600 feet above sea level. The average mean temperature is 77.4° F., and the average rainfall 52.83 inches.

King's House Garden and Grounds.

Since the year 1886-87 the Annual Vote for this Garden has been £390. When I first took charge of the Department, I called attention to the fact that this sum was insufficient for all that had to be done ; that the road and fences had to be maintained, lawns, pastures, grass-piece and grounds kept clean, and moreover the garden required more than ordinary care and attention. During the last two years, the vote has been relieved of the care of the roads, and it appears to me only right that they should continue to be kept up by the Public Works Department, not alone because the expense of their maintenance encroaches on funds which should be devoted to garden purposes, but also becauso the roads are used as a public approach to King's House. During the same period special grants have been

made for various improvements which I had long been anxious to carry out. The sum of £500 has been voted for the current year for maintenance.

Mr. W. J. Thompson is at present Superintendent.

The borders in the garden and along the avenue have been in good order throughout the year, except for a few weeks during the long drought.

The border on the north side of the garden had become crowded with trees and shrubs, many of which have been removed, leaving the place more open, and giving glimpses of the hills in the distance. The open ground has been planted with Bahama Grass. Behind the border, the fence has been taken up, and moved further back, enclosing a piece of waste ground where a new border has been begun, but work is delayed pending the laying down of more water pipes. At one end of the border, a fernery has been made under the trees for ferns and orchids.

The triangle bed where the East Indian Mango Tree was planted by Prince George, contained crotons, which gradually failed, as the mango tree grew; they have therefore been moved, and Bahama Grass planted.

The orchids have been carefully attended to, and 38 species and varieties have flowered.

A considerable amount of attention and labour has been bestowed on the pot plants, and most of them have been re-potted. These are used for decoration of the house, and have been exhibited at the two Flower Shows during the year.

The old Rose Garden has been thoroughly remodelled. The north fence was taken down, and a chain and a half of waste land added. The whole of this ground was on a slope, but it has all been levelled. The cross walks have been dug up and a walk 9 feet broad, has been made down the centre of the garden. The lime trees along the fence had become much overgrown, they have been cut back, and some removed. Three chains of one inch piping have been laid down.

Climbers in variety have been planted on the fences round the Arboretum, and are growing well.

During the autumn two vine borders were made near the house, and planted with ten vines presented by Mr. Schloss—eight of these have succeeded.

The cultivation of the grape vine is one of those *petites cultures* admirably adopted to the circumstances of many people of all classes, and to the climatic conditions of several parts of the Island.

Mr. Thompson is skilful in this particular branch of Horticulture, and is capable of imparting his knowledge to others. I hope soon to be able to announce that advice and help in this cultivation will be offered freely to all who wish for aid,—this assistance to be given by means of practical demonstration on living vines.

Some time ago I obtained through Kew Gardens a large number of cuttings of vines of the best kinds from the Royal Horticultural Society's Gardens at Chiswick. Dr. Grabham has also kindly presented cuttings of some of the best Madeira Vines. By permission of His Excellency the Governor, these cuttings have been planted in a portion of King's House Grounds immediately adjoining the East Lodge. American vines also will be obtained from the United States, and it is intended to experiment with grafting on our native vine (*Vitis caribœa*). In European vineyards, the vines are grafted on American stocks, and the phylloxera is being combated by this method.

The plan proposed is to allow those who are interested in this culture to visit this vinery, and listen to demonstrations by Mr. Thompson on the care of the vine from the time of first putting in a cutting, the proper method of pruning, thinning the branches, &c. In order to cause as little interruption as possible in the Superintendent's duties in the garden, a special time will be appointed once a week for demonstrations at which all who wish may attend.

The Pine Ground has been well hoed, ploughed, and manured during the year, and has given a good number of fruit.

Twenty-four groo-groo palms (*Acrocomia sclerocarpa*) have been planted in the pastures, of which 18 are growing, and will prove effective in a few years' time. Twenty coco-nut palms have been put out in the Arboretum; and 40 palms of various species in the Palmetum.

A large amount of work has been done on the lawns;—they have been constantly weeded, mown, and rolled, and dressed with good rich soil. The area of one acre laid down last year is looking well and is a great improvement. About 40 crotons that were in tubs, have been planted out about the lawns, and have much improved. All the hay-grass in the Arboretum and behind the borders in the drive has been mown; twenty acres of pasture have been cleaned.

Several more water cocks are needed in the garden. In some places there is a space of 70 yards between the nearest. Besides giving extra work, twice as much hose is necessary. Several tanks are also much needed and would save a great deal of time.

A fire took place in the Rectory Garden adjoining, and entered the grounds by the south east corner. A strong breeze was blowing at the time, and in spite of all efforts, it could not be got under, until it had burnt most of the large pasture, killed several palms, and ficus trees, damaged a number of plants in the border, and burnt several fence posts.

The drives have been constantly weeded, and kept in good condition, though there has been a great deal of traffic.

Seventy-seven chains of fencing with 150 new posts have been repaired, together with six chains of penguin fence along the road-side.

Mule and cart sheds are needed for protection from weather. The buck-eye mowing machine is rusting away for want of shelter. There should be proper sheds for large tools, clay pots, different kinds of soil, sand, manure, &c. A small glass house is desirable for some species of orchids, and for propagating.

The elevation is 400 feet above sea level; the average rainfall is 49.20 inches, and the average mean temperature is 78.7° F.

Kingston Public Garden.

The following paragraphs are taken from the Report of the Superintendent, Mr. Joseph Harris :—

During the year another *Ficus lucida* has succumbed, but on the whole, the trees and shrubs are in a healthy state, many of the latter having made good growth.

A portion of the walks has been re-gravelled and special attention has been paid to the edges and the condition of the walks generally.

The borders and beds have been thoroughly manured throughout, much to the improvement of the smaller shrubs.

A large number of plants from the Exhibition Grounds were transferred to this garden, and being of a good size have added to the appearance of the borders in which they have been planted ; in addition to these about 1,000 ornamental plants in bamboo pots have been received from Hope and Castleton Gardens, and numerous vacancies have been filled up with these.

A good display of Zinnias has also been made in the beds.

The weather has been exceedingly dry during a portion of the year and copious watering has been necessary.

The tank in the centre of the garden has been cleaned, and fresh soil supplied to the aquatic plants.

Wire netting has been fixed to the railing all round the garden and has proved an efficient barrier to the inroads of goats and fowls.

The entire fence has been painted by the Public Works Department.

By arrangement with the City Council the Garden has been kept open every night until 9 p.m., and lighted as before with the Electric Light. The Bands of the Kingston Infantry Militia and the West India Regiment have given a regular weekly performance which of course always attracts a large number of inhabitants.

The fact of so many people collecting in a small space has somewhat destroyed the beauty of the garden near the Band Stand, especially the green appearance of the grass.

The Kiosk erected by the City Council, and for some time rented by a refreshment caterer, has remained closed for a considerable time ; the demand for light refreshments not being so large as was expected.

Another work carried out by the City has been the removal of the Fountains hitherto standing outside the garden fence, to a position immediately inside the garden, enclosed with an iron railing and with gates giving access both from the gardens and the streets.

The donkey and cart hitherto in use in the garden have been replaced by a mule and spring cart ; with this improved means of removing the very large quantity of rubbish, the garden has been kept tidy and clean.

With a few exceptions, the conduct of visitors to the garden has been good, particularly since a Constable has been told off for duty.

The elevation is 60 feet above sea level, average rainfall 37.96 ; and mean temperature 79° F.

Bath Garden.

The "Bath of St. Thomas the Apostle" in the Parish of St. Thomas is a remarkable hot medicinal spring. It is situated in one of the most interesting and beautiful parts of the country. The rides to Cuna-Cuna Pass, and other places in the mountains ; the drives to Port Morant and towards Manchioneal are through charming scenery, and if the virtues of the Bath were more widely known, the little village would deservedly become a health resort for Canada and the States during the winter.

The remnant of the old Botanic Garden is still a great attraction, and it is a pity that more money than the vote of £20 cannot be obtained for doing something further than sweeping leaves and keeping up the fence. To make a good garden, the necessary cost would amount at least to £100 per annum, without taking into account any sum for supervision.

Mr. A. H. Groves continues to act as Overseer,—he complains of the inadequacy of the annual grant.

Situation of Botanic Gardens in Jamaica.

After the resignation of Mr. Morris in 1886 consequent on his appointment to the post of Assistant Director at Kew, and at a time when the finances of the Island were not very flourishing, there was a proposal to abandon the Gardens at Castleton and Cinchona, which was deliberately rejected by the Legislative Council. As the idea of abandonment occasionally re-appears, it may be useful to state a few considerations that show the value of the Gardens at different elevations.

First it may be noticed that in 1777, Dr. Thomas Clarke came to the Island "at the particular instance and request of the late Sir Basil Keith, to superintend two Botanic Gardens, then intended to be established in this Island, the one as a European and the other as a tropical Garden," in addition to the one already in existence at Bath. The spot chosen for the tropical garden not proving suitable, the "Assembly of Jamaica co-operating with the benevolent intentions of His Majesty, (to introduce valuable exotics and productions of the most distant regions to the West Indies), purchased in 1792-93 the magnificent Botanical Garden of Mr. Hinton East" at Gordon Town. Nothing however was done towards making a European Garden till the year 1868 in connection with the plantations of Cinchona.

Other countries have perceived the necessity for Gardens at different elevations. In Ceylon, which may be more nearly compared with Jamaica than any other Colony, there are five gardens. The chief garden is at Peradeniya, 4 miles from Kandy and more than 70 by rail from Colombo, at

an elevation of 1,540 feet. There is a Hill Garden at Hakgala at an elevation of 5,000 feet. In addition to these gardens there are three others at different elevations and with varying climates. Dr. Trimen, the Director, in a paper read before the British Assotiation, says, " no other British Colony possesses so complete a system of botanical and experimental gardens as Ceylon; and I may add that their sites have been determined on the principle that each of the climatic districts which I have passed in review should be represented."

In a country that has not the same range of elevations, and consequently of climate, there may not be the same necessity as in Ceylon or Jamaica for many gardens, but in both these Islands there are great differences of climate, and therefore not only a possibility but a necessity for various cultures.

First, as regards elevation I lately consulted Mr. Thomas Harrison, late Surveyor General, on the area at different elevations, and he has very kindly taken an immense deal of trouble in contouring the whole Island, and then measuring the areas between each contour. The contours were very irregular and crooked, and gave much labour in measuring, but Mr. Harrison thinks the result is fairly accurate. He says, "the total area shows an excess of 14 square miles over the measurements formerly given by me, and published in the Handbook: but those measurements were made 19 years ago, and were prepared from a small map; the present area is obtained from our recent maps and is therefore more correct." The following is the table:—

Elevations of the Island of Jamaica.

—	Below 1,000 feet. Sq. miles.	1,000 ft. to 2,000 ft. Sq. miles.	2,000 ft. to 3,000 ft. Sq. miles.	3,000 ft. to 4,000 ft. Sq. miles.	4,000 ft. to 5,000 ft. Sq. miles.	5,000 ft. and upwards. Sq. miles.	Total.
Kingston ...	6½	⅔	...	...	...	...	7⅙
St. Andrew ...	59	54	27	17½	8	½	166
St. Thomas ...	135	59	35	20	14	11	274
Portland ...	94	89	40	32½	17	12½	285
St. Mary ...	110	116	19	4	...	...	249
St. Ann ...	85	337	54	...	...	...	476
Trelawny ...	166	135	32	...	...	...	333
St. James ...	139	90	5	...	...	...	234
Hanover ...	161	6	...	...	...	...	167
Westmoreland ...	235	73	...	...	...	...	308
St. Elizabeth ...	335	120	7	...	...	...	462
Manchester ...	42	134	126	...	...	...	302
Clarendon ...	314	115	45	...	...	...	474
St. Catherine ...	336	124	10	...	...	...	470
	2,217½	1,452⅔	400	74	39	24	4,207⅙

Judging from elevation alone, inasmuch as about half the total area of the Island is above the contour of 1,000 feet, under which nearly all the more important agricultural operations have hitherto been carried on, it would appear that those who are engaged in cultural industries above this limit have a right to demand that half the number of gardens should be situated above that contour, instead of there being only one as against four below it, besides the remnant of the fine old garden at Bath. In addition to the present Hill Garden, there ought to be one at about the elevation of 2,000 feet to represent what may be termed the zone of oranges; for there are numerous plants like the orange, citron, pistachio, peccan-nut, liquorice, and caper, which cannot advantageously be subjected to experimental cultivation either in the Hill Garden or in any of the lowland gardens. The area between the contour of a 1,000 feet and 3,000 feet amounting to 1,852 square miles has not yet been developed to anything but a very limited extent, except for coffee,—nor has anything been done towards that development by means of a garden.

Besides elevation, an important element in plant growth is the rainfall. Where the rainfall is copious and constant in the tropics, there vegetation is luxuriant, and consequently such areas should be selected for the sites of the principal botanical gardens.

The Garden at Castleton (with 110 inches of rain at 580 feet above the sea), and the Hill Garden at Cinchona (with 105½ inches at 4,907 feet) fulfil the requirements of Botanic Gardens in the matter of abundant rainfall, and if another were to be added at some intermediate elevation, the most suitable locality would probably be somewhere in the high lands of the western part of the Island, rather than in the eastern where all the gardens are situated at present.

If the number of gardens in the Island were reduced, there ought to be, at any rate, three at these elevations with a heavy annual rainfall.

It is of course advisable that there should be experimental gardens representing other climatic conditions, one for instance for plants suited to the southern division of Mr. Maxwell Hall's weather reports with an average annual rainfall of 52½ inches, and for such an experimental station the garden at Hope is admirably situated.

The design to make Hope Garden the chief, if not the only Botanic Garden in the Island, has always seemed to have been advanced without any sufficient reason. With the small average rainfall of 52.83 inches, it can never be thoroughly successful as a Botanic Garden, even with abundance of water for irrigation. But when it is found that the water is liable to be withheld in order that the wants may be supplied of a large area like the Liguanea plains including the capital, Kingston, with an ever increasing population; when a drought may necessitate the diverting of the whole of the water to supply the needs of human beings, with the consequence to the garden of the death of numberless valuable plants, and the destruction of the work of years: then it seems wise to pause, and to consider whether it is prudent to continue a large annual expenditure on this garden.

It is desirable and even necessary to have a garden where plants may be cultivated to represent the dry lowlands such as Sisal Hemp and grapes. But the attempt to make Hope the chief garden must lead to disappointment, and when it is known that it is difficult to propagate even roses in it, it is evident how hopeless is the idea to constitute it the only garden.

The Public Garden in Kingston, and the garden and grounds at King's House, are attached to the Department as a matter of convenience rather than of necessity. And, although the community would in any case pay for their maintenance, yet if their cost of over £1,000 were deducted from the total cost of the Department, the actual expenditure for Botanic Gardens would at once be seen to be considerably less than is generally supposed.

Questions of Locality for Head-Quarters of the Department.

The Report adopted by the Legislative Council on 13th October, 1886, provides for the Director a "house at such place as may hereafter be determined on as the best in the common interests of all the Gardens." It further adds that, "in the proposed continuance of provision of a Director, the Committee has recognized the absolute necessity for keeping up a scientific department for the diffusion of information and for the distribution of plants, and is decidedly of opinion that its head-quarters should be within as easy reach as is practicable of all classes and accessible from Kingston. The Committee thinks that all requirements will be best met at Hope, and is mindful that extensive buildings will be necessary, in a residence and office for the Director, in a herbarium, in nurseries, and out-offices."

During the Session of the Legislative Council in March and April, 1892, the following Message from His Excellency the Governor was read:—

"Honourable Gentlemen—I beg to remind you that the Select Committee of your body whose proposals for the future working of the Botanical Department were adopted by you on the 13th October, 1886, recommended as a part of the scheme for constituting Hope Garden the central establishment of the Department, that buildings should be provided there as a residence and office for the Director.

As it appeared to me that the scheme in question was now so far advanced that the Director should take up his residence, I caused Estimates to be prepared of the cost of providing a residence for the Superintendent, so as to leave the present building at Hope in which the Superintendent now lives available for the Director. The estimates and plans of the residence for the Superintendent have just been received, and I submit for your favourable consideration that the cost, Six Hundred Pounds (£600) be voted for the current financial year, the estimates for which have already been passed."

The sum of £600 was thereafter passed; on the receipt of representations from me His Excellency was pleased to appoint a Board, consisting of the Director of Public Works, and two medical men to inspect the Superintendent's house at Hope. They reported unfavourably of the house, both as regards its structure, and its nearness to the Reservoirs, and I was therefore informed that a sum would be placed on the estimates for next year for the erection of another house.

I had the honour also to represent to His Excellency that to transfer the head-quarters from Cinchona to Hope, it is necessary first to provide several buildings, as was recognized and insisted upon by the Select Committee, all of which are already provided at Cinchona.

The Herbarium is of vital importance in carrying on the work of the Department, as reference is made almost daily to the collection of dried plants. The building containing it should have a room for the Herbarium-cabinets, microscopes, &c., for the purpose of study, and a room for the assistants for drying plants, changing drying papers, mounting dried plants for the cabinets, &c.

The Library and Director's Office should be in a separate building from his private residence. The Library may be used by the gardeners, and it must be in immediate connection with the Director's Office for the sake of the references which have constantly to be made to books.

An office for the Clerk is necessary. It should be distinct from the Director's Office, and be large enough to hold presses for filing correspondence, holding departmental account books and printed papers, stationery, &c.

Quarters for the Clerk and Herbarium-Assistants are absolutely necessary considering the inaccessibility of Hope Gardens, and the want of accommodation in the neighbourhood. The distance from Kingston is 5 miles.

The buildings at Cinchona for all the above purposes are rather small, but in the heat of the plains, it would not be possible to use buildings unless constructed of much more ample dimensions.

The old great house at Hope is at present used chiefly as store rooms, and in any case could not be used for quarters or offices on account of its insanitary condition.

With regard to the house occupied by the Director at Cinchona, it would be necessary for him always to have it at his disposal when visiting the Hill Garden. When the department was for a short time under General Mann a small house was built for his accommodation while inspecting the garden, namely the present Superintendent's house, the Director's house being then in occupation of Mr. Robt. Thompson, the Superintendent.

As the question has now arisen of the removal of the head-quarters to Hope from Cinchona where the business of the department has been carried on for so many years, I beg leave to state the conclusion at which I have arrived after more than 5 years departmental work.

In the first place, in the nature of the case, there does not appear to me to be any necessity for the permanent residence of the Director at the Hope Garden or in the capital, Kingston. In Ceylon with an area nearly 6 times that of Jamaica, the head-quarters of the Botanical Department and the residence of the Director are in the Peradeniya Gardens, more than 70 miles by rail from Colombo, the seat of Government.

In Java, the Botanic Gardens are at Buitenzorg, 26 miles distant from Batavia. In India, the Director in the Bengal Presidency is stationed at Seebpore, going in the summer to Darjeeling in the hills; the Director in the north west provinces is stationed at Saharupur with a residence in the hills at Chassoree; in the Madras Presidency the Director lives at Ootacamund in the Nilgiri Hills. Finally the most important Botanic Garden in the world, Kew, is at some distance from London.

The Report of the Committee states the chief functions of the Department to be the "diffusion of information" and the "distribution of plants." The diffusion of information must either be in the way of itinerant lecturing, or by correspondence and by printed papers such as the "Bulletin;" in either case it does not much matter where the Director lives; and in the latter case, a far greater amount of work can be done in the climate of the hills than in the plains. The distribution of plants from the various Gardens (Castleton, Hope, Parade, Cinchona) is carried on by the different Superintendents in pursuance of directions by post from the Director's Office, and can be controlled as effectually from Cinchona as from Hope.

The Report further states that the head quarters should be "within as easy reach as is possible of all classes, and accessible from Kingston." Now, as a matter of fact, Hope is not accessible by all classes, for it is more than 5 miles from Kingston, there is no railway or tram line, a single buggy costs 8s. and a double buggy 12s. for a drive there and back of three hours. For more than a year, during the time of the Exhibition and prepartion for it, I spent part of every week in Kingston, and my experience was that all the departmental business could be transacted quite as well from Cinchona as in Kingston. Nor has any business in connection with the department during five years rendered my presence in Kingston necessary, or suffered by my absence, although I visited it once or twice a month on the occasions of my periodical visits to inspect the various gardens. There is a daily post, and if any occasion should occur, I can reach Kingston in less than four hours time. I do not consider that it is necessarily an advantage to be able to communicate by word of mouth. One hundred people in different parts of the Island may wish for much the same information about some cultural product. This information, asked for by definite questions in letters, can be given by definite answers in writing or in print, and can be supplied to the hundred probably in as short a time as it would take to talk it over, with the chance of its being soon forgotten, with perhaps only one person out of the hundred who could come to Kingston.

Herbarium.

The Herbarium is an essential element in every Agricultural Department, and it was recognized as such in the early days of the Botanical Department in Jamaica, for one of the chief duties assigned to the Island Botanist was "to collect, class, and describe the native plants of the Island."

If a plant is already known to have an economic value, it is necessary to describe, class, name it, and keep a dried specimen for ready reference. For instance, a planter in the Island supplied a Firm in the United States with a quantity of a certain bark, one of our native drugs. The Firm at first refused payment on the ground that it had not the appearance of the bark wanted Application was made to me to certify the scientific name of the bark sent as deduced from specimens of flower, fruit, and leaf; and on this certificate being forwarded payment was at once made.

The Herbarium is the necessary complement to a Botanical Library, and must be added to indefinitely.

A collection of those plants only that are known to possess useful properties is not by any means sufficient. Those species may be so similar in appearance to closely allied, but worthless species, that it requires careful comparison to enable one to state their distinguishing marks. A complete Herbarium is required for the study of economic Botany; and it is indispensable for the sake of reference when a broader view is taken, and students send up plants generally for determination.

Duplicate sets of Jamaica plants are of great value for the purpose of exhange with other West India Islands, and with other Botanical Establishments. A plant may be used for some purpose in one Island, and its economic value may not be known elsewhere. An interchange of plants among the Islands is therefore of importance.

The collections of plants had outrun the possibility of coping by the ordinary staff with their classification and arrangement, although representatives of our native plants are very far indeed from being all present in the Herbarium. To remedy this state of things I obtained permission to secure the services of Mr. C. Nicholls who had spent some time in the Kew Herbarium, and was about to visit Jamaica, on condition that the small salary of £12 per month offered to him should be paid out of the ordinary vote.

Mr. Nicholls worked for five months, from 1st November, 1891, to 31st March, 1892, with great energy and perseverance, and entirely to my satisfaction. Every specimen in the accumulations of plants of more than five years passed through his hands, and was placed in its natural order. Many which before this, had not been represented in the Herbarium cabinets, were added to the collections, many more also were referred to their proper genus or species, and all were placed in order for further work.

Mr. Nicholls employed his evenings in working up the microscopic anatomy of the leaf of Sisal Hemp, a subject which is of special importance in estimating the value of machinery for the extraction of the fibre, and he read a paper, giving the results of his investigations, before the Jamaica Institute which will be published in due course.

Library.

The Library has received several valuable additions. Its importance is great in carrying on the work of the Department. The List of Books obtained during the year is added in the Appendix.

Hope Industrial School.

This School was founded, and placed on a portion of the Hope Grounds, in order that the boys might have the opportunity of instruction and of practice in general agricultural operations.

The School is put under the management of the Hon. T. Capper, and under the general supervision of the Board of Visitors of the Reformatory Schools. Five or six boys are sent into the gardens for three hours work in the morning, and another set in the afternoon. At other times they are employed in School, or at work round the School-house under a Schoolmaster.

A warder looks after them in the Hope Garden. The staff in the garden is barely sufficient for the proper garden work, and it is therefore not possible to give any direct teaching. But provision was made out of the Vote for Instructors for obtaining the services of Mr. McNair to teach the boys how to cultivate and cure cocoa. The result has been most satisfactory. I considered myself fortunate in being able to secure the services of Mr. McNair. He was engaged for some time in the department in former years, having charge of the experimental grounds at Hope, and was lately most successful in founding a Botanical Station in Lagos. But as he is leaving Jamaica to start a Station in British Honduras, other provision must be made.

Instruction in an Agricultural School should combine theoretical explanation with practical work in the garden; as being the only way to put intelligence into the hand of labour. Theory and practice should be taught by the same instructor both in the field and schoolroom.

The office of Instructor is a most important, and at the same time a most difficult one. There are many very different cultures, requiring special modes of treatment in the field, and of preparation in curing, packing, &c., for the market. The rationale of these requires to be understood. The Instructor should be conversant with theory, and have the somewhat rare faculty of being able to impart his knowledge, and interest others in the work. It would probably be necessary to apply to one of the Agricultural Colleges for an Instructor. He would have himself a great deal to learn of tropical agriculture, but with his scientific training, it would not be difficult to acquire this knowledge.

If it be objected that expenditure for this object is not warranted when there are only perhaps 30 boys, it must be pointed out that the very object of starting the Industrial School was for the special purpose of teaching the boys the principles of agriculture, and if there is no Instructor, the school must prove a failure in that respect.

The Instructor would take advantage of various operations going on in the gardens for the purpose of instructing the boys and there would be special cultures to be attended to in their proper seasons.

One such special culture should be cocoa. It is most important that every means should be taken to improve the quality of the Jamaica product, and instruction of the boys at Hope should come in as part of the general scheme.

It is proposed to buy cocoa from small settlers, have it cured at Hope, and shipped with the expectation of getting a better price than is obtainable for the ordinary cocoa. The settlers would then be told what their cocoa realized in the market.

This process must be continuous; one or two consignments would not exercise any appreciable effect.

Cocoa might be purchased from each cocoa district throughout the Island in turn, in sufficient quantity to send a consignment.

After purchasing from all the districts in succession the round should again be taken up, in order to impress the people by constant repetition.

Only a certain quantity can be cured at Hope at one time, and therefore no very immediate results can be anticipated as regards the general improvement of the Island produce.

The curing and cultivation of cocoa should always be one of the subjects taught at the Industrial School, first, because it is so important for the Island where the art is not understood to such an extent as curing of coffee, making sugar, &c.; secondly, because it is a subject of practical instruction very well adapted for developing careful and patient attention; thirdly, because there is generally abundance of cocoa to be had as material to work upon.

Other subjects of instruction might be the cultivation of grapes, of pine apples, of Sisal Hemp, of Tobacco.

If several Industrial Schools should at some future time be started in different parts of the country, then each one should take as its main subject such a culture as is most important in its special district according to the zone of vegetation, the orange in one, cocoa in another, coffee, tobacco, vegetables, grapes, &c., in others.

The best boys at each school might be drafted to Hope for general instruction, and after some years of work would be capable of taking posts as managers, or Instructors.

Foreign Students in the Gardens.

Harvard University.

In March 1892, the Botanic Gardens of the Harvard University, Massachusetts, sent two representatives to collect and study at the Botanical Gardens in Jamaica. Mr. Rudolf Blaschka is engaged in making for the University, glass models of flowers, fruit, &c., and their dissections, in order to illustrate the science of Botany. He spent his time here in making accurate coloured drawings of 116 different species; and Mr. Robert Cameron, the Curator of the Gardens, made a large collection of dried plants of the same, and other plants for their Herbarium. Professor Goodale wrote, on their return, expressing his appreciation of the facilities afforded them for their work, and of the success which they had attained.

Apprentices from Lagos.

Mr. Cradwick supplies the following report on Leigh and Dawodu, who were sent by the Government of Lagos to be trained at Hope Gardens to take charge of Botanic Stations in their own country:—

"The two apprentices have been working under my own special superintendence. Particular attention has been paid by me to them, especially in trying to make them smart and workmanlike, and to prevent them falling into careless, shiftless ways of working. They have paid special attention to the raising of economic plants, and the careful methods required in germinating seeds, and in protecting young seedlings from the many ills which they are subject to. I am pleased to say that I can now leave either of them in charge of any operation, and know that they will do their best, not only to carry out my instructions, but to use their judgment in the event of any circumstances arising which it was impossible to foresee. In short, they now understand what I try to impress upon every employee under my charge, that a great deal more depends on their taking an intelligent and *thinking* interest in their work, than in learning a few rules of thumb, which so often are palmed off for practice.

They have entire charge of all the sowing of the seeds, also care of the orchids. They have had lessons in the curing of cocoa and in the proper planting of it.

They have also been taught how to properly prepare a pot for the reception of a plant, and how to put the plant into the pot, technically crocking a pot, a very much more important operation than it is usually thought to be,—and lastly potting a plant.

The collecting of seeds is looked after by them, the proper entering of seeds collected, received, and sent away is now understood by them; and also the keeping of the other books necessary in a garden. The meteorological observations are carried out by them.

I may here mention that if they are industrious and painstaking, when they return home, they may be placed in charge of a Botanical Station with perfect confidence."

Bulletins.

Bulletins Nos. 22 to 29, have been published during the year, containing 33 articles, besides information in the annual Report, on cultural industries, either quite new or such as might be greatly extended; on diseases of plants, on soils, and on native plants.

The following are the contents:—

No. 22, July 1891.—Report on Fibre Machinery. Coffee leaf disease. Dr. Burck's method of treatment of the coffee leaf disease in Java. Ferns: Synoptical List: IV.

No. 23, Septr. 1891.—Cocoanut disease at Montego Bay. Cocoa: Samples from London Market. Potatoes from Canada sown at Cinchona. Cola-nut or Bissy. Ferns: Synoptical List: V.

No. 24, October 1891.—Nutmegs. Experiments in the cultivation of Vegetables. Soils. The Mangosteen. The Jamaica Forget-me-not. Sisal Hemp in the Bahamas and Florida.

No. 25, Nov. 1891.—Ferns: Synoptical List: VI. Curing Nutmegs. Experiments in the cultivation of Vegetables.

No. 26, Dec. 1891.—Ferns: Synoptical List: VII. Dried Bananas and Plantain Meal. Ginger. Phasmidæ or Stick Insects. Cinnamon. Arrowroot. Bay Rum. Nutmegs.

Nos. 27 & 28, Jany. & Feby. 1892.—Report of the Director of Public Gardens and Plantations for the period ended 31st March, 1891.

No. 29, March 1892.—Strawberry Cultivation. Liquorice. Cassava. Vegetables. Bay Rum. Ginger. Ferns: Synoptical List: VIII.

The Bulletin is supplied free of cost to residents in the Island and is a most useful agent in the dissemination of information amongst all classes. Testimony is frequently received of its value to people in Jamaica; and it is found useful even by planters in other countries. The following from the Editor of the Planter's Monthly, Honolulu, is an example of what is often written:—"I appreciate "very much the service which you are rendering to progressive agriculture, in the well prepared ar "ticles which appear in the Bulletin which cannot fail to do much good."

Cultural Exports and Imports.

Annatto.

	* Quantities Exported.	Values.
1892	476,735 lbs.	£3,972 15 10
1891	511,800 "	4,265 0 0
½ Yr. 1890	426,201 "	3,551 13 6
1889	455,874 "	3,798 19 0
1888	524,429 "	3,583 11 9
1887	363,669 "	6,061 3 0

It is strange that Annatto is not produced to a greater extent. Cattle do not browse on the leaves and it could therefore be easily grown along the fences of pastures. This product would well repay more care in the preparation.

Arrowroot.

Exported.	Cwt.	Qr.	Lbs.	Values.
1892	12	0	0	£7 15 3
1891	3	1	7	2 12 2
½ Yr. 1890		...		...
1889	7	1	24	11 6 8
1888	27	2	12	38 3 6
1887	15	0	13	23 7 4

Arrowroot is a product to be taken up rather by the man of capital than the peasantry, for unless great care and skill are expended on the preparation of the starch, and proper appliances used, the price is scarcely remunerative. There is a notice of this product in Bulletin No. 26.

Bananas.

Exported.	Bunches.	Values.
1892	3,503,275	£262,745 12 6
1891	4,847,659	444,368 14 10
½ Yr. 1890	1,554,904	142,532 17 4
1889	2,881,313	252,114 17 9
1888	3,093,393	270,671 17 9
1887	1,460,322	146,032 4 0

It should be noticed that there have been great fluctuations from year to year in the quantity of Bananas exported, and probably the great falling off during last year may be accounted for by temporary causes, namely, a large local fruit crop in America, and a small banana crop in the island following drought.

It has been suggested that the fruit of small bunches, that are unmarketable, might be utilized if made into banana meal, or distilled as spirit. Enquiries are being carried on with regard to both these points, but so far the prospects are not very promising. It is doubtful whether the meal can be made cheaply enough to compete successfully with other products of the same description; and it appears that the percentage of starch in the unripe fruits is not large enough to allow the banana to supersede corn (maize) in America, or the beet and potato in Europe for the purpose of distilling spirit. Some notes on dried bananas and meal are given in Bulletin No. 26.

Bay Rum.

Bay Rum is made from the leaves of *Pimenta acris*, one of the plants known here as wild cinnamon. Notes will be found in Bulletins 26 and 29. As loss may be sustained by using the leaves of the wrong plant, any one thinking of starting this industry is recommended to send specimen leaves, and if possible flowers or seeds also, to the Director for identification.

Bitter Wood.

Exported.	Tons.	Cwt.	Values.
1892	1,120	14	£2,241 8 0
1891	924		1,848 0 0
½ Yr. 1890	102	15	205 10 0
1889	649	19	1,299 18 0
1888	218	10	437 0 0
1887	68	17	154 18 3

The export of bitter-wood is increasing so steadily and so fast, that attention should be paid to trees wherever they are growing, and bush cleared from young trees to give them every chance of development.

Cassava.

Cassava is a cultivation which should be largely taken up by small settlers, and the root utilized, not for one product only, such as starch, as is the custom in some parts, but for the preparation of all the products, meal, starch, tapioca, cakes, cassareep. Notes are given in Bulletin No. 29.

* In the Report for 1887 figures were quoted from the Collector General's Report to show the value of certain Exports, and their increase or decrease. It may be well now after a lapse of five years to make a similar review.

Cinnamon.

Trees of the true cinnamon are found in various parts of the Island, but no attempt has been made to utilize the bark, possibly for want of the knowledge how to prepare the commercial article. Information is supplied in No. 26. This is a product suited to the small settler.

Cola or Bissy.

Attention is directed in No. 23 to Cola. This is a product which requires no skilled labour, either to grow the tree or to cure the bean, and may be recommended to the settlers. The demand for cola is likely to increase enormously in the future, and it might well be planted out in cocoa plantations.

Cocoa.

Exported.	Cwt.	Qr.	Lbs.	Values.
1892	5,485	0	15	£12,349 11 0
1891	6,417	2	24	14,439 17 2
½ Yr. 1890	1,623	3	8	3,653 11 11
1889	5,248	3	19	10,581 16 5
1888	4,750	0	6	10,640 2 5
1887	3,452	3	13	8,314 10 0

While the export for this year is less than that of 1891, there is a steady increase, and quite lately information has been received that the quality is slightly improved.

The question of curing properly is one of the most serious to the Island, involving in Mr. Morris's opinion (see Bulletin No. 23) an annual loss of £20,000 or £30,000. If settlers fermented their cocoa they would get better prices, and would soon plant more trees, and increase the amount as well as the value. Messrs. Wilson Smithett and Co speak of Jamaica cocoa in very disparaging terms.

They say :—"A small proportion of Jamaica cocoa imported here has undergone fermentation to a "greater or less degree, but the bulk is of very ordinary quality, the only West Indian Cocoa taking "rank below it being St. Domingo from Jeremie, whilst that from Samana in the same Island is "superior to Jamaica. It has, however, all the characteristics of good cocoa—although wanting in "size, and if properly harvested, fermented or sweated, and then dried in the sun until the bean be- "comes crisp to the feel, so that the shell is fairly loose, and the interior dry and of an even chocolate "brown not violet brown, when broken, it should command the general attention of trade. Great "care should be taken to protect it from rain whilst curing. It must be noted that manufacturers "cannot pay much attention to small parcels, and that to insure a ready sale not much less than a ton "weight of even colour and quality should be shipped, the larger the lot the better." The words "small parcels" in the preceding statement point to the main difficulty that lies in the way of improvement. If brokers in London will only deal with shipments of at least a ton in weight, merchants in Kingston must mix all the small parcels brought in by the buyers, and cannot discriminate between good and bad curing, for the proportion of good to bad must be, for some time, at any rate, very small and therefore cannot have any great effect in improving the quality of the whole. If the same price is then paid to the people for their cocoa, whether cured or only washed, it is not to be wondered at if they refuse to take trouble that is not paid for. It would appear that the only way out of this difficulty, inasmuch as it is hopeless to expect a combination amongst shippers, is for the government by some means to prevent the shipment of inferior quality. The same remark applies to oranges, logwood, &c.

Coco-nuts.

Exported.	Number.	Values.
1892	7,855,656	£26,512 16 9
1891	8,554,618	27,802 10 2
½ Yr. 1890	3,195,238	12,461 8 7
1889	4,831,615	15,219 11 9
1888	5,909,301	20,682 10 10
1887	2,399,730	8,998 19 9

The export of coco-nuts has been greater during 1891–92 than during any year for the past ten years, in spite of great mortality amongst the trees at Montego Bay. A report was made on this disease, (Bulletin No. 23) but scarcely anything has been done by owners of trees to make use of the remedies suggested.

Coco-nut butter has been manufactured in Europe since 1888. It is of great hygienic and dietetic value. The process of manufacture has been patented, and no details can be obtained. Coco-nut oil, however, can easily be made, and can be used with great advantage in cooking, and in other ways, in place of cooking-butter, or olive-oil. If the oil is put while still hot into hermetically sealed tins, or into bottles using cotton wool with the stoppers, it ought to keep sweet for an indefinite time.

Coffee.

Exported.	Cwt.	Qr.	Lbs.	Values.
1892	86,926	1	20	£336,839 18 0
1891	75,680	0	7	283,800 4 6
Yr. 1890	73,402	3	8	249,569 11 10
1889	84,606	0	8	291,383 6 2
1888	98,965	2	8	321,440 2 3
1887	56,586	3	26	209,145 9 8

The value this year exceeds that in any year during the last ten years though the amount exported was not as large as in 1888.

Venezuela, Columbia, and Hayti, having declined to enter into reciprocity agreements with the United States in connection with the McKinley Bill, their coffee, exported to the States, amounting in the total to 76,096,700 lbs., becomes subject to a duty of 3 cents per lb.

Shipment of coffee in parchment is strongly recommended to small settlers, who have no mill of their own. They will find it much more economical than to pay, as some of them do, as much as 3s. per bushel for milling. The remarks made by the Collector of Taxes in Trelawny is that, all the coffee (which was but an average crop) was badly cured, no care being taken in its preparation at all, which means a great loss of money to the producers and the Island.

Corn Imported.

Imported.	Bushels.	Values.
1892	178,357	£26,735 15 6
1891	212,898	31,934 14 0
½ Yr. 1890	71,771	10,765 15 3
1889	108,586	16,287 18 0
1888	90,341	18,068 7 0
1887	83,760	16,752 0 0

Corn cannot be grown here as cheaply as in the States, and therefore the importation will probably increase as the means of communication between ports and remoter parts of the Island are improved.

Ebony, West Indian.

Exported.	Tons.	Cwt.	Values.
1892 233 pieces and	241	19	£640 6 6
1891	500	3	1,375 8 3
½ Yr. 1890	150	17	377 2 6
1889	383	2	956 15 0
1888	57	5	143 2 6
1887	46	5	115 12 6

West Indian Ebony or Coccus Wood is only valuable when it can be supplied in large pieces. Attention should be paid to clearing this wood of the parasites by which it is so liable to be covered.

Fustic.

Exported.	Tons.	Cwt.	Values.
1892	677	6	£2,031 18 0
1891	950	1	2,612 12 9
½ Yr. 1890	655	0	1,768 10 0
1889	793	8	2,142 3 7
1888	2,463	8	7,390 4 0
1887	4,181	5	12,543 15 0

Ginger.

Exported.	Cwt.	Qr.	Lbs.	Values.
1892	16,272	2	11	£40,681 9 10
1891	10,885	2	21	24,492 15 11
½ Yr. 1890	4,948	0	17	11,133 6 9
1889	8,952	1	1	18,615 8 9
1888	10,222	0	13	19,462 18 2
1887	9,927	0	2	17,789 4 6

The export of Ginger has taken an immense stride during 1892, and the value per cwt. has also increased.

The growing and curing of ginger is an industry admirably suited to small settlers, while the preparation of preserved ginger is one which may well be recommended to the notice of the Women's Self-Help Society. Hints on ginger are given in Bulletins Nos. 26 and 29.

Fibre.

The cultivation and preparation of Sisal Hemp is one of the most important amongst new industries. Extracts from reports full of details for the practical planter, written by Mr. James M. Roe on the Bahamas Plantations and by Mr. C. R. Dodge, Fibre Expert for the United States, are published in Bulletin No. 24. It is not a cultivation for the small settler. Not less than 200 acres should form a plantation, and perhaps not less than 500 acres can be worked economically. The plantation should be in such a situation that roads and tramways can be easily made through the whole extent. At Hope, planters can see for themselves all that concerns the practical cultivation.

The question of machinery for extracting the fibre is not one that is at present of pressing moment for the island, but enquiries are constantly made by me as to the progress of improvement in machines, and the invention of new processes. A report on the Weicher Machine was given in Bulletin No. 22. Hon. Captain Jackson, Colonial Secretary in the Bahamas, informs me that Albee Smith is improving his machine, that Van Buren's is very like Kennedy's, and that much is expected of an invention by Forbes,—a process of extraction by steam in closed cylinders. Correspondence is also maintained on the subject with Mr. C. R. Dodge.

Lancewood Spars.

Exported.	Numbers.	Values.
1892	14,245	£4,273 10 0
1891	26,810	8,043 0 0
½ Yr. 1890	12,034	3,610 4 0
1889	8,062	2,821 14 0
1888	7,921	2,383 15 6
1887	11,486	4,594 8 0

Lancewood should be planted in suitable localities, as there will always be a demand for it for carriage poles, fishing rods, &c.

Lignum-Vitae.

Exported.	Tons. Cwt.	Values.
1892	141 2	£440 18 9
1891	204 13	461 0 6
½ Yr. 1890	207 2	544 5 10
1889	446 19	1,251 9 2
1888	20 13	61 19 0
1887	47 5	118 2 6

Such an ornamental tree as this is, ought to be planted, especially in places subject to drought which it withstands well.

Limes.

Exported.	Barrels.	Values.
1892	913½ and 49 boxes	£361 1 6
1891	802½	401 5 0
½ Yr. 1890	8½	4 5 0
1889	701	350 10 0
1888	634	317 0 0
1887	1,028½	411 8 0

Some effort should be made to make this fruit more known in England than it is at present. Limes might largely supplant lemons in popular flavour.

Lime juice.

Exported.	Gallons.	Values.
1892	116,765	£4,865 4 2
1891	53,884	2,245 3 4
½ Yr. 1890	19,826	826 1 8
1889	77,745	3,239 7 6
1888	85,963	2,865 8 8
1887	96,153	3,205 2 0

This industry might be more flourishing, if the essential oil were extracted from the peel, and a first quality of lime juice made from the drainings of the fruit when cut before being pressed to make the "concentrated" juice. It is said also that the Jamaica concentrated juice is burnt in consequence of the concentration being carried too far, the strength being 90 ozs. of citric acid per gallon instead of the strength obtained in Sicily from 65 to 70 ozs.

Liquorice.

Liquorice is another plant for the small settler. It will grow where the orange flourishes, in deep rich soil. A notice of it is inserted in Bulletin No. 29.

Logwood.

Exported.	Tons. Cwt.	Values.
1892	86,675 7	£303,363 14 6
1891	109,283 6	382,491 11 0
½ Yr. 1890	59,478 15	197,766 16 8
1889	115,454 0	375,225 10 0
1888	100,901 6	353,154 11 0
1887	58,932 16	191,531 12 0

Enquiries are often made as to why the St. Mary's Logwood is better than that from other parts of the Island, and why Honduras Logwood is the best. As far as can be ascertained, the species is the same, and the difference must be ascribed to soil and situation.

Mangoes.

Exported.	Number.	Values.
1892	258,060	£203 2 6
1891	222,020	158 12 6
½ Yr. 1890	18,388	19 19 0
1889	170,988	100 19 6
1888	299,584	258 9 0
1887	93,470	116 6 0

This export will never be of any great value, unless the fruit is picked by the hand, and packed with care, for the least bruise is fatal. Good mangoes would doubtless fetch a high price in New York.

Nutmegs.

The attention of planters and small settlers has been directed to the cultivation of Nutmegs and to the large profits to be made in suitable localities. Articles on the subject have appeared in the Bulletins Nos. 24, 25 and 26. It is pleasing to find that this cultivation is being entered upon with spirit and energy, as many as 20,978 plants having been sold by the Department during the year. All the Nutmegs used as seed are most carefully selected on one of the best Estates in Grenada. Great care and attention are given to them at Hope Gardens, and it is satisfactory to learn from the largest grower that they can be obtained cheaper and in better condition from the Department than if he grew them himself.

Oranges.

Exported.	Number.	Values.
1892	19,386,466	£23,263 15 0
1891	40,725,085	57,015 2 4
½ Yr. 1890	25,711,222	35,995 14 2
1889	35,394,271	51,321 13 10
1888	47,910,177	64,678 14 8
1887	42,391,803	58,288 14 7

The value of this export has never been so low since 1881. Apparently nothing will check the export of inferior fruit, and the consequent loss in the market, unless it be the intervention of the Government. This fruit should always be carefully picked and handled so as to prevent the least bruise ; a knock that would crack an egg, spoils an orange for export. Grading into sizes, and packing in boxes are also matters that require attention.

Peas and Beans.

Imported.	Bushels	Values.
1892	5,854	£2,195 10 9
1891	3,711	1,299 2 3
½ Yr. 1890	2,378	861 18 9
1889	5,795	2,172 1? 2
1888	6,710	2,684 0 0
1887	7,652	3,060 16 0

These products can only be cultivated in a small way, and the imports will therefore always be large.

Pimento.

Exported.	Cwt.	Qr.	Lb.	Values.
1892	63,729	3	6	£50,983 16 10
1891	90,362	3	11	81,326 11 3
½ Yr. 1890	35,705	2	18	33,920 7 7
1889	46,179	3	21	47,842 8 4
1888	66,559	2	2	44,727 19 9
1887	65,497	1	20	45,848 4 0

The value of this export is greater than in any year since 1885,except 1890–91.

Pine Apples.

Exported.	Dozens.	Values.
1892	10,294	£1,286 15 2
1891	10,527	1,579 3 3
½ Yr. 1890	860	139 16 8
1889	8,293	1,036 11 3
1888	9,812	1,471 16 0
1887	8,289	1,243 8 3

When inferior pines sell in the States in the early Spring at 1s. each, it is surprising that not more is done in extending the area of cultivation here. This fruit would travel well even to England, if packed so as not to touch, and abuot 20 in a box.

Rice.

Imported.	Lbs.	Values.
1892	11,264,631	£67,650 19 11
1891	6,985,940	41,915 12 9
½ Yr. 1890	4,758,954	28,553 14 5
1889	7,314,368	43,886 4 1
1888	9,137,198	54,823 3 8
1887	7,277,721	42,756 12 2

There is no reason why a large quantity of rice should not be raised in the island, as there are large tracts where it will grow. A small quantity of "hill rice" is being obtained from India for experiment in the Red Hills.

Rum.

Exported.	Gallons.	Values.
1892	1,704,919	£255,737 17 0
1891	1,593,584	199,198 0 0
½ Yr. 1890	584,091	65,710 4 9
1889	1,374,931	137,493 2 0
1888	1,868,490	202,419 15 0
1887	2,412,596	301,374 10 0

Although the amount is less than in any year from 1882 to 1888, (except in 1886) the actual value is greater than in any of these years except 1882 and 1887.

From the fine rains and seasonable weather during three-fourths of the financial year ended 31st March, 1892, agriculture has been fairly prosperous; and sugar as well as rum would have realized the estimated crops, but for the fact that in some instances sugar was sacrificed for the increase of the rum crop; the price of the latter rendering its production more profitable; under the circumstances the sugar crop was slightly below the estimate, while the rum crop exceeded it.

Sugar.

Exported.	Cwt.	Qr.	Lbs.	Values.
1892	425,792	2	20	£255,475 12 2
1891	377,901	1	5	236,188 6 2
½ Yr. 1890	170,615	2	12	102,369 7 4
1889	323,238	1	1	244,368 2 5
1888	490,480	0	25	288,402 7 9
1887	460,866	3	6	264,537 10 10

Sugar Refined.

Imported.	Lbs.	Values.
1892	223,208	£2,365 8 3
1891	115,628	1,445 7 0
½ Yr. 1890	44,984	562 6 2
1889	86,221	1,077 15 4
1888	90,644	1,133 1 0
1887	91,574	1,144 13 6

While the exports of sugar are not declining, there is a great increase in the amount of refined sugar imported, due to the remission of the duty of 2d. per lb. There is a fair chance now for the development of the manufacture of preserves, since refined sugar is so much cheaper,—Ginger, Orange, Marmalade, Guava, &c.

Strawberries.

Notes on the cultivation of the Strawberry are given in No. 29. This is a fruit which might be grown in large quantities in the Red Hills district. Experiments are being made with several varieties sent from Kew.

Tea.

Imported.	Lbs.	Values.
1892	36,071	£3,607 2 3
1891	37,697	3,769 15 3
½ Yr. 1890	20,327	2,032 14 6
1889	28,797	2,879 14 0
1888	29,952	2,995 5 6
1887	25,394	2,539 8 6

It has been ascertained that Tea of good quality grows rapidly in the Island. The only drawback is the want of abundance of cheap labour. The plant might, however, be grown where there is a fair supply of labour, and manufactured for home consumption. Tea plants will be supplied to those who apply for them.

Tobacco—Cigars.

Exported.	Lbs.	Values.
1892	18,858	£9,429 5 0
1891	10,892	5,446 5 0
½ Yr. 1890	4,193	2,096 10 0
1889	4,479	2,799 13 9
1888	7,008	3,504 0 0
1887	4,252	2,126 0 0

The export of Cigars has increased considerably, and it is understood that it is capable of much greater extension, if the Cigars were pushed by Merchants in Europe.

The amount of unmanufactured tobacco exported is very small, being only 990 lbs., of the value of £34 15s. 0d. during this year.

Vegetables.

Articles giving the results of growing varieties of English peas, appear in Nos., 23, 24, 25, 29. The experiments are still being carried on. There would be a ready demand in Kingston for a very large quantity of this vegetable.

Onions (see No. 24) do well in certain parts of the Island.

Yams.

Exported.	Cwt.	Qr.	Lbs.	Values.
1892	483	2	18	£253 18 5
1891	687	3	7	343 18 1
½ Yr. 1890	283	2	2	113 8 1
1889	6,149	0	16	3,074 11 5
1888	28,194	1	0	11,277 14 0
1887	31,957	3	10	15,978 18 3

APPENDIX.—I.

List of Recipients of Plants or Seeds distributed free or in exchange from the Botanic Gardens Jamaica :—

Plants.

Parochial Board, Westmoreland, for Norman Square, Sav.-la-Mar; Parochial Board, Trelawny, for Falmouth Park; Parochial Board, St. Thomas, for Cemetery; Parochial Board, St. Mary, for Victoria Park, Port Maria; Constabulary Quarters or Stations at Port Maria, Ocho Rios; Falmouth, St. Ann's Bay, Port Antonio; District Prison, Falmouth; Head Quarter House Grounds; Kingston and Liguanea Water Works; Superintending Medical Officer for Lepers' Home, Spanish Town, and Maternity Hospital, Kingston; Major Martin, for Port Royal; Bishop Gordon, for Convent Industrial School; Revd. J. Radcliffe, for Collegiate Hall Grounds; Industrial School, Hope; Messrs. W. M. Bailey, F.H. Barker, P. H. Baxter, J. J. Bowrey, Dr. Brookes, C. W. Chapman, W. G. Clark, R. M. Cocking, W. Douet, G. Douet, H. P. Deans, M. H. Edwards, H. Fowler, B. S. Gosset, J. W. Fisher, A. Hopwood, E. E. C. Hosack, L. Isaacs, C. Isaacs, H. Isaacs, A. Kemble, J. LeRay, J. Lannaman, L. F. Mackinnon, G. Massy, Melhado Bros., O. Marescaux, A. A DeMontagnac, P. A. Moodie, Hon. N. Porter, E. G. Orrett, T. Sargood, J. Stephens, A. Stewart, E. Stewart, R. Stewart, W. Wynne, R. Sidgwick, Revds. W. Griffith, E. B. Key, J. Reinke, J. L Ramson, H. Walder; Mrs. Farquharson, Mrs. Heaven, Mrs. Hotchkin, Mrs. James, Mrs. Maclaverty, Mrs. Osmond, Miss Johnson, Miss Marescaux; Royal Gardens, Kew, Royal Horticultural Society, England, Government of Fiji Islands, Government of Martinique, Messrs. Jas. Carter & Co, London, and Jas. Veitch & Sons, London.

Seeds.

Dr. Yates, Admiral Ammen, President Harrison, Colonel Griffith, Colonel Ward, Messrs. H. P. Deans, W. T. James, T. J. Breakspear; Royal Gardens, Kew; Botanic Gardens: Cambridge, Hull, Liverpool, Dublin, Vienna, Edinburgh, Manchester, Glasgow, Oxford, Demerara, Trinidad, Martinique, Montreal, Washington, Rio de Janeiro, Cape Town, Grahams Town, Port Elizabeth, King Williamstown, Graef Reinet, Uitenhage, Natal, Mauritius, Calcutta, Mungpoo, Darjeeling, Saharanpur, Lucknow, Odeypore, Poona, Ootacamund, Ceylon, Straits Settlements, Hong Kong, Sydney, Brisbane, Adelaide, Port Darwin, Melbourne, Hobart Town, Tasmania; Wellington, New Zealand, Napier; Botanical Stations: Barbados, Honduras, Grenada, St. Lucia, Antigua, Lagos, Gold Coast, Gambia, Fiji; British Museum; Messrs. Jas. Carter & Co., Sutton & Sons, Veitch & Sons, Reasoner Bros., J. B. Beach, Sir F. Von Muëller, Dr. Stubbs, Damman & Co., Krelage & Co.; Ottawa Experimental Farms; Agri-Horticultural Society, Madras; Acclimatization Society, Brisbane.

List of Donors of Plants or Seeds to the Botanic Gardens, Jamaica :—

Plants.

Royal Gardens, Kew; Royal Botanic Gardens, Seebpore, Calcutta; Agri-Horticultural Society of India, Calcutta; Botanical Station, Barbados; Dr. Henderson, Dr. Grabham; Mrs. Heaven, Mrs. Maclaverty, Miss Terry Moulton Barrett; Mr. J. B. Beach (Florida) Mr. W. T. James (Bermuda), Messrs. B. Gosset, Krelage & Son (Haarlem), W. W. Wynne.

Seeds.

Hon. J. W. Fisher, Messrs. S. Soutar, J. Stephens, K. Thompson, Mrs. Curran, Mrs. Plaxton, Mrs. Heaven, Mrs. Henderson, Mrs. Cundall, Messrs. T. Kemp, R. Stewart, R. Sidgwick, R. K. Tomlinson, R. Holwell, B. S. Gosset, Colonel Griffith, Dr. Plaxton, Rev. H. H. Isaacs, Hon. T. Capper, Horticultural Society, Kingston, Messrs. Jules de Cock (Belgium), Jas. Carter & Co., J. B. Beach (Florida), Messrs. Reasoner Bros. (Florida), Mr. Lindsay Smith (Turks Island), Sir F. Von Mueller: Royal Gardens, Kew; Botanical Gardens: Demerara, Trinidad, Washington, Seebpore, Saharanpur, Ceylon, Hong Kong, Port Darwin, Melbourne; Botanical Station, Grenada; Dr. Stubbs (Louisiana Sugar Experiment Station); Acclimatization Society, Brisbane.

Appendix II.

Measurements of Trees planted at Hope Gardens.

The following are measurements of various species of Eucalyptus trees planted about five years ago, and noted in the Report for 1888–89 :—

No.	Name.	Height, feet.	Girth, inches.
1	Eucalyptus rostrata ...	50	22
2	„ leucoxylon ...	20	5
3	„ viminalis ...	12	3
4	„ macrocorys ...	5	2
5	„ obliqua ...	10	2½
6	„ punctata ...	50	22
7	„ diversicolor ...	15	2½
8	„ platypus ...	30	12
9	„ robusta ...	53	30
10	„ saligna ...	16	10
11	„ tereticornis ...	60	34
12	„ corymbosa ...	30	8
13	„ piperita ...	54	24
14	„ hæmastoma ...	36	10
15	„ pilularis ...	59	32

The following are measurements of various trees planted in 1886 :—

Cedrela odorata (Cedar) ...	32 ft.	24 ins.
Achras Sapota (Naseberry) ...	20 „	8 „
Chrysophyllum Cainito (Star Apple) ...	30 „	21 „
Simaruba glauca (Bitter Dan) ...	32 „	16 „
Feronia Elephantum (Elephant, or Wood Apple)	8 „	5 „
Sloanea jamaicensis (Greenheart) ...	17 „	36 „
Theobroma Cacao (Cocoa) ...	12 „	6 „
Picræna excelsa (Bitterwood) ...	27 „	20 „
Cinnamomum zeylanicum (Cinnamon) ...	12 „	4 „
Guaiacum officinale (Lignum Vitæ) ...	10 „	5 „
Myroxylon Pereiræ (Balsam of Peru) ...	16 „	7 „
Mimusops Elengi (Elengi Tree) ...	11 „	4 „
Cananga odorata (Ilang Ilang) ...	46 „	38 „

The girth measurements are taken three feet from the ground.

Naseberry has fruited at 4 years old.
Star Apple „ 3 „
Cocoa „ 3 „

The other trees named have not yet fruited.

Appendix III.

Catalogue of Books added to the Library.

(The Names of Donors are printed in Italics in square brackets.)

Aitken, (E). Elementary Text Book of Botany. London. 1891. 8vo.

Arthur, (J. C.) History and Biology of Pear Blight [Extract.] *Proc. Philadelphia Acad. Sc.* Philadelphia. 1886. 8vo.

Baker, (J. G.) Handbook of the Bromeliaceæ. London. 1889. 8vo.

Balfour, (Prof. I. B. and others.) Annals of Botany. Nos. 18, 19, 20. London and Oxford. 1891. 8vo.

Beer, (J. G.) Beitrage zur Morphologie und Biologie der Familie der Orchideen Vienna. 1863. Fol.

Bennett, (A. W. and Geo. Murray.) Handbook of Cryptogamic Botany. London. 1891. 8vo.

Bosisto, (J.) Is the Eucalyptus a Fever destroying Tree? Read, 10th August, 1874. (Extract.) 8vo.

Branner, (J. C.) Course and growth of the Fibro-Vascular Bundles in Palms. [Extract.] *Proc. Amer. Philos. Soc. XXI.* 1884. 8vo.

Britten, (J.) Journal of Botany. Edited by J. B. London. Apr. 1891 to Mch. 1892. 8vo.

Candolle, (A. de). Laws of Botanical Nomenclature. . . . London. 1868. 8vo.

Candolle, (A. de and C. de). Monographiæ Phanerogamarum. Vol 7. Melastomaceæ by A Cogniaux. Paris. 1891. 8vo.

Christison, (Sir Robert). The exact measurement of Trees . . . [Extract.] *Trans. Bot. Soc. Edin. XII.* Edinburgh. [1877.] 8vo.

Christison, (Sir Robert). On the exact measurement of trees . . . [Extract.] *Trans. Bot. Soc. Edin.* Edinburgh. [1878.] 8vo.

Engelmann, (Dr. George.) Cactaceæ. (*U. States and Mexican Boundary Survey.*) [Washington. 1858.] 4to.

Engler, (A. and K. Prantl). Die Naturlichen Pflanzenfamilien. Vol. II. Leipzig. 1889. 8vo.

Firminger, (Rev. T. A. C.) Manual of Gardening for Bengal and Upper India. Third Edition. London, &c. 1874. 8vo.

Gaertner, (J.) De fructibus et seminibus plantarum. 3 Vols. Stuttgardiæ et Lips. 1788. 1807. 4to.

Griffiths, (A. B.). Treatise on Manures . . . London. 1889. 8vo.

Hanbury, (D.) On the species of Garcinia which affords Gamboge in Siam. (Read 7th April, 1864.) [Extract.] *Trans. Linn. Soc. XXIV.* London. 4to.

Hector, (Sir James.). *Phormium tenax* as a fibrous plant. 2nd Ed. New Zealand. 1869. 8vo.

Henslow, (Rev. Prof. Geo.) The making of Flowers. London, &c. 1891. 8vo.

Hooker, (Sir J. D.). Icones Plantarum . . . Third Series. Vol. X, Pts. 1, 2, 3. Fourth Series. Vol. I. Pts. 1, 2, 3. London. 1890-91. 8vo. [*Bentham Trustees through Kew.*]

Im Thurn, (E. T.). Botany of the Roraima Expedition of 1884. (Extract.) *Trans. Linn. Soc. 2nd Ser., Vol. II.* London. 1887. 4to.

Inzenga, (Prof.) On the cultivation of Sumach . . . By Prof. Inzenga. Translated by Col. H. Yule. Read 14th May, 1868. [Extract.] *Trans. Bot. Soc.* Edinburgh. 8vo.

Journal of the Royal Agricultural Society. Third Series. Vols. I and II. London. 1890, 91. 8vo.

Kew, Royal Gardens. Bulletin of Miscellaneous Information. London. April 1891 to March 1892. 8vo [*Kew.*]

Knight, (T. A.) Cultivation of the Pine Apple. [Extract.] Read November 6, 1821.

Laslett, (Thos.) Timber and Timber Trees. . . London. 1875. 8vo

Laurent, (Emile). Les microbes du sol. . . (Extract.) [1886.] 8vo.

Lockyer, (Norman). Nature; Edited by N. L. London. April 1891 to March 1892. 8vo.

Masters, (Dr. M. T. and Dr. J. H. Gilbert.) Reports . . . on the influence of various Manures . . . (Extract.) (*Proc R. Hort. Soc.*) London. 1870. 8vo.

Masters, (Dr. M. T.) Gardeners' Chronicle. London. April 1891, to March 1892. Fol.

Morren, (Ed.) Bromeliaceæ: (Extracts from La Belgique Horticole.) Ghent. 8vo.

Oliver, (F. W.) On . . . Flowers of "Pleurothallis ornatus" (Reprint from "Nature.") London. 1887.

Parker, (Prof. T. Jeffery). Lessons in Elementary Biology. London. 1891. 8vo.

Pfitzer, (Dr. Ernst). Grundzuge einer vergleichenden Morphologio der Orchideen. Heidelberg. 1882. 4to.

Ralph, (T. S.) Icones Carpologicæ . . . Leguminosæ. London. 1849. 4to.

Roscoe, (Wm.) Monandrian Plants of the order Scitamineae . . . Liverpool. 1828. Fol.

Routledge, (Thomas). Bamboo and its treatment: cultivation and cropping. Sunderland. 1879. 8vo.

Sagot, (Dr. Paul). De l'état sauvage et des résultats de la culture et de la domestication. Nantes. 1865. 8vo.

Sagot, (Dr. Paul.) Manioc. [Cassava.] (Extract.) *Bull. de la Soc. bot. de France.* Paris. [1872.] 8vo.

Sagot, (Dr. Paul.) Les différentes espèces dans le genre Musa (Bananier), leur groupement natural. Courtes indications sur les caractères distinctifs de chacune et sur l'intérêt alimentaire ou ornamentale de plusieurs. [Extract]. *Journ. de la Soc. Nat. d' Horticulture de France.* Paris. [1888.] 8vo.

Sargent, (C. S.) Silva of North America, Vol. II. Cambridge, U. S. A. 1891. Fol.

Seemann, (B.) Flora of the Isthmus of Panama (in part,) being part III. of the Botany of the Voyage of H.M.S. Herald. London. 1853. 4to.

Swartz, (Olaf). Adnotationes Botanicæ, quas reliquit O. S. Edited by J. E. Wikstroem. Holmiæ. 1829. 8vo.

Trelease, (Wm. and others). Missouri Botanical Garden. First Annual Report. St. Louis, Mo. 1890. 8vo.

Trelease, (Wm. and others) Missouri Botanical Garden. Second Annual Report. St. Louis, Mo. 1891. 8vo.

Vines, (Prof. S. H.) Lectures on the Physiology of Plants. Cambridge. 1886. 8vo.

Ward, (Prof. H. Marshall). Diseases of Plants. London. [1891.] 8vo.

Waring, (E. J.) . . . Bazaar Medicines and Common Medical Plants of India . . . Fourth Edn. London. 1883. 8vo.

Watt, (Dr. Geo. and others.) Dictionary of the Economic Products of India. Vols. III, IV, and V, D-O. Calcutta. 1889. 8vo.

Watson, (W.) Cactus Culture. . . . London. [1889.] 8vo.

Watson, (W. and W. Bean.) Orchids: their culture and management . . . . London. [1890.] 8vo.

Appendix IV.

Meteorological Tables.

Castleton Gardens—Elevation 580 Feet.

Month.	Temperature, Degrees Fahrenheit.					Dew Point.		Humidity.		Rainfall. Inches.	Pressure.	
	7 a.m.	3 p.m.	Max.	Min.	Range.	7 a.m.	3 p.m.	7 a.m.	3 p.m.		7 a.m.	3 p.m.
1891												
April ...	67.1	79..	81.1	66.2	14.9	65.4	73.5	93	89	10.80	29.54	29.54
May ...	70.0	79.4	81.2	69.5	11.7	69.1	73.3	97	82	18.77	29.56	29.55
June ...	71.4	82.8	.	.	.	69 6	71.4	93	68	11.31	29.55	29.55
July ...	72.0	84 5	86.6	71.0	15.6	70.9	76.1	96	76	2 09	29.60	29.60
August ...	71.1	79.3	84.5	70.8	13.7	70.2	73.4	97	82	8.96	29.59	29.59
September ...	70.3	80.5	85.8	69.7	16.1	69 2	74.6	96	82	12.71	29.56	29.55
October ...	71.6	79.4	83.6	70.4	13.2	64.1	73.5	97	82	32.71	29.51	29 50
November ...	70.1	77.8	80.8	69 0	11.8	68.2	72.2	94	83	19 80	29.56	29.55
December ...	67.4	76.2	80.0	67 1	12.9	66.3	69.2	96	79	11.10	29.62	29.61
1892												
January ..	65.5	79 5	79.7	64.7	15.0	63.6	74.0	93	83	8.04	29 62	29.60
February ...	63.1	76.4	80.3	61.9	18.4	61.0	65.6	93	70	5.01	29 57	29.59
March ...	65 7	79.1	82 7	64.4	18.3	64.3	70.0	93	74	1.92	29.60	29.58
Means ...	68.7	79 5	82 4	67.7	14.7	66.8	72.2	95	79	143.22	29.57	29.56
			Mean 75 0							Total.		

Month.	Hill Garden.—Elevation 4,907 Feet.															Newhaven Gap.—Elevation 5,600 Ft.			Blue Mountain Peak—Elevation 7,406 Feet.					
	Pressure.		Temperature.—Degrees Fahrenheit.					6 feet under ground.		Dew Point.		Humidity.		Wind.			Temperature.							
	7 a.m.	3 p.m.	7 a. m.	3 p.m.	Max.	Min.	Range.	7 a.m.	3 p. m.	7 a. m.	3 p. m.	7 a. m.	3 p. m.	Direction.	Force.—Miles.	Rainfall.—Inches.	Max.	Min.	Rainfall.—Inches.	Date of Observation.	Time of Observation.	Temperature.	Max. Temp.	Min. Temp.	Rainfall.—Inches.
1891.																									
April ...	25 in. .217	25 in. .210	58.9	62 6	67.6	57.6	10.0	61.2	...	54.9	59.5	86	89	.	86.0	5.16	75.3	46.5	12.75	25.4.91	2.45p.m.	60	76	41	10.09
May ...	.228	.227	62.6	64.6	70.8	61.9	8.9	61.2	...	57.6	61.5	84	90	.	19.1	12.67	77.5	50.0	13.13	31.5.91	2.30 "	62	73	41	16.22
June ...	.305	.198	64.0	66.6	70.2	59.8	10.4	61.7	...	60.0	62.3	87	82	.	56.5	11.03	80.5	51.0	6.50	28.6.91	2.15 "	60	73	45	21.60
July ...	.223	.284	63.4	67.6	72.8	60.6	12.2	62.6	...	56.2	61.9	78	82	.	106.5	4.29	...	...	3.75	1.8.91	2.35 "	65	70	46	9.00
August ...	.309	.320	64.5	67.1	72.5	56.8	15.7	63.8	...	55.3	64.0	72	90	.	65.8	3.75	...	...	...	29.8.91	3.30 "	50	72	47	9.00
September ...	.322	.325	64.7	66.8	71.3	62.5	8.8	63.8	...	58 5	65.5	80	96	.	36.8	9.42	...	...	...	27.9.91	10.45.a.m.	52	76	48	3.30
October ...	.268	.247	63.4	64.6	69.0	62.7	6.3	63.5	...	59.7	62.8	88	94	.	82.9	23.47	...	...	...	31.10.91	11.0 "	57	72	45	35.12
November ...	.323	.304	60.8	65.9	68.8	61.1	7.7	63.1	63.5	57.1	62.3	88	88	E	70.2	16.52	...	...	...	28.11.91	2.5 p.m.	64	69	42	33.27
December ...	.362	.349	58.1	67.5	68.5	58.3	10.2	62.6	63.0	53.9	57.1	86	69	E	59.4	6.20	74.3	41.5	22.90	3.1.92	11.15 a.m.	67	70	36	23.50
1892.																									
January ...	.336	.327	56.4	62.3	67.0	56.3	10.7	62.1	62.4	52.1	58.6	85	88	E	44.8	7.15	68.8	45.5	16.46	30.1.92	11.15 "	60	70	35	14.80
February ...	.317	.303	54.1	62.4	66.4	52.9	13.5	61.1	61.6	49.2	57.5	83	82	E	43.4	2.78	73.3	42.5	2.52	27.2.92	11.30 "	60	73	42	8.00
March ...	.323	.315	58.1	63.1	67.5	57.2	10.3	61.0	61.2	52.0	59.3	80	86	E	41.4	0.96	73.3	44.5	0.06	2.4.92	11.35 "	55	73	38	2.65
Means ...	25.293	25.284	60.7	65.0	69.3	58.9	10.4	62.3	62.3	55.5	61.0	81	86	E	59.4	103.40	74.9	45.9	...	...	...	58.5	72.2	42.1	186.55
					Mean 64.1											Total.	Mean 60. 4						Mean 57.1		Total

APPENDIX IV, *continued.*

HOPE GARDENS—ELEVATION 600 FEET.

Month.	Aneroid Barometer 7 a.m.	Thermometers 7 a.m., Fah.					Dew Point 7 a.m.	Humidity 7 a.m.	Rainfall.
		Dry Bulb.	Wet Bulb.	Max.	Min.	Range.			
1891.									
April ...	29.20	70.2	67.2	86.0	66.9	19.1	64.8	84	4.75
May ...	29.20	74.2	70.1	88.0	71.5	16.5	68.0	84	7.17
June ...	29.19	77.0	72.8	89.5	72.3	17.2	70.3	79	6.12
July ...	29.21	74.9	71.2	90.7	70.6	20.1	68.8	81	1.98
August ...	29.22	74.5	70.9	90.6	70.5	20.1	68 3	78	5.66
September ...	29.19	73.6	70.8	88.0	70.9	17.1	68.7	84	7.08
October ...	29.16	79.0	75.8	89.4	76.2	13.2	73.5	84	14.53
November ...	29.19	73.6	71.2	87.2	71.9	15.3	69.5	87	4.90
December ...	29.24	68.8	66.4	84.6	66.6	18.0	64.5	87	1.11
1892.									
January ...	29.23	66.4	64.6	83.6	63.6	20.0	63.1	89	1.19
February ...	29.21	63.7	62.0	83.2	61.9	21.3	60.6	88	0.88
March ...	29.21	68.7	65.9	86.9	70.3	16.6	63.9	84	0.25
Means ...	29.20	72.0	69.0	87.3	69.4	17.8	67.0	84	55.62 Total.
				Means. 73.3					

APPENDIX IV, *continued.*

KING'S HOUSE—ELEVATION 400 FEET.

Month.	Temperature. Degrees Fahrenheit.					Dew Point.		Humidity.		Rainfall. Inches	Pressure.	
	7 a.m.	3 p.m.	Max.	Min.	Range.	7 a.m.	3 p.m.	7 a.m.	3 p.m.		7 a.m.	3 p.m.
1891												
April ...	75.0	82.1	83.2	69.6	13.6	68 1	74.1	79	78	0.80	.	.
May ...	76.8	82.5	83.5	72.3	11.2	73.4	77.2	89	84	5.10	.	.
June ...	77.5	85.6	84.3	74.6	9.7	75.5	77.4	94	77	4.80	29.92	29.87
July ...	78.4	86.7	86.2	74.2	12.0	75.0	82.4	89	87	3.00	29.95	29.90
August ...	77.2	83.0	.	73.7	.	72.3	75.3	85	78	7 40	29 95	29.91
September ...	76.3	82.5	85.7	73.9	11 8	71.3	74.5	85	77	4.25	29.91	29.88
October ...	75.9	81 6	83.6	72.7	10.9	71.5	77.2	86	87	11.50	29.85	29.81
November ...	74.3	79.9	80.5	70.8	9.7	69.1	73 0	84	80	5.40	29.87	29.82
December ...	70.9	78.9	80.8	66.9	13.9	64.6	71.3	81	78	1.50	29.95	29.91
1892												
January ...	69.9	79.5	80.9	66.9	14.0	62.8	70.4	78	74	0.80	29.96	29.92
February ...	66.9	79.7	81.7	64.0	17.7	63.3	69.7	88	78	1.75	29.96	29.95
March ...	68.4	86.5	86.6	65.0	21.6	62.4	70.6	81	59	0.10	30.0	29.92
Means ...	73.9	82.3	84.3	70.3	13.0	69.1	74.4	85	78	46.40	29.93	29.89
			Means 76.8							Total.		

Appendix IV, *continued.*

Kingston Public Garden, Elevation 60 Feet.

Month.	Pressure.		Temperature. Degrees Fahrenheit.					Dew Point.		Humidity.		Wind—Miles per Day.		Rainfall. Inches.
	7 a.m.	3 p.m.	7. a.m.	3 p.m.	Max.	Min.	Range.	7 a.m.	3 p.m.	7 a.m.	3 p.m.	Direction.	Force.	
1891.														
April ...	29.995	29.934	74.9	84.6	86.3	71.9	14.4	67.5	69.5	78	61	S.E.	70	1.25
May ...	29.980	29.930	77.1	85.2	87.0	73.1	13.9	69.7	71.3	78	63	S.E.	64	2.03
June ...	29.964	29.916	79.0	85.9	87.7	74.9	12.8	70.6	72.6	76	65	S.E.	112.7	6.47
July ...	30.009	29.960	78.6	88.6	90.4	75.0	15.4	68.8	70.6	72	56	S.E.	116.7	0.49
August ...	30.002	29.960	76.8	85.6	91.2	74.5	16.7	69.8	72.3	79	66	S.E.	69.8	3.08
September ...	29.975	29.922	76.9	85.6	89.4	74.4	15.0	70.3	74.4	80	69	S.E.	41.6	1.54
October ...	29.920	29.867	75.6	83.2	87.1	74.0	13.1	70.4	72.6	84	71	Var.	77.8	9.10
November ...	29.964	29.908	72.7	83.6	84.1	69.3	14.8	69.2	70.8	88	66	Var.	63.1	3.95
December ...	30.039	29.978	69.8	84.0	87.1	69.4	17.7	64.5	68.0	83	59	Var.	71.1	0.23
1892.														
January ...	30.032	29.969	69.4	83.0	86.1	68.4	17.7	63.4	67.5	81	60	Var.	93.4	0.15
February ...	30.033	29.974	68.6	82.1	84.8	66.6	18.2	62.6	65.7	81	58	Var.	97.0	0.34
March ...	30.025	29.956	72.2	83.9	85.8	69.8	16.0	66.4	70.3	82	64	S.byE.	117.6	0.19
Means ...	29.994	29.945	74.3	84.6	87.2	71.7	15.4	67.7	70.5	80	63	S.E.	82.9	28.82
					Means. 79.4									Total

No. 40. February, 1893.

BULLETIN

OF THE

BOTANICAL DEPARTMENT,

JAMAICA.

CONTENTS:

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[A Copy will be supplied free to any Resident in Jamaica, who will send Name and Address to the Director of Public Gardens and Plantations, Gordon Town P.O.]

JAMAICA:
GOVERNMENT PRINTING OFFICE, 79 DUKE STREET, KINGSTON.

1893.

EXPERIMENTS IN THE CULTIVATION OF VEGETABLES.—VII.

Peas.

The following Tables are a continuation of those published in Bulletin No. 38.

Names of Peas grown at Cinchona.	Date of Planting in January, 1892.	First appearance above Ground.	Days from Planting.	First Bloom.	Days from Planting.	Pods of Edible Size.	Days from Planting.	Days fit for Table Use.	First Seed Ripe.	Days from Planting.	Last Seed Ripe.	Days from Planting.	Number of Pods on a Plant—average.	Number of Peas in a Pod—average of 100.	Mean Average Temperature while Peas were growing	Minimum Temperature.	Maximum Temperature.	Average Maximum Temperature.	Average Minimum.	Rainfall.	Number of Days on which rain fell.	Height in feet.	Time of Cooking in Minutes.	Quality.
Carter's Little Wonder ..	11th	21st	10	Dead.	.	.	.	.	.	.	.	.	.	.	60.6	51.0	70.2	66.3	53.1	0.69	3	.	.	.
" Stratagem ...	"	"	10	"	.	.	.	.	.	.	.	.	.	.	60.6	51.0	70.2	66.3	53.1	0.69	3	.	.	.
" Pride of the Market	"	"	10	3.3.92	52	2.4.92	82	12	17.4.92	97	31.5.92	141	4	4	60.0	48.0	73.2	66.7	53.4	19.48	58	2½	18	2
" Blue Express ...	"	"	10	21.2.92	41	6.3.92	55	16	10.4.92	90	27.5.92	137	3	5	60.0	48.0	73.2	66.7	53.4	18.87	57	3	18	1
" Anticipation ..	"	"	10	Dead.	.	.	.	.	.	.	.	.	.	.	60.6	51.0	70.2	66.3	53.1	0.69	3	.	.	.
" Wonder of the World	"	"	10	"	.	.	.	.	.	.	.	.	.	.	60.6	51.0	70.2	66.3	53.1	0.69	3	.	.	.
" Balmoral Castle ...	"	"	10	2.3.92	51	31.3.92	80	14	20.4.92	100	27.5.92	137	7	5	60.0	48.0	73.2	66.7	53.4	18.87	57	5	18	1
" First Crop ...	"	"	10	20.2.92	40	11.3.92	60	12	8.4.92	88	30.5.92	140	6	5	60.0	48.0	73.2	66.7	53.4	19.48	58	3½	18	2
Laxton's Fillbasket ...	"	"	10	3.3.92	52	4.4.92	84	12	22.4.92	102	27.5.92	137	5	3	60.0	48.0	73.2	66.7	53.4	18.87	57	4	18	2
" William the First ..	"	"	10	20.2.92	40	31.3.92	80	15	24.4.92	104	30.5.92	140	6	4	60.0	48.0	73.2	66.7	53.4	19.48	58	5	20	3
McLean's Little Gem ...	"	"	10	1.3.92	50	26.3.92	75	12	20.4.92	100	10.5.92	120	5	3	59.6	51.0	71.2	65.7	53.4	10.22	49	2½	18	2
" Blue Peter ...	"	22nd	11	Dead.	.	.	.	.	.	.	.	.	.	.	60.6	51.0	70.2	66.3	53.1	0.69	3	.	.	.
Advancer ...	"	"	11	"	.	.	.	.	.	.	.	.	.	.	60.6	51.0	70.2	66.3	53.1	0.69	3	.	.	.
American Wonder or Emerald	"	23rd	12	"	.	.	.	.	.	.	.	.	.	.	60.6	48.0	70.2	66.3	53.1	0.69	3	.	.	.
Bishop's Long Podded ...	"	"	11	1.3.92	50	8.4.92	88	12	26.4.92	106	28.5.92	138	8	8	60.0	48.0	73.2	66.7	53.4	18.87	57	2½	20	3
Sharpe's Invincible ...	"	"	11	6.3.92	55	4.4.92	84	16	27.4.92	107	30.5.92	140	5	4	60.0	48.0	73.2	66.7	53.4	19.48	58	4½	20	3
Princess Royal ..	"	"	11	6.3.92	55	8.4.92	88	18	26.4.92	106	10.5.92	120	11	4	59.6	48.0	71.2	65.7	53.4	10.22	49	6½	20	1
Omega ...	"	21st	10	Dead.	.	.	.	.	.	.	.	.	.	.	60.6	51.0	70.2	66.3	53.1	0.69	3	.	.	.
Kentish Invicta ...	"	"	10	18.2.92	38	8.3.92	57	16	9.4.92	89	27.5.92	137	9	6	60.0	48.0	73.2	66.7	53.4	18.87	57	5	18	2

Abundance ...	"	"	10	1.3.92	50	31.3.92	80	16	28.4.92	108	31.5.92	141	8	5	60.0	48.0	73.2	66.7	53.4	19.48	58	2½	18	1
Carter's Dignity ...	"	"	10	6.3.92	55	7.4.92	87	12	22.4.92	102	27.5.92	137	5	5	60.0	48.0	73.2	66.7	53.4	18.87	57	6	18	1
" Progress ...	"	23rd	12	.	Dead.		.	.	.	.	.	.	.	.	60.6	51.0	70.2	66.3	53.1	0.69	3	.	.	.
" Telephone ...	"	21st	10	4.3.92	53	4.4.92	84	15	26.4.92	106	27.5.92	137	5	6	60.0	48.0	73.2	66.7	53.4	18.87	57	6	18	1
" Telegraph ...	"	"	10	4.3.92	53	4.4.92	84	18	28.4.92	108	31.5.92	141	6	6	60.0	48.0	73.2	66.7	53.4	19.48	58	7	18	1
" G. F. Wilson ...	"	"	10	6.3.92	55	7.4.92	87	15	28.4.92	108	31.5.92	141	6	5	60.0	48.0	73.2	66.7	53.4	19.48	58	5	18	3
" Elephant ...	"	23rd	12	Attacked by mildew and died.					.	.	.	.	.	.	60.6	51.0	70.2	66.3	53.1	1.02	4	.	.	.
" Empress ...	"	"	12	25.4.92	74	20.4.92	100	16	4.5.92	114	31.5.92	141	5	3	60.0	48.0	73.2	66.7	53.4	19.48	58	6	18	1
Laxton's Alpha ...	"	21st	10	1.3.92	50	2.4.92	82	15	22.4.92	102	27.5.92	137	12	4	60.0	48.0	73.2	66.7	53.4	18.87	57	4	18	2
" Supreme ...	"	"	10	4.3.92	53	2.4.92	82	16	26.4.92	106	27.5.92	137	6	5	60.0	48.0	73.2	66.7	53.4	18.87	57	5	18	1
" Prolific ...	"	"	10	1.3.92	50	1.4.92	80	16	28.4.92	108	10.5.92	120	12	4	59.6	48.0	71.2	65.7	53.4	10.22	49	5	18	3
Sturdy ...	"	"	10	1.3.92	50	2.4.92	82	14	22.4.92	102	27.5.92	137	8	5	60.0	48.0	73.2	66.7	53 4	18.87	57	4	18	2
Dickson's Favourite ...	"	"	10	6.3.92	55	7.4.92	87	16	22.4.92	102	10.5.92	120	3	5	59.6	48.0	71.2	65 7	53.4	10.22	49	4	18	2
"Dwarf" Sugar ...	"	"	10	6.3.92	55	5.4.92	85	16	4.5.92	114	27.5.92	137	8	4	60.0	48.0	73.2	66.7	53.4	18.87	57	7	18	2
Early Sunrise ...	"	"	10	1.3.92	50	7.4.92	87	18	4.5.92	114	27.5.92	137	7	5	60.0	48.0	73.2	66.7	53 4	18.87	57	3	18	3
James's Prolific ...	"	"	10	Dead.		.	.	.	.	.	.	.	.	.	60 6	51.0	70.2	66.3	53.1	1.02	4	.	.	.
Marvel ...	"	"	10	"		.	.	.	.	.	.	.	.	.	60.6	51.0	70.2	66.3	53.1	0.69	3	.	.	.
Hundredfold or Cook's Favourite ...	"	"	10	"		.	.	.	.	.	.	.	.	.	60.6	51.0	70.2	66.3	53.1	1.02	4	.	.	.
Duke of Albany ...	"	"	10	6.3.92	55	1.4.92	80	16	26.4.92	106	26.5.92	136	8	8	60.0	48.0	73.2	66.7	53.4	18.85	56	6	18	1
Champion of England ...	"	"	10	4.3.92	53	7.4.92	87	18	4.5.92	114	26.5.92	136	6	5	60.0	48.0	73.2	66.7	53.4	18.85	56	7	18	1
British Queen ...	"	"	10	5.3.92	54	7.4.92	87	18	26.4.92	106	31.5.92	141	7	4	60.0	48.0	73.2	66.7	53.4	19.48	58	8	18	1
Tall Sugar ...	"	"	10	7.3.92	57	1.4.92	80	20	4.5.92	114	21.5.92	131	10	3	59.6	48	73 2	65.7	53.4	18.60	55	8	18	3
Ne Plus Ultra ...	"	"	10	6.3.92	56	2.4.92	81	20	2.5.92	112	20.5.92	130	10	4	59.6	48	73.2	65.7	53 4	11.30	54	8	18	3
Emperor of the Marrows ...	"	"	10	6.3.92	55	7.4.92	87	20	4.5.92	114	31.5.92	141	10	4	60.0	48.0	73.2	66.7	53.4	19.48	58	7½	18	2

W. H.

PLANTS IN THE PUBLIC GARDENS.

Jamaica Plum or Tree Tomato.

The Jamaica Plum (*Cyphomandra betacea*) is an excellent fruit and is said to have a beneficial action upon the liver. It can be eaten as a dessert fruit, cutting in two, and using a spoon, or it can be cooked like an ordinary tomato. The following is a receipt for stewing :—Scald the fruit, and remove the thin outer skin. Put the fruit into an enamelled saucepan with just enough water to cover them. Add sugar to taste, and stew gently for 15 or 20 minutes. Serve up when cold.

The Jamaica Plum is exceedingly well adapted for export as the skin is tough, and the fruit will keep perfectly for a month after picking.

This is a product which should be taken up for all the higher elevations of Jamaica, as it will probably grow well from 2,000 to 5,000 feet. The plant is an erect shrub. Seedlings will bear fruit in from one to two years,—cuttings in less than a year.

It is a native of the Andes, and is met with occasionally in the hills of Jamaica, apparently wild. It has been distributed from the Jamaica Botanic Gardens to the hills of India, Ceylon and Hong Kong.

Napoleona.

Napoleona imperialis, is a small tree, native of western tropical Africa. The structure of the flower is interesting. The corolla consists of three rows: the outer is of a rich claret colour with a cream, or apricot coloured margin; it is divided into 5 lobes, each lobe with 6 or 7 ribs spreading from the base like a fan; as it expands, it bends outwards concealing the calyx. The next row is somewhat like the "crown" of the passion flower, consisting of a number of whitish threads tipped with pink. The third and innermost row is cup-shaped with the margin bent inwards and divided into numerous pinkish teeth. Within this, come the stamens, about 20 in number, cream-coloured with the points of a pale claret colour. The fruit is soft, somewhat like a pomegranate, the rind contains so much tannin that a kind of ink is made from it in Africa. This ornamental tree can be now supplied from the Public Gardens.

CLOVES.

The clove, *Eugenia caryophyllata*, Thunberg, is a tree 30 or 40 feet high when full grown. The cloves of commerce are the unexpanded flower-buds, of which great numbers are produced. The average weight of cloves produced by a tree in Amboyna is 2 or 2½lbs, and as it takes about 5,000 cloves to make a pound, each tree will have 10,000 to 12,000 flowers, and that twice in the year.

One of the original trees planted by the French in Mauritius yielded in some years 125 lbs of spice, and there must have been more than 600,000 flowers on this single tree during the year, a fact says Bory de St. Vincent, "which would appear incredible, were we not to mention that this beautiful tree is at least 40 ft. high, throwing out innumerable branches, some of which falling down on all sides, form a pyramid of verdure."

At the end of the year the tree is covered with its lovely crimson buds, shown off by the background of dark-green leaves. The buds are picked by hand as soon as they turn crimson and before opening. They are then dried in the sun.

The form of the dried buds somewhat resembles a nail,—the French call the spice *Clou*, and the Spanish *Clavo*, whence the English name *Clove*.

The tree begins to flower at the age of 6 years, yields the largest crops at 12, and does not last longer than 20 years.

The spice appears to have come into use in Europe after the Portugese in the year 1511 discovered the Moluccas, where it is a native. When the Dutch seized the Spice Islands, they tried to restrict the cultivation, but the French introduced the tree into Maurititus in 1769, and from that island into Cayenne 10 years later.

At later periods they planted it in Haiti, Dominica, St. Kitt's and Martinique, whence it was introduced to St. Vincent. It was first planted in Jamaica in 1769 by Dr. Thomas Clarke, Island Botanist, who obtained it from Port-au-Prince.

Cloves have been supplied commercially almost wholly from the island of Zanzibar. But with the abolition of slavery there, the exports will fall off very considerably, and the supply must come from elsewhere.

The tree in the Castleton Gardens is now flowering, and there are 500 young seedlings ready for planting, which will be delivered in Kingston at the rate of 2d each.

Kangaroo Grass.

Kangaroo Grass (*Anthistiria ciliata*, Linn.) is well known in Australia, and it is also found in the warmer parts of Asia and Africa. It is not recorded from the New World, and it is probable therefore that it has been accidentally introduced into Jamaica. It was brought to my notice two or three years ago as occurring in Trelawny, and now another correspondent from the same parish makes enquiries about it.

This grass is recommended as a pasture grass for dry situations as it is perennial, and the long roots penetrate to a great distance in the soil. It is most nutritious. and horses and cattle are so fond of it, that in an over-stocked pasture, it is liable to be killed out. Cut when flowering, it makes an excellent hay. Baron von Mueller gives the chemical analysis as follows: —Albumen, 2.05; gluten, 4.67; starch, 0.69; gum, 1.67; sugar, 3.06. He says that in good seasons and in fair soil it will rise to over man's height.

Seed is only rarely produced, but it is propagated by division of the roots. W.F.

REPORT ON COFFEE LEAF FUNGI.

28th January, 1893.

To the Honourable Colonial Secretary.

Sir,

I have the honour to inform you that I visited Manchester to enquire into statements that were made that coffee shrubs in some places were dying in consequence of being attached by a leaf disease.

On enquiry, the Hon. J. P. Clark, and Messrs. Braham and Fitzherbert informed me that the Coffee shrubs on their estates were not suffering from disease.

I rode through the Brokenhurst Coffee fields belonging to Mr. Wynne and found that the leaves on most of the shrubs were spotted through the growth of a stalked yellowish fungus quite evident to the naked eye ; and agreeing with the description given of *Stilbum flavidum* by Dr. M. C. Cooke, a well known writer on Fungi. This fungus was plentiful not only at Brokenhurst but elsewhere on settlers' Coffee, and is probably abundant in Manchester. It occurs very rarely in the Blue Mountain districts, and there apparently, only at low elevations in damp, shady places.

I attribute the extent to which this fungus is spread in Manchester to the partial shade which is found favourable to the growth of Coffee in that district. In the Blue Mountains where the shrubs are exposed to the full sunshine the fungus has not the same opportunity of development.

This fungus *Stilbum flavidum* does not appear to me to do any great damage to the Coffee, and it would scarcely be worth while to apply any remedy.

Another fungal disease which had attacked leaves sent to me from Manchester has the appearance of a fine spider's web on the underside of the leaf, and continued down the stalk to the twig. When the under surface of the leaf is nearly covered, the leaf drops, but continues to hang for some time by the fungus thread.

I found this disease in one place only, and was informed that it had been known there for 12 or 13 years, and that during that time it had spread through about half an acre of Coffee on a plantation of five or six acres. From enquiries made, it appeared that the Coffee had been planted somo years ago in ruinate land. Whether care had ever been bestowed on this Coffee field seemed very doubtful, but at the time of my visit, the shrubs showed utter neglect. They had been allowed to grow with five or six trunks from a single root to a height of ten or twelve feet. Wherever in the cavities of the limestone rock a berry had fallen and taken root, it was allowed to grow, so that as a rule the shrubs were only three or four feet apart. Orange and other trees were intermingled with the Coffee and all were more or less covered with growths of all kinds; fungi, lichens, mosses, wild vines, wild pines, parasitic loranthaceæ, etc. The ground was cumbered with weeds; and it was surprising that Coffee could grow at all under such unfavourable conditions.

The fungus has been identified at Kew by Dr. M. C. Cooke as *Pellicularia Koleroga* first described by him from Mysore. It has also been noticed in Venezuela.

I attribute no importance whatever to this fungus, and think it a pity that alarm should have been caused by the notices published in the newspapers.

I may add that Mr. Wynne complains of damage being done to both Coffee and Orange Trees, by slugs eating away the young bark. The slugs have been kept down only by constant hand picking facilitated by intermingling with the Coffee banana plants of which the slugs are very fond. As the Orange Trees are chiefly of spontaneous growth, and young trees are liable to be utterly killed off by the slug, it is possible that after a few years the amount of fruit available will be very seriously diminished. Coffee Planters in Manchester have reason to be alarmed at the increase of the ravages of this pest. A writer in Biedermann's Centralblatt, 1881, states that the potash manure known as "Kainit" has the power of destroying caterpillars, and is harmful to snails. It might be well to try the experiment of applying some to the ground round a few Coffee shrubs.

I have &c,

W. Fawcett,
Director of Public Gardens and Plantations.

REPORT ON INFESTED SUGAR CANES.

I have examined the sugar-canes and specimens of pests from the Cave Valley Estate, forwarded in accordance with the directions of the Director of Public Gardens and Plantations. The following insects, fungus and worm were found on or at the roots of the canes :—

(1.) *Diatræa saccharalis*, Fabr.
Several lepidopterous larvæ were found inside a cane not far from the root. The cane had become brown and rotten. These larvæ are small, yellowish-white, spotless, with red-brown heads. So far as I can see, they are the immature larvæ of *Diatræa saccharalis*.

(2.) *Lachnosterna ?* or *Ligyrus ?*
Among the specimens sent in a bottle are a few Scarabæid larvæ, and I found one alive at the roots of the cane. Until the adult beetle is reared, it will be impossible to identify the species.

(3.) Curculionid larva.
In a rotten cane-root, apparently of last year's growth, I found a single larva of some weevil. It is about 5 millim. long, plump, purplish with a pale line along the side. The head is yellowish-white, the mouth-parts dark.

(4.) Telephorid larvæ and adults.
In the bottle are a larva and adult female of some species of "glow-worm."

(5.) *Stylopyga antillarum*, Brunner.

Many specimens of a brown-black cockroach were sent in the bottle, and some few were found still lurking amongst the canes received. The species is very similar to, if not altogether identical with, *S. antillarum*, which was described last year from a specimen found in St. Vincent.

(6.) *Dactylopius calceolariæ*, Maskell.

In the sheathing bases of the leaves I found a few specimens of a mealy-bug, which appears to be identical with *D. calceolariæ*. It has been previously found on sugar-cane in Fiji, but is new for Jamaica.

(7.) Earthworm.

At the roots of the cane two earthworms were found. The largest is over three inches long when alive, colour purplish grey, except the first 22 rings or segments, which are pink. The chœtæ are in eight longitudinal rows, arranged as regards the distance of the rows from one another, much like those of *Plutellus perrieri* Benham, or a *Microscolex*. No clitellum is developed, so I suppose the specimens to be immature.

(8.) *Trullula sacchari*, Ellis & Everhart.

Inside the dead sheathing bases of the leaves on the smaller stems, I found black spots which prove to be *T. sacchari*. Hitherto the fungus has been found on the culm, but having compared the present specimens with part of the original lot, and examined the spores or conidia, I have no doubt as to their identity.

Conclusions.

It seems probable enough that the *Diatræa* is at the bottom of the trouble experienced. This insect, and the remedies for it, are fully discussed in the *Botanical Bulletin* for April 1892. The living roots did not appear to be seriously attacked, but no doubt the Scarabæid larvæ do some damage, nibbling at them. The Curculionid larva, living in the dead roots, is harmless. The Telephorid larvæ are beneficial creatures, and may attack the *Diatræa* caterpillars. (One of this family is a known enemy of *Diatræa* in Louisiana.) The cockroaches probably are attracted by the juice of the rotting canes. The mealy-bug, so far it goes, is harmful, but I do not think it is a serious trouble. The earthworm is of no particular importance. The *Trullula*, as here seen, seems harmless; and it seems still open to question whether it attacks sound canes, notwithstanding apparent strong evidence to the contrary from Trinidad.

T. D. A. Cockerell,
Institute of Jamaica,
Kingston, Feb. 7, 1893.

INSTRUCTION IN THE CULTIVATION OF THE GRAPE VINE.

Mr. Thompson of the Botanical Department has given demonstrations on the treatment of mature vines at Collins Green, by permission of S. L. Schloss, Esq., on the treatment of yonng vines at the vinery close to the East Lodge, Kings House Grounds, by permission of His Excellency the Governor.

Young vine plants of the best English kinds will be ready for distribution in April. The charge will be 2d. each plant, delivered in Kingston.

Mr. Thompson has drawn up the following notes on the present treatment of vines in continuation of those in Bulletin, No. 38, for those who are unable to attend the demonstrations.

"All vines which have been kept dry till now, as I recomended in November of last year, should now have the growth of last year's wood well ripened. The main stem of the vine should be kept as straight as possible. The side shoots on the main stem should be cut back to a plump bud close to the old wood of the main stem. It must be understood that the fruit of this year will be borne on the wood of last year.

"After pruning, vines grown on a flat arbour can be left as they are, but vines grown on a trellis should be laid or tied down to a level with the bend in the main stem; by so doing you give the vine a better chance to break its buds evenly all over the vine, instead of just breaking at the top of the shoot, as is often the case when the vines are simply tied up to the trellis.

"The roots of the vines should not be watered till about a week after the pruning has been done; then the vines should have a good soaking of water, not a few bucketfuls but a watering equivalent to about six inches of rain, so that the whole of the roots will get well watered. It is of the utmost importance that the vine should have a good soaking for if the water does not reach the end of the young roots then you are preventing the roots from having a chance to grow; and if all the roots are not in a fit condition to grow, you cannot expect the buds of the vine to break well.

"Besides the watering at the roots it is of the utmost importance that the vines should be sprinkled over with a good syringe or the hose. This should be done at least twice a day, and if it can be done several times a day, the buds of the vine will break so much better. The syringing should be stopped as soon as the buds have all broken, and started to grow.

After or before watering the vine-borders, the borders should have a few inches of good stable manure put over them. The manure will prevent the sun from absorbing so much of the moisture and help to keep the roots cool.

If the copious supply of water is given when the vines are started, they will not need any more water till just as they are showing for flowering, then they should have another soaking like the first.

Anyone with young vines which have made growth from six to twelve feet, should prune them now. If they are intended for growing on a trellis, the vine shonld be cut back to a good bud about three feet from the ground. If the vines are intended to be grown as standards out in the field, then cut them back to a good eye about *six inches* from the ground; and in both cases allow only one main growth to grow this year."

COCCIDÆ, OR SCALE INSECTS.—II.

By T. D. A. Cockerell, F.Z.S., Curator of the Museum, Institute of Jamaica.

It will be my endeavour, in this and subsequent papers, to so describe the West Indian Coccidæ that they may be recognised by any-one who is willing to take a little trouble in examining them, without having any particular knowledge of Entomology. For this reason, all technical terms and microscopical details will be avoided as much as possible; although in certain cases the use of the microscope is absolutely necessary to determine the identity of a species, and therefore microscopical characters must be cited. Strictly Entomological articles, describing the characters of the species in in detail, will be published elsewhere.

It is proper to state that although all the *known* West Indian Coccidæ will be described in these papers, new species, and even new genera, are frequently being found, rendering any list which might be published incomplete in a short time. For this reason, nobody need be much surprised if he should come across a scale not resembling anything I have described. In the event of such a discovery it will be necessary to send specimens to the present writer or some other student of Coccidæ, in order that they may be properly classified.

Before describing the species, it is desirable to give an account of the 23 genera in which they are included. These are comprised in four sub-families, known as the *Monophlebinæ*, *Coccinæ*, *Lecaniinæ*, and *Diaspinæ*. This arrangement is derived from Mr. Ashmead's generic synopsis (*Trans. Amer. Ent. Soc., 1891*), and although it appears to require revision, it may be adopted in the present instance.

(I.) *Monophlebinæ.*

The adult females are active or stationary, segmented, with no scale, but frequently more or less covered with a mealy, cottony or waxy secretion. The antennæ have 10 or 11 joints (rarely 9). The males have facetted eyes.

(1.) *Icerya*, Signoret. The adult females have eleven joints to the antennæ, a character which should be observed, in order to distinguish them from similar-looking species of the next sub-family, in which the joints are fewer. *I. rosæ*, the only species yet observed in Jamaica, is a plump greyish insect, about the size of a half-pea, and more or less covered with mealy secretion. The larvæ are red. This is found on rose, *Amherstia*, and other plants. Mrs. Swainson found it in some plenty under the bark of lignum-vitæ in Kingston. Another species, *I. montserratensis*, is found in Montserrat and Trinidad.

(II.) *Coccinæ.*

These resemble the last family a good deal, but the antennæ of the adult female have from 6 to 9 joints; and there is usually a pair of distinct, though sometimes short filaments arising from the hind end of the body. The posterior cleft, which is so noticeable in the next family, is wanting.

(2.) *Dactylopius*, Signoret. The species of this genus are commonly known as "mealy bugs". The antennæ of the adult females have eight (rarely seven) joints. These insects, which abound on various trees and shrubs, are small, soft, and more or less oval in shape, with the segmentation distinct and the body partly covered with a mealy secretion. Some of the species have a fringe of cottony or mealy appendages all round the body, and a pair of very distinct caudal filaments; while others lack these ornaments. Two species are common in Kingston; and a little pink species may be found inside the cavities of pine apples. A curious new species has been found by Dr. Strachan at the Caicos Is., Bahamas.

(3.) *Coccus*, Linné. This genus comprises the cochineal insect, which may be found on *Opuntia* in the Parade Garden, Kingston. It occurs in masses covered by white secretion, but if this is scraped away with a knife the true cochineal colour will be observed. The antennæ of the female have seven joints.

(4.) *Margarodes*, Guilding. Consists of one species, a curious insect found in Antigua and the Bahamas, living in the ground associated with ants. It has some resemblance to a pearl, and is accordingly known as the "ground pearl." The adult female has antennæ of seven joints, and is said to lack a rostrum.

(III.) *Lecaniinæ.*

The distinguishing character of this group is the presence of a distinct cleft at the posterior end of the body, above which is a pair of more or less triangular plates. The sub-family, according to Ashmead's arrangement, includes some very little related genera, which ought not, in my opinion, to be referred to it. These I shall provisionally class below as aberrant genera.

(5.) *Lecanium*, Illiger. A genus with many species differing very much in appearance. They have no scale, properly speaking, but the back of the female is so constructed that it represents a scale. The adult females have antennæ of from 6 to 8 joints. The shape of these insects is sometimes flat and oval in outline, sometimes high and elongated, like a flat-bottomed boat turned upside down, and sometimes hemispherical. The colour of the flat species may be green or brown, that of the convex ones brown or black. Some are viviparous, others produce eggs. A subgenus, *Bernardia*, Ashmead, is hemispherical, brown or black, with some indication of ridges, at least in the young, and eight-jointed antennæ. It is a member of this subgenus, the "brown scale," that is so injurious to creepers and other plants in Kingston.

(6.) *Ceroplastes*, Gray. Scratch a *Ceroplastes*, and you have a *Lecanium*. That is to say, the wax-scales, *Ceroplastes*, are like the hemispherical brown Lecaniums except that they are covered with a layer of wax. Sometimes this wax forms distinct plates, but in other species this is not the case. In a

new species found by Dr. Strachan at the Island of Grand Turk, the wax is so abundant that that from the several scales runs together, covering the scales and surrounding the twig on which they grow, almost as the wax of a candle surrounds the wick.

(7.) *Vinsonia*, Signoret. There is only one species, which is something like a small *Ceroplastes*, but round the margin are seven waxy rays, making the insect look like a little star. They are fairly common on mango leaves in Jamaica, and are also found on orchids.

(8.) *Pulvinaria*, Targioni-Tozzetti. These, when immature, are just like the flat oval Lecaniums, but the adult female produces a large cottony sac, in which she lays her eggs. As this sac is produced, she shrivels up, so as to appear like a little dark scale at one end of it. The white cottony ovisacs are very conspicuous; those of *P. cupaniæ* must often have been observed on the leaves of Akee trees in Kingston.

Aberrant genera.

(9.) *Orthezia*, Bosc. These are curious looking creatures, the females small, broadly oval, with eight-jointed antennæ and well-developed legs. They are more or less ornamented with a waxy covering, and produce long white ovisacs which project posteriorly. They have a sort of superficial resemblance to little spiders. There is a species, *C. insignis*, found on low plants in gardens in Jamaica, particularly on violets and chrysanthemums. This genus is placed by Maskell in the same subdivision as *Dactylopius*.

(10.) *Tachardia*, Signoret. This consists of the lac insects, which cover themselves with a hard coating of lac, strong but brittle, melting at a moderately high temperature. There is a species in Jamaica, infesting the coco plum, and appearing as subglobular lumps rather smaller than a pea, with a crimson knob on the back. Maskell, in a paper published 1891, refers this genus to the group *Brachyscelidæ*. The genus is usually called *Carteria* but the name was altered on account of preoccupation.

(11.) *Planchonia*, Signoret. Small scales, hardly bigger than the head of a pin, nearly circular and slightly convex. They look like members of the next sub-family, but with a lens it is easily seen that they have a delicate waxy fringe all round the margin, which distinguishes them. *P. pustulans* is common on twigs of Akee in Kingston, producing a pustular appearance; *P. oncidii* is very similar, but bright yellow in colour, it is found on orchids, and was discovered by Dr. Henderson.

(12.) *Asterolecanium*,, Targioni-Tozzetti. These are very much like *Planchonia*, and have the fringe, but from their more elongated shape they might be taken, on hasty examination, for species of *Lecanium*. Of course they are really very different from any *Lecanium*, being enclosed in a true scale, and having a very different structure in many ways There is a species, *A. bambusæ*, found on bamboo stems at Moneague; and also a very small and narrow species, *A. palmæ*, found on leaves of cocoanut palm sent by Dr. Sinclair from near Montego Bay.

(IV.) *Diaspinæ.*

These are the true scale-insects, having a scale distinct from the insect itself. They are all small, on the average about the size of a pin's head, and are found abundantly on a great variety of plants. The scales may be any shape from circular to linear, and flat to hemispherical, and any colour from white to reddish, brown, or black. They have this peculiarity, that the exuviæ of the younger stages are retained on the back of the scale. The female scales show the minute shield-shaped transversely ribbed "first skin," and this is situated either in the middle or to one side of a larger second skin, below which is the larger scale proper. In the species of *Diaspis*, which have white scales, these first and second skins stand out prominently as a dark spot. In the subgenus *Targionia* of *Aspidiotus*, the exuviæ are covered by secretion, so that only a nipple-like prominence is left. The male scales show only the first skin and the scale proper: they are, in several of the genera, totally unlike those of the female in form. Thus, in *Diaspis* the female scale is oval or rounded; that of the male cylindrical with parallel sides, and much smaller.

(13.) *Aspidiotus*, Bouché. Very numerous in species. The female scales are circular or slightly oval, flat or convex; the male scales are either like them but smaller, or (as in the case of a species found on orchids) narrow and elongated. When the male scales are elongated, they are not cylindrical, white, with terminal exuviæ, like *Diaspis*. *Aspidiotus* proper has the female scales white or whitish, and the exuviæ uncovered. The subgenus *Targionia* Signoret (I here use the name in a wider sense than was originally intended) contains species with covered exuviæ, and the scales generally dark-coloured.

(14..) *Diaspis*, Costa. The female scales are white, with the exuviæ conspicuous from their darker colour; the male scales are small, cylindrical, with terminal exuviæ, and a single median keel. A species of this genus, *D. lanatus*, is very destructive to *Capsicum* plants in Kingston.

(15.) *Aulacaspis*, Cockerell. Female scale nearly circular in outline, waxy-white or pale greyish; male scale like that of *Diaspis*, but with three strong keels. *A. rosæ* is found on roses; *A. boisduvalii* on cocoanut palm.

(16.) *Parlatoria*, Signoret. The female scale is brownish, nearly circular, or elongate-oval, with the exuviæ to one side, and the second skin quite large. The male scale is small, elongate, dark in colour, with parallel sides and the exuviæ at one end. A species is common in Kingston on leaves of croton.

(17.) *Pseudoparlatoria*, Cockerell. The only West Indian species is found commonly in Kingston usually on *Acalypha*. The female scales, which infest the twigs, are blackish, and resemble those of *Aspidiotus*. The male scales, found more usually along the midribs of the leaves, resemble the female scales of *Parlatoria* and are pale in colour.

(18.) *Mytilaspis*, Signoret. The female scales, as the name indicates, are mussel-shaped, usually brown in colour. The male scales are similar but smaller and narrower. A species of this genus, *M. citricola*, may very often be observed on oranges.

(19.) *Pinnaspis*, Cockerell. The scales are brown or whitish and like *Mytilaspis* in shape, though rather broader. The distinguishing character is afforded by the second skin, which is very large, and covered by secretion. Species occur in Jamaica on cocoanut palm and bamboo.

(20.) *Chionaspis*, Signoret. The female scale is elongate or broadly mussel-shaped, in nearly all the species white, with darker exuviæ. The male scale is white and keeled, like that of *Aulacaspis*. In one American species the male scale is not keeled, but this should probably be removed from the genus.

(21.) *Fiorinia*, Targioni-Tozzetti. A species of this genus is found on cocoanut palm. The scale resembles *Parlatoria* but is more elongate, and the second skin, which is keeled, is so large as to leave nothing but a sort of fringe round the margin to represent the true scale. The first skin is placed at one end, and very evident.

(22.) *Ischnaspis*, Douglas. The one species of this genus is common on palms, and may be easily recognised by its shape, being linear and black in colour.

Aberrant genus.

(23.) *Conchaspis*, new genus. I found this on a Madagascan orchid, *Angræcum eburneum* var *virens*, at Hope Gardens. The scale is about 1 millim. diameter, white, high conical, very much like the shell *Calyptræa chinensis* in miniature. The apex is a little to one side of the centre. The insect under the scale is something like a *Diaspis* superficially, but the structure, examined with a microscope, is very peculiar, and there are legs, which is never the case with adults of *Diaspinæ*, so far as yet known.

Mr. L. O. Howard kindly gave me his opinion about it as follows :—

"Your *Conchaspis* does not seem to belong to the *Diaspinæ*. The characters of the last segment as well as the presence of antennæ and legs would place it in the *Coccinæ*, and possibly in the *Acanthococcini*, in which it would form a new genus. The scale resembles that of *Inglisia* although the anal characters remove it from the *Lecaniinæ*, the antennæ being apparently five-jointed." *(in litt.*, Aug. 6, 1892.)

The species will be described as *Conchaspis angræci*.

Jan. 12, 1893.

FERNS : SYNOPTICAL LIST.—XV.

Synoptical List, with Descriptions of the Ferns and Fern-Allies of Jamaica, by G. S. Jenman, Superintendent Botanical Gardens, Demerara, (continued from Bulletin, No. 38.)

Genus XIV. *Pellæa*. Link.

Sori terminal on the veins, at first round and distinct, but soon becoming confluent, linear and continuous, surrounding the margin; involucres continuous, membranous or coriaceous, plain or undulate; fronds generally small, veins free.

This genus differs chiefly from the preceding by the less divided fronds, the confluent sori making a continuous line around the margin as in *Pteris*; the ends of the veins, which are the receptacles, being distinct, and not transversely connected as in the latter genus.

1. *P. geraniæfolia*, Fée.—Rootstock upright, fibrous, scaly; stipites tufted, channelled, slender, naked or the base slightly scaly, polished dark brown; fronds chartaceous, naked, bright green, subdeltoid, palmatifid, subtripartite, 2-4 in. each way, upper part simply pinnatifid, rachis and costæ obscure above, prominent beneath but evanescent, polished blackish; 1-2 or 3 central pinnæ lobed or pinnatifid, narrowed at the base and decurrent, lowest pair much the largest, with the lower side the deeper and freely developed with subentire lobed or pinnatifid basal pinnulæ that vary from ½-1¾ in. l. and 2-6 li. w.; final segments connected at the base, acutely pointed, 2-3 li. l. 1½-2 li. w.; veins free, forked, evident in fresh fronds, rather obscure in dry : sori at first distinct, at length confluent forming a continuous marginal line, which barely falls short of the very tips of the segments; involucres continuous, narrow, membranous, undulate, turned back and concealed eventually by the matured sori.—*Pteris geraniifolia*, Radd. Hook. Icon. Pl. t. 915. *Pteris concolor*, Langs & Fisch. Ic. Fil. t. 21.

Infrequent or rare; gathered by Sloane in 1688 "between the town of Savanna and Twomile Wood," and rediscovered in 1877 at the old mines, between Hope and Gordon Town, St. Andrew. A widely spread species over the tropical and sub-tropical regions of the world, and long constantly referred to *Pteris* owing to the confluence of the sori and obscurity of venation in dried specimens. It has a general resemblance to *Pteris pedata*, but is distinguished by the more copiously lobed parts, free veins, and, at first, punctiform sori. The barren fronds are small with rounded lobes, and short slender stipites.

Genus XV. *Plagiogyria*, Kunze.

Sori terminal on the forked horseshoe-shaped thickened ends of the veins, laterally confluent, forming a linear, continuous marginal band; involucres continuous, involute and connivent over the sori and costæ, ultimately open; sterile and fertile fronds distinct, pinnæ of the latter contracted; veins free; stipites dilated, fleshy and triquetrous at the base, possessing spongy glands.

In the fertile fronds the veins are forked from the base, the branches diverging, and at their apices they are again shortly forked with a pair of soriferous venules, which together are horseshoe-shaped. The sori are at first roundish, but from their contiguity are early confluent, and form a continuous line, which at maturity fills the space between the margin and costæ. Occasionally a vein-branch occurs not again branched at the soriferous summit mixed with those that are, and in some instances the fertile venules seem to form a nearly complete circle by convergence. These particulars show that the genus is well founded, and. in spite of habit and apparent superficial affinity, belongs undoubtedly to this tribe, to which Moore ascribed it in his *Index Filicum*, rather than to the next to which it is generally referred and merged in *Lomaria*.

1. *P. biserrata,* Mett.—Rootstock upright, short immersed; stipites cæspitose, dilated and triquetrous near the base, but narrowed again at the axis, 3-9 in. l.; barren fronds papyraceous, dark clear green, naked, 1¼-1¾ ft. l. 4-6 in. w. lanceolate, fully pinnate at the rather reduced base, pinnatifid to the narrow wing of the rachis above, the apex acuminate and lobate-serrate; pinnæ very numerous, contiguous or rather apart, horizontal, 2½-3 in. l. ⅓ in. w. with a rounded open sinus between, dentate-serrate, the teeth deeper, sharper and bidentate at the finely acuminate point; veins oblique, forked from the middle or base, or some simple, pellucid; fertile fronds on longer stipites, the pinnæ linear, the lower free at the base, those above adnate but notched on the inferior side, 2-2½ in. l. 1½ li. w.—*Lomaridium,* Presl, *Lomaria semicordata,* Baker.

Frequent at about 7,000 ft. alt. on the forest-clad slopes of the higher peaks of the Blue Mountain range. The fronds rather resemble some of the conditions of *Acrostichum sorbifolium* and *Pteris longifolia.* Discovered in 1874 in Jamaica and not known elsewhere in the West Indies but widely spread on the continent from Mexico to Peru.

Genus XVI. *Lonchitis,* Linn.*

Sori confined to the sinuses and hollows of the lobes, or more or less continuous around the margin; receptacles linear, transverse with the apices of the veins; involucres membranous; veins areolated or free.

This genus differs only from *Pteris* by the sori originating in and being continuous around, the sinuses and hollows of the lobes, instead of being interrupted there, as in that genus. But while affecting those situations most it often forms a sinous band around the lobes, more or less continuous from the base to the apex of the pinnæ.

L. aurita, Linn.—Rootstock erect; stipites cæspitose, strong erect, 1 - 2 ft. l. freely clothed with a pale spreading soft pubescense; fronds 1½ - 2 ft. l or more, ¾ - 1¼ ft w., simply pinnate with a pinnatifid apex, or bipinnatifid at the base, herbaceo—chartaceous, copiously pellucid dotted, light green pilose as are the rachis and costæ; pinnæ spreading, sessile or shortly petiolate, a span or more l., simply lobed, or pinnatifid, the basal pair branched; pinnulæ sessile lobes rounded or acute, veins prominent beneath, copiously and angularly areolated; sori lunate, in the sinuses only or extending to the hollows of the sides of the lobes, involucres pale, membranous.— Plum. Fil. t. 17.

Rare; gathered in 1880 by Nock on the flat above Morce's Gap, below John Crow Peak, in the forest, between 5,000 - 6,000 ft. alt. In the specimens in question the pinnæ are simply lobed, as shown in Plumier's figure, upon which the species was founded, Plumier gathered his plant in Martinique, and it is remarkable that 200 years should have elapsed before its rediscovery in the West Indies, and that it should have again dissappeared with the single plant then found, though careful search in the same locality has been made for it. Whether regarded as conspecific with *L. pubescens,* Wild, which as a rule is larger and more compound, or not the Linnean name has priority. The different character of the vestiture, position of the sori and reticulated venation distinguish it at sight from *Pteris laciniata* the only other species having resemblance to it.

Genus XVII. *Pteris,* Linn.

Sori marginal, linear, continuous, rarely oblong, inserted on a special linear receptacle; involucres the same shape as the sori, attached by the outer edge, inflexed, free along the inner, a rudimentary interior valve in rare cases present also, veins free, or united; fronds varying from subentire to decompound.

This genus, which is confined with one or two exceptions to the tropical and warm temperate regions, is represented in Jamaica at all altitudes, from the lowest to the very highest, about half the species being strictly forest denizens, the rest growing in more or less exposed situations, some being communal, particularly the bracken (*P. aquilina*) which covers an enormous area of the country.

a. Fronds pinnato-palmate.

1. *P. pedata,* Linn.

aa. Fronds uniformly once pinnate.

b. Veins free.

2. *P. longifolia,* Linn.

bb. Veins united.

3. *P. grandifolia,* Linn.

aaa. Fronds once pinnate above, lower pinnæ forked.

4. *P. cretica,* Linn.

(See also small states of *P mutilata.*)

aaaa. Fronds mainly bipinnatifid, but usually having the basal pair of pinnæ branched on the underside at the base.

b. Lowest vein of each segment springing from the costa.

5. *P. mutilata,* Linn.

6. *P. Swartziana,* Agardh.

bb. Lowest vein springing like the rest in each segment from the midrib.

7. *P. longipinnula,* Wallich.

8. *P. quadriaurita,* Retz.

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* *Onychium,* Kaulf. which comes in beside this genus, has not been found in the British West Indian Islands, but as it is represented, in Cuba it may also be in Jamaica. The fronds are a span or two long, multifidly divided, with small linear, bifid or trifid sharp segments, free veins, short sori on a transverse filiform receptacle which combines the ends of the veins, the edges of the opposite involucres meeting, giving the leaf segments a podliko appearance.

O. strictum, Kunze, so far only known from Cuba, has a small erect or oblique rootstock, fronds tufted, 1-2 spans long including the stipites which are ½ ¾ the whole length; blade elongato-deltoid, finely cut (resembling in outline and cutting the more finely cut forms of *Asplenium fragrans* and the sori shorter than the leaf segments, the points of which extend beyond.

bbb. Midribs of the segments connected by a shallow costal arch, other veins free.
9. *P. biaurita*, Linn.
aaaaa. Fronds tri-or quadripinnatifid.
b. Veins areolated.
10. *P. podophylla*, Swartz.
11. *P. aculeata*, Swartz.
12. *P. Kunzeana*, Agardh.
13. *P. bulbifera*, Jenm.
14. *P. gigantea*, Willd.
bb. Veins free.
15. *P. laciniata*, Willd.
aaaaaa. Fronds tripinnate.
b. Veins free.
16. *P. heterophylla*, Linn.
bb. Veins free or casually united.
17. *P. incisa*, Thunb.
aaaaaaa. Fronds quadripinnate ; veins free.
b. Involucres simple.
18. *P. deflexa*, Link.
bb. Involucres double.
19. *P. aquilina*, Linn.
20. *P. viscosa*, Moore.

1. *P. pedata*, Linn.—Rootstock small, fibrous, scaly ; stipites tufted, slender, wiry, polished blackish, 2-6 in. l., furfuraceous or naked at maturity ; fronds subdeltoid, tripartite, 3-5 in. each way, subcoriaceous, dark green above, pale beneath, naked or the ribs slightly furfuraceous ; central portion larger, and equilateral, deeply pinnatifid below the entire lanceolate-acuminate apex, the lowest pair of its segments entire or pinnatifid and decurrent ; lateral portions furcate from near the base, the divisions nearly equal or the superior larger, divaricating, subentire or more or less pinnatifid on one or both sides ; rachis and costæ inconspicuous on the upper side, beneath prominent but evanescent outwards, dark coloured and polished ; veins forming a fine net work, without free branches, obscure in dry fronds ; sori continuous along the margins.—Plum. t. 152. *Doryopteris*, J. Smith.

Frequent under banks in open and shady situations in the mid-region of the principal mountain ranges, from 3,000 to 4,500 ft. alt. The smaller, less divided, fronds, which are uniform, in some plants, but may often be gathered with the larger, more divided, from the same rootstock, are often in herbaria ascribed to *P. palmata*, Linn., a species similar but more coriaceous, and somewhat less divided in the fronds, found on the mainland. See also the note to *Pellæa geraniæfolia*.

2. *P. longifolia*, Linn.—Stipites tufted, spreading, from a few inches to 1 or 2 ft. l. nearly naked or more or less freely villose, scaly; arising from a stout, shortly repent rootstock ; fronds 1 - 3 ft. l. ½ - 1¼ ft. w. simply pinnate, stiff dark green, striated, the base generally much reduced, the apex terminating abruptly in a linear segment ; rachis channelled, and with costæ glabrous or villose ; pinnæ very numerous, spreading horizontally, linear, 4 - 8 in. l. 2 - 6 li. w. cordate or more or less auricled at the sessile base, acuminate or blunt-pointed, the barren margins crenate-serrate ; veins close, spreading, once or twice forked ; sori continuous along both margins,—Sloane, t. 34. ; Plum. t. 69 and 70 ; Eat. Fer. N. Am. pl. 78. *P. Vittata*, Linn.

Common on banks and in dry woods up to 4,000ft. alt. Very variable in size of fronds, width of pinnæ and vestiture. In the narrower forms the inflexed involucres nearly touch the midrib, while in the broader there is a more or less open space between ; the pinnæ of barren fronds in all being broader than those of the fertile. At the higher elevations it is more hispid or villose than in the low. The summits of the veins in barren fronds are thickened, and often covered with minute calcareous scales. There is a remarkable multifid freely lobed and incised state, and another with the apex fasciated, spreading fringe-like. The Linnean names are founded on the larger and smaller states.

3. *P. grandifolia*, Linn.—

Rootstock stout, free-creeping, densely coated with brownish scales ; stipites apart, strong, erect, scaly at the base, 2-4 ft. l. not channelled ; fronds stiff, 3-6 ft. l. 1½-2½ ft. w. simply pinnate, subcoriaceous, naked, the rachis strong, channelled, straw-coloured or brown ; pinnæ entire, numerous, about 2 in. apart, ¾-1¼ ft. l. 1-1½ in. br., sessile and subrounded or rather cuneate at the base, the lower ones shorter on the inferior side, terminal like the lateral ; veins very close, spreading at a wide angle from the midrib, simple or forked and parallel within the marginal network ; sori in a marginal band, extending from the base to the finely serrated tapering point.—Plum. t. 105. Hook. Sp. Fil. Vol. 2 t. 113 B. *Heterophlebium*, Fée.

Common among the lower hills on roadsides, banks, and more or less open places. The upper dark green surface is rather silky looking. Both in this and the preceding the sporangia are early mixed with scales. Sir Henry Barkly gathered a form with sinuated and branched pinnæ. *P. dominicensis*, Baker of Dominica differs by having the veins wholly areolated. The habit resembles that of *Davallia saccoloma*. *P. vittata*, Schk. from Cuba has mostly free veins.

4. *P. cretica*, Linn.—Stipites 1-2 ft. l. numerous, slender, erect, naked, straminous, channelled, arising from a shortly creeping rootstock ; fronds ½-1 ft. l., nearly as w., light green, naked, chartaceous, composed of a long terminal pinnæ and 2-3 pairs of distant similar, linear-ligulate, and acuminate erecto-spreading lateral ones, the upper pair of which are close to the base of the terminal and shortly decurrent on the slender, channelled, straw coloured rachis, the middle pair sessile, subcuneate at the base but not decurrent, the lowest pair forked from near the base, the membrane on the lower side below the fork being absent, 4-9 in. l. about ½ in. w. those of the barren fronds rather wider and spinu-

lose-serrate; veins close, spreading nearly at right angles, simpled and forked; sori continuous in a marginal band, falling short of the sharply serrated apex.—Eat. Fer. N. Am. pl. 64.

Infrequent on the banks of streams between 4,000-5,000 ft. alt; gathered below Belle Vue, of the Government Cinchona Plantation. The discovery in Jamaica, in the region mentioned, by Nock, some sixteen or seventeen years ago, made the West Indies a new habitat for this widely distributed species. It is remarkable for its fine, long, narrow, very tapering pinnæ, and slender straw-coloured vascular parts.

CONTRIBUTIONS TO THE DEPARTMENT.

Library.

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Annual Progress Report of State Forest Administration New South Wales, for 1891. [Director General.]
Annual Report of the Gardens at Oodeypore for 1891-92. [Superintendent.]
Annual Report on Botanical Station at Aburi to 30th June, 1892. [Curator.]
Annual Report of Botanic Gardens, Lucknow, to 31st March, 1892. [Superintendent.]
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Report of the Viticultural Work, 1887—1889. [University of California.]
Reports of Experiments on Methods of Fermentation. [Do.]
Distribution of Seeds and Plants. [Do.]
Root Knots on Fruit Trees and Vines. [Do.]

Seeds.

From Royal Gardens, Kew :—

Gaultheria perplexa, G. fragrantissima, Acacia melanoxylon, A verticillata, A. pycnantha, A. armata, A. lophantha, A. acanthocarpa, Gahnia erythrocarpa, Bellendenia moutana, Capparis Mitchelli, Cæsalpinia echinata, Rhodamnia trinervis, Gomphocarpus arborescens, Cordyline australis, Billardiera longiflora fructu albo, Tecoma australis, Alyxia-buxifolia, Anigozanthus Manglesii, Maba natalensis, Schizophragma hydrangoides, Veronica Derwentia, Leptocarpha rivularis, Stapelia gigantea, Plectranthus glaucocalyx, Eucalyptus punctata, Atriplex halmoides, Andropogon sp., Melhania erythroxylon, Cephalostachyum capitatum, Blue Kennedya, Anthistiria avenacea, Bucklandia populnea, Helichrysum rosmarifolium, Cordyline indivisa, Rhododendron spp. Nos. 3, 5, 10, 11, 12, 15, 16, 18, 21, 22, 3337, and Rhododendron Delavayi, R. campanulatum, R. Falconeri, R. barbatum, R. decorum, R. hybridum, R. glaucum, R. Dalhousiæ, R. camphylocarpun, R. Hodgsoni, R. cinnabarinum, R. Wightii, Dichrostachys sp.

From Harvard University:—

Silene stylosa, Calendula regalis, Helianthus rigidus, Coreopsis cardiminifolia, Tagetes africana, Mauraudia Barclayana, Phytolacca decandra, Coreopsis auriculata, C. lanceolata, C. delphinifolia, C. senifolia, Dimorphotheca pluvialis, Chrysanthemum segetum, C. coronarium, Calendula officinalis, (meteor), Anchusa angustifolia, Iberis coronaria, Bidens atrosanguinea, Petunia nyctaginiflora, Phlox Drummondii, Zinnia elegans, Digitalis ochrolueca, Gypsophylla acutifolia, Silphium perfoliatum, Veronica caucasica, Scutellaria macrantha, Scrophularia alata, Pardanthus chinensis, Lobelia cardinalis, Scrophularia latifolia, Pentstemon pulchella, Statice latifolia, Parthenium integrifolium, Rudbeckia bicolor, R. grandifolia, Actinomeris helianthoides, Verbena hybrida, Godetia bijou, Scabiosa nana fl. pl., S. isctensis, Didiscus cæruleus, Agcratum mexicanum, Salpiglossis croceum, Tagetes patula, vars, Gladiolus Lemoine's, hybrids, Heuchera sanguinea, Pentstemon diffusus, Heliopsis scabra, Anemone decapitata, Alyssum saxatile, A. argenteum, Clematis ochroleuca, Grindelia hirsutula, Aster puniceus, Pycnanthemum montanum, Heuchera hispida, Ruellia ciliosa, Saponaria officinalis, Digitatis gloxinoides, Cimicifuga racemosa, dissecta, Hibiscus militaris, Gaillardia aristata, Pentstomon Digitalis, Ptelea trifoliata, Statice speciosa, Plantago Cynops, Silene caucasica, S. nutans, Scrophularia nodosa, Erigeron pulchellus, Physostegia virginica, Arabis alpina, Pelekia speciosa, Eryngium giganteum, E. rigidum, Digitalis purpurea, Dianthus latifolium, Alstrœmeria aurea, Salvia pratensis, Sonchus palustris, Eupatorium purpureum, Silphium asperrimum, Lychnis chalcodonica, Gaillardia picta, Plantago major, atropurpurea, Helianthus lactiflorus, Celsia Arcturus, Pentstemon barbatus, Verbascum Blattaria.

Council Paper No. 40 of 1894.

BOTANIC GARDENS.

Report of the Superintendent of the Royal Botanic Gardens, Trinidad, for the year 1893.

Laid before the Legislative Council on the 19th March, 1894.

Last Annual Report, Council Paper No. 43/1893.

Registered No. of Correspondence relating to the subject—M. P. No. 1393/1894.

TRINIDAD:
PRINTED AT THE GOVERNMENT PRINTING OFFICE, PORT-OF-SPAIN.
1894.

BOTANIC GARDENS.

Report of the Superintendent of the Royal Botanic Gardens, Trinidad, for the year 1893.

Council Paper No. 40 of 1894. *M. P. No. 1393/1894.*

ROYAL BOTANIC GARDENS,
March 30, 1894.

SIR,

I beg to forward herewith my seventh Annual Report on the Royal Botanic Gardens and their work. The year under review ends December 31st, 1893.

I have again to record that the year's work has been a difficult one. The inclement weather which prevailed in 1892 continued for the greater part of the year 1893, and the rainfall as recorded at the gardens exceeded that of 1892 by 1·35 inches; 1892, 91·14 inches; 1893, 92.49 inches. The establishment suffered severely from the damage occasioned by the heavy downpours, and roads, drains, borders and beds have needed constant attention, vegetation suffered generally and plants of a tender character had to be frequently replaced, in all parts of the garden.

ESTABLISHMENT.

The staff of the gardens remains the same as last year. The Superintendent was absent on leave for three months commencing on April 26th during which period Mr. W. E. Broadway acted as Superintendent. Mr. Broadway was absent on fourteen days' vacation leave in September and ten days on Medical certificate in November.

METEOROLOGY.

The usual observations have been duly made at the Gardens, and the record of the Island rainfall has been continued. We have lost some observers, but new Stations having been added to these already existing, and our total number of observers in the Island is now ninety-nine. The annual returns are appended to this report. The barometric observations taken in this office have on several occasions proved of service to the shipping interest in Port-of-Spain, as we were able to give timely warning of disturbed weather which enabled suitable precautions to be taken by "flat" owners and Captains of vessels in port. Our means of making the barometric variations known to shippers is however inadequate for the purpose, and it is hoped that during 1894 a system of signals may be devised which will prove of greater service. Inquiries have been received from Cuba asking that intelligence of any disturbance may be communicated to them during the hurricane season, for it is well known that the storms which do so much damage further North, take their rise near the Equator, and that in Trinidad, we are from our geographical position able to make the first note of barometric variations common to such disturbances. Trinidad, as a rule, is not affected to any serious extent, but loss is occasionally caused to "flat" owners by these storms. It is well known that weather, which amounts only to a "strong blow" with us, may develope as it travels North into the much dreaded hurricane or cyclone, and a great service could be rendered by giving telegraphic communication of any serious barometric variation, to Stations at the Northern Islands during the season when such storms are known to be of frequent occurrence.

Towards the end of the year, I had the advantage of being able, through the kindness of His Excellency the Governor, to take an automatic record of the temperature at the Gardens office by the use of Daniel's Recording Thermometer. These records are of a very interesting character, but have not been taken for a sufficient length of time to enable any accurate deductions to be made. The instrument is clock-shaped and records on a circular diagram the rise and fall of temperature at all times during the day and night for each day of the week; each diagram containing a seven days' record. The instrument also answers as a clock and calendar, telling the time, the day and the date.

HERBARIUM.

Steady progress has been made with the Herbarium during the year and about 2,500 specimens of the Flora have been added. Among the latter a new species of Orchid which has been named at Kew as *Epidendrum Hartii n. sp.* Rolfe. This was collected many years ago by Dr. Cruger, but to this time had remained without name. No consignment was sent to Kew for determination during the year, but our work has been to arrange the orders so that a complete sequence may be sent during the coming year, consisting of those which stand most in need of being authoritatively determined at Kew. The most numerous orders are now in readiness and will be despatched at an early date.

We have to thank the authorities at the Royal Gardens, Kew, for the unfailing courtesy they extend to us in the determination of garden and indigenous plants, and we have this year in addition to thank them for the important work of determining the fungus of the cane disease, the exposition of which has been treated in a masterly manner by Mr. Massee, with full illustrations in the Annals of Botany, December, 1893. In this work credit is given to our office as the first to call attention to the evil. Now that the character of the disease is known, it opens up the way for our cultivators to adopt successful means for its extermination. The name of the fungus is *Trichosporeæ Sacchari, Mass.*

A disease of the Cocoa tree has also been determined by the same authorities as being caused by a fungus called *Fusarium album Sacc,* and I am glad to record their opinion that "no serious harm is likely to follow," as the plant is not a true parasite, but merely affects the places where the trees have suffered injury to the stem or branches.

CORRESPONDENCE.

Colonial, foreign and local correspondence has been maintained, and the register shows a considerable increase on last year's number of communications sent out. The issue of a catalogue of the plants cultivated, has resulted in numerous applications for seed and plants from all parts of the world, which, added to our issue of circulars accounts for the increase.

DECORATIVE WORK.

Plants were loaned out on seventeen different occasions (Public Balls and other entertainments), the total number used being 1,305, which is slightly less than the number for last year, the major portion of these were large plants in tubs.

The supply of decorative plants and flowers required for the residence of His Excellency the Governor has been fully maintained.

FLOWER GARDEN.

Many of the beds containing shrubby flowering plants were renewed during the year and two or three beds of roses of the best imported kinds have been planted. Besides the usual routine work, we have had to remove several overgrown and unsightly trees, which have been replaced by plants of suitable character. A constant war has to be carried on in the Flower Garden, and indeed in all other sections, against the "Parasol Ant," *Œcodoma cephalotes,* and probably two other species and each nest is exterminated as soon as seen. From the proximity of adjoining woodlands, I fear we cannot hope to be ever free from this destructive pest, to destroy which, means considerable expenditure of labour annually.

The material which grows in the nests of these ants has now been determined as as the *mycelium* and *conidia* of one of the forms of fungus which develope large toadstools or mushrooms as an ultimate result, and is thought to be identical with a *species* observed by A. Möller in Brazil as being cultivated by South American ants. I have had the opportunity of making observations on the Parasol or Sauba ant in Nicaragua on the same ground as Belt studied them, but only a single species, *Œcodoma cephalotes,* which is the largest of this family was observed. In Trinidad we probably have three species, all growing the fungus in the nests, and all more or less destructive to vegetation.

The following Orchids flowered with us during the year 1893 :—

Epidendrum elongatum, Jacq.
,, *Stamfordianum*, Baden.
,, *Schomburgkii*, Lindl.
,, *ciliare*, L.
,, *nocturnum*, L.
,, *sthenopetalum*, Hook.
,, *variegatum*, Hook.
,, *cochleatum*, L.
,, *atropurpureum*, Willd.
,, *fragrans*, Swartz.
,, *patens*, *sw. sec.*, Lindl.
,, *jamaicense*, Lindl.
,, *Hartii*, *Rolfe*, n. sp.
,, *rigidum*, Jacq.
,, *raniferum*, Lindl.
Oncidium. *Papilio*, Lindl.
,, *ampliatum*, Lindl.
,, *citrinum*, Lindl.
,, *Lanceanum*, Lindl.
,, *luridum*, Lindl.
,, *Sprucei*, Lindl.
,, *pulchellum*, Hook.
,, *Kramerianum*, Rchb. f.
,, *hæmatochilum*, Lindl.
,, *altissimum*, Sw.
,, *triquetrum*, R. Br.
Brassia caudata, Lindl.
,, *maculata*, R. Br.
Gongora atropurpurea, Hook.
,, *maculata*, Lindl.
,, (white form) Hook.
Cattleya Skinneri, Baten, var. parviflora, Hook.
,, *Gaskelliana*, Rchb., f.
,, *amethystoglossa*, Linden et Rchb., f.
,, *mossiæ*, Hook.
,, *superba*, Lindl.
Lockhartia acuta, Rchb.
,, *elegans*, Hook.
Vanda tricolor, Lindl.
Phalænopsis amabilis, Lindl.
,, *cornu-cervi*, Blume et Rchb., f.
,, *grandiflora*, Lindl.
,, *sumatrana*, Korth.
,, *Schilleriana*, Rchb., f.
,, *violacea*, T & B.
Stelis ophioglossoides, Sw.
Diacrium (*Epidendrum*) *bicornutum*, Benth.
Schomburgkia undulata, Lindl.
Rodriguezia, *secunda*, Kunth.
Pleurothallis discoidea, Lindl.
,, *lepanthiformis*, G. Rchb.
Bifrenaria aurantiaca, Kth.
Angræcum Scottianum, Rchb. f.
,, *sesquipedale*, Thouars.
Dendrobium aggregatum, Roxb.
,, *Pierardii*, Roxb.
,, *fimbriatum oculatum*, Hook.
,, *densiflorum*, Wallich.
,, *Jenkinsii*, Wallich.
,, *formosum*, Roxb.
Dendrobium formosum, Roxb. var. giganteum.
,, *moschatum*, Wallich.
,, *Parishii*, Rchb, f.
,, *sauvissimum*, Rchb., f.
,, *nobile*, Lindl.
,, *Farmeri*, Poxt.
,, *Aphrodite*, Rchb., f.
,, *anosmum*, Lindl.
,, *bigibbum*, Lindl.
Ceologyne flaccida, Lindl.
Maxillaria, (four species.)
Aspasia variegata, Lindl.
Cypripedium Lawrenceanum, Rchb., f.
,, *Harrisianum*, Rchb., f.
Peristeria pendula, Hook.
,, *elata*, Hook.
Coryanthes, sps.
Broughtonia sanguinea, R. Br.
Miltonia spectabilis, Lindl.
Catasetum tridentatum (its various forms.)
,, *Bungerothii*.
Polystachya luteola, Hook.
Stanhopea grandiflora, Lindl.
Aërides sauvissimum, Lindl.
Camaridium ochroleucum, Lindl.
Zygopetalum cochleare, Lindl.
Saccolabium guttatum, Lindl.
,, *giganteum*, Lindl.
Dichæa graminea, gr.
Loelia anceps, Lindl.
Brassavola cucullata, R. Br.
Cirrhopetalum O'Brienianum.
Rhynchostylis retusa.
Cygnoches loddigesii, Lindl.
Calanthe vestita, Lindl.
Æranthes micrantha, G. Rchb.
Trichocentrum iridifolium, Sodd.
Bulbophyllum pachyrrhachis, Gr.
Bletia shepherdii, Hook.
Hexadesmia fusiformis, Gr.
Ponera prolifera, G. Rchb.
Hexisea reflexa, G. Rchb.
Stenia pallida, Lindl.
Cyrtopodium cristatum, Lindl.
,, ,, Grise.
Notylia punctata, Lindl.
Cryptarrhena pallidiflora, G. Rchb.
Ornithocephalus gladiatus, Hook.
,, *Cruegri*, G. Rchb.
Trizenxis falcata, Lindl.
Jonopsis utricularioides, Lindl.
Pogonia surinamensis, Lindl.
Epistephium parviflorum, Lindl.
Vanilla planifolia, Andr.
,, *phœnantha*, Rchb. f.
,, *grandifolia*, Lindl.
Prescottia, sps.
Spiranthes Hostmanni, G. Rchb.
Spiranthes orchioides.

As will be seen, many of these are of Botanical interest only and do not form part of the decorative collection. A part of the collection of the late Mr. J. Cunningham has been added to our stock during the year, having been acquired by purchase with the consent of His Excellency the Governor.

ROADS, WALKS AND DRAINS.

The main drive has been gravelled during the year, the work being carried on conjointly between ourselves and the Public Works Department, the former finding the material and the gardens the labour and supervision.

In the same way a large new drain was built to assist in carrying off the surface water from the main drive. This was a difficult operation, as in some places it had to be laid at a depth of eight feet from the surface. It works well and relieves the drive of storm water. This work was carried out under the immediate direction and supervision of the Superintendent. A surface drain was also made across the back road which prevents the overflow in the main drain near Guard House, which formerly did considerable damage at each heavy fall of rain. All the garden drains have been carefully overhauled, and repaired where necessary. A new piece of drain was put in between the garden's office and Government House, relieving the Palm avenue of a considerable amount of flood waters which formerly used to accumulate near the front of the Governor's residence.

The permanent paving of the large ravine has been considerably improved and two large side drains near the cemetery have been led thereto. The storm

waters which these now carry, used to do considerable damage to the nutmeg trees and especially to our large mangosteen tree. At the end of the ravine, near the Giant Bamboo, abutments have been put to the stone bridge, for greater safety of carriages coming to the nurseries. It is much improved in appearance.

VISITORS.

The number of visitors who registered at the garden's office is less than last year by 53 than for 1892, but this may probably be accounted for by the fact that the residence of the Governor was unoccupied for a portion of the year, His Excellency being on leave, and the building undergoing repair. There was a large attendance of visitors, however, who did not register.

Prominent among the names of the list are those of Mr. J. E. Haynes, Mayor of Newark, New Jersey. Major Mason, Chicago. Commodore Beaumont. Dr. and Mrs. Blandford. J. J. Quelch, Esq. Baron Eggers. Marquis of Hamilton. The Earl and Countess of Harewood. Judge Bell of Ontario. Mr. Henshaw of Staten Island. Sir Benjamin Stone, F.L.S., and Colonel Howard Vincent, M.P.

A great attraction has been the electric eel, *Gymnotus electricus*, especially to the officers and men of the various merchant and war-ships which have visited Port-of-Spain. We have now had this animal over three years. It was fed on worms and small fish.*

NURSERIES.

I have again to report a successful year of nursery work. The stock on hand has been fully maintained. The distribution of orange plants was not so large as had been expected, notwithstanding their being advertised at the low rate of 25c. per 100.

The distribution for the year stands as follows :—

DISTRIBUTION OF PLANTS AND SEEDS, 1893.

Table I.

Where Distributed.	Plants.	Seeds.
To places outside the Island	6,089	411 packages.
To places outside the Island	...	11,500 } countable
Locally	15,598	350 } seeds.
Total Distribution ...	21,687	11,850 and 441 packages.

The detail of our receipts is seen in Table II. It should be observed that the receipts are naturally much less than the distributions. This arises owing to Table I. including all our plant sales as well as plants distributed free of charge, and exchanges. Table II. includes merely receipts from exchanges and the few purchases that are annually made.

PLANTS AND SEEDS RECEIVED IN EXCHANGE.

Table II.

Plants.	Seeds.
490	262 Packages.

Among our exchanges during 1893 we received a valuable collection of East Indian Orchids suitable for our warm damp climate. These were obtained for a consignment of *Oncidium ampliatum* or the "Yellow Bee" as it is locally called. We also obtained new varieties of *Eucharis* in exchange for ordinary tubers.

From the Royal Gardens, Kew, we received the usual annual consignment. The value of the contributions to our garden from this establishment cannot be too highly estimated, for the year seldom passes without plants of interesting and useful character being received from them for trial in our climate. Plants, it may be mentioned, which it would be almost impossible to procure anywhere else but at a public establishment, part of whose time is devoted to the task of searching for and supplying useful plants to Colonial Gardens. Among the plants sent in 1893 is one labelled "Coffee, sp. *Sierra Leone*," raised from seeds collected by Mr. Scott Elliott in Africa when on the delimitation committee of the Anglc-French Frontier in 1892.

* I am sorry to say that it died on 22nd February, 1894.

In appendices are published the details of Plants and Seeds distributed and received. The Catalogue of plants cultivated was published early in 1893 and has, as before stated under correspondence, brought us enquiries for plants from Kew and from many other gardens in all parts of the world; and I am every mail receiving applications for copies from parties interested in Tropical cultures. The value of a Catalogue of this kind to such an institution as the Royal Botanic Gardens is therefore plainly shewn.

BULLETIN.

The Bulletin of the Royal Botanic Gardens has been continued, the numbers issued were: No. 17, containing classified lists of plants or Catalogue, April; No 18, containing articles on the Rubber industry and Cane diseases and Pests in Trinidad; No. 19, September, consists of a report on "Cocoa" in Nicaragua, giving the details of the introduction of *Theobroma pentagona* or "Alligator Cocoa." *Theobroma Cacao or* "Nicaraguan Criollo." *Theobroma bicolor* or "Pastaste" Cocoa. The "Tiger Cocoa" of Veragua; and *Theobroma augustifolia* "Monkey Cacao," "Cocao Meco" or "Cocoa Mono" of Nicaragua. No. 20, December, contains articles on an experiment with Cocoa seeds, the Cola Nut, Cane diseases and extract, Circular notes, Nos. 2, 3, 4 and 5 and Cacao disease. These Bulletins are now, by the kind permission of His Excellency Sir F. N. Broome, K.C.M.G., issued at intervals. The series have been much in demand as affording current information of a practical character, of interest to planters and agriculturists in general. They also form a medium of exchange for obtaining similar information of what is being done in other parts of the world, as recorded by similar publications, and I have to thank many correspondents for regular exchanges.

ECONOMIC SECTION.

To record the work of this Section would simply mean for the greater part a repetition of the notes in former year's reports, but the Section has been carefully continued in accordance with the ascertained wants of cultivators. I, however, mention a few items.

Calathea Allouya has yielded under good cultivation a fine crop of tubers much larger in size than any hitherto seen, and nearly twice the size of the tuber as ordinarily seen in the markets. Supplies of this were successfully sent to numerous Botanic Gardens, and information has been received in several instances that the plants are thriving well.

Maranta Arundinacea.—From tubers obtained direct from Bermuda, we have manufactured a small quantity of starch or arrowroot. This is certainly a finer sample than any previously grown and fully proves the constant need there is for change of plants and seeds from one district to another, as the quality of the product and the yield is much better from the imported plants.

Lemons.—Our plants of these raised from seed of imported Sicily Lemons grow fruit of large size, and of excellent quality, but they are not much sought after, as the "Lime" is in most cases preferred.

Citrons.—We have proved that Citrons can be grown of a fair size and of a good quality, but there appears to be no demand.

Piper Nigrum.—One of our plants this year produced good fruit. At the Convict Depôt a nice crop was harvested which has been reported as of excellent quality by the London brokers, a report being obtained through the favor of the Director, Royal Gardens, Kew (see Kew Bulletin for March, 1894). This culture is reported on fully in our Garden Bulletin, No. 21, and Kew Bulletin for February, 1894.

Uncaria Gambir.—Plants which we reported last year as doing very poorly have taken a turn for the better, and one plant especially is growing freely and hopes are entertained that it may now be acclimatized.

Vanilla.—Our cultivation of the species mentioned last year has been continued with a view to testing which is most suitable for extended cultivation in Trinidad.

Cacao.—The system of drying Cacao artificially by hot water, which was introduced at the local Exhibition of 1890 by a model made at our Gardens, has gained much approval during the three years which have since elapsed, and two or three large sets of apparatus are at work and others are now being put up on several of our largest estates.

I note in Ceylon papers a discussion on the confusion existing as to the word "Cacao" and "Cocoa." So far as Trinidad is concerned this has but little interest. The tree is "Cacao" to Spanish speaking people, and "Cocoa" to the English, and those engaged in trade know what is meant by the use of different words for the same article, and it is probably impossible to devise a system of naming which would be universally adopted by commercial firms and the public in different parts of the world. I append a short extract from the Ceylon *Observer* for the information of our planters.

COCOA (OR CACAO)—COCA—COCO—COCOANUT.

(From the Ceylon Observer of June 28, 1893.)

"FOUR WORDS IN COMMON USE."

Probably no four words in commou use have become more tangled and confused in the minds of learned and unlearned than *cacao, coca, coco,* and *cocoa.* Dr. Eugene Murray Aaron points out that even critics themselves stumble in attempts to clear away the confusion, and he mentious that the four distinct products to which the names belong—the first and last of great importance—are commonly mixed under the one term *cocoa.* These products are :—

1. Cocoa (*Theobroma Cacao*), the chocolate berry tree. This is an evergreen growing from 15 to 45 feet, a native of tropical America, but now become wild in Africa. It bears pointed pods, each of which contains a number of the nutritive seeds. From the seeds are derived "cacao nibs," "chocolate" (the most important substance), "cacao" (erroneously called *cocoa* in English countries), "broma," "cacao shells," and "cacao butter."

2. Coca *(Erythroxylon Coca)*, the coca leaf bush. This shrub is found in the Andes, and is famed for the extraordinary stimulating properties of its leaves, which are known as "spadic" as well as "coca," and contain two alkaloids—cocain and hygrin.

3. Coco (*Colocasia esculentum, et al.*), the coco roots. The name is properly applied only to the tubers of several allied species of plants, which furnish a starch-laden food in tropical countries.

4. Cocoa (*Cocos nucifera*), the cocoanut palm, which yields the well-known hard-shelled fruit, together with valuable fibre.—*Straits paper.*

[No distinction is made between the product of the chocolate plant, namely "cocoa" and the palm fruit in the above, so far as spelling goes. As it is impossible to get Mincing Lane to give up the use of "cocoa" for pods and nibs, to make some distinction we, on the suggestion of Dr. Trimen, have dropped the "a" in the palm's name, making it "coconut," which is more in accordance with the botanical name, *Cocos nucifera.* This has been followed, we are glad to see, by the Kew authorities, by *Nature* and other London papers. We seldom or never hear of "coco roots."—Ed. *C. O.*]

We have made attempts during the year to find out whether any of the trees of the original type of Cacao, which is recorded as being formally cultivated, were still in existence in Trinidad (i.e.) that type grown before the introduction of the Forastero varieties. The evidence from Nicaragua and Ceylon tended to show that this type of Cacao possessed a seed with uncoloured embryo and cotyledons. Nearly all the Cacao on the estates of to-day, proves to be of that kind which produces a bean coloured in the interior; which appears to be a characteristic of the Forastero type. Towards the end of the year a pod was kindly sent to the gardens, gathered from the high woods in the interior, which produced the uncoloured bean, and was of the form which common consent accords to "Criollo" Cacao, and there appears thus to be little doubt that we have still the original variety with us. Whether it would pay to give more attention to its cultivation on account of its quality, is a matter to be proved by the planter, but it is fairly evident that if grown there would be no trouble in producing a *fac simile* of Ceylon Cocao in Trinidad, as it appears to be clear that the colour is not due to the influence of climate or cultivation, but to a difference in the variety of plant cultivated.

A collection of Exhibits was prepared by the Gardens and sent to the Chicago Exhibition, of which the following is a list :—

1. Arrowroot—(From *Maranta Arunidinacea.*
2. Starch—(From *Pachyrhizus tuberosus.*)
3. Starch—Extracted from seeds—*Cycascircinalis.*
4. Moka Coffee—(Small berried.)
5. Arabian Coffee—(Coffee Arabica.)
6. Sansevieria Fibre—(From Sansevieria longi-
7. Agave Fibre—*Agave rigida.* [folia.)
8. Agave Fibre—*Agave rigida, var. sisalana.*
9. Trinidad Cigars.
10. Chutney—(West Indian.)
11. Cacao Vinegar—(From the pulp of the Cacao
12. Carap Oil—*Carapa Guianensis.* [Bean.)
13, 14, 15, 16, 17, 18, 19, 20, 21—Essential Oils.
22. Dried Cloves.
23, 24, 25, 26—Bamboo poles.
27. Vanilla.
28. Cinnamon.
29 & 30—Tinctures.
31. Balsam Copaiva.
32 & 33—Nutmeg or Mace.
34. Fibre—*Abutilon periplocifolium.*
35 & 36—*Chione* and *Mangrove* Barks.
37. Mangrove Cutch.
38. Annatto.
39. Cohune Nuts,
40–45—Cacao Pods in solution.
47 & 48—Logwood and Fustic.
49. Vegetable Blood—*(Croton yossypyfolius.)*
50. Fish Poison—*Clibadium surinamensis.*
51. Ardrue—*Cyperus articulatus.*
52. Sarsaparilla—*Simlax officinali.*
53. "Dragon's Blood"—*Pterocarpus marsupium.*
54. Delta Bark—*Alstona Scholaris.*
55. Rubber—*Castilloa elastica.*
56. Areca Nut—*Areca Catechu.*
57. Letter Wood—*Brosimum Aubletii.*
58 to 72—Miscellaneous Exhibits.

Besides this a collection of 50 large and small plants were prepared and forwarded.

As will be observed from the Section under the head of "Bulletin," much that would otherwise appear in an annual Report is already in the hands of readers, and without the delay of waiting some months for publication. The issue of "Circulars" has also been commenced during the year and they have been fairly successful in drawing attention *at once* to matters of importance in connection with Agri-Horticultural matters.

J. H. HART, F.L.S.,
Superintendent.

The Hon'ble the Colonial Secretary,
Trinidad.

APPENDIX I.

PLANT AND SEED DISTRIBUTION AND EXCHANGE.

Plants and seeds were distributed to the following correspondents during the year :—

Royal Gardens	Kew.
Botanic Gardens	Ceylon.
,, ,,	Jamaica.
,, ,,	Calcutta.
,, ,,	S. Australia.
,, ,,	Hong Kong.
,, ,,	Mauritius.
,, ,,	British Guiana.
,, ,,	Dominica.
,, ,,	St. Vincent.
,, ,,	Grenada.
,, ,,	St. Lucia.
,, ,,	Antigua.
Albrecht Seitz, Esq.	Tobago.
Messrs. J. Veitch & Sons	England.
M. Russel Cotes, Esq.	England.
Captain Carr	Bermuda.
Secy. Agriculture	Queensland.
I. Rand, Esq.	Brazil.
Mrs. James	Bermuda.
Dr. H. A. Nicholls	Dominica.
A. C. Bancroft, Esq.	Jamaica.
Marquis of Hamilton	England.
Messrs. Parke, Davis & Co.	U. S. A.
Hon. W. Low	Tobago.
G. S. Davis, Esq.	U. S. A.
S. L. Mead, Esq.	U. S. A.
M. Buysman, Esq.	Holland.
Secty. Dept. Agriculture, Washington	U. S. A.
Societe Anonyme	Brussels.
J. R. Bovell, Esq.	Barbados.
Senor A. Arguello	Granada, Nicaragua.
Secty. Pharmaceutical Society	England.
Miss Willington	Tobago.
German Officers	Warship "Stosch."
— Sewell, Esq.	England.
Senor Sokolowski	Colon.
Messrs. Hugh, Low & Co.	England.
Captain Semini	Barbados.
A. F. Hernaman, Esq.	Barbados.
J. S. Greenidge, Esq.	Barbados.
C. Kenrich Gibbons, Esq.	Barbados.
J. O'Brien, Esq.	England.
Rev. Father Bertrand	France.
Rev. Richard	(For Barbados.)
J. W. Gillespie, Esq.	Santa Barbara, U. S. A.
Captain Powles	R. M. S. Company.

APPENDIX II.

Plants and Seeds were received from correspondents according to the following List, which forms annually a permanent record of introductions made, and is also an acknowledgment to our correspondents in the various Institutions which favour us with exchanges, and present similar returns :—

NAME.

From Royal Gardens, Kew.

Cephalostachyum capitatum
Stapelia gigantea
Melhania erythroxylon
Macrozamia spiralis
Raphia vinifera
Piper guineense (Ashantee Pepper)
Bambusa siamensis
Dictyospermum fibrosum
Andropogon schœnanthus
Acanthaceæ (Sierra Leone)
Alsodeia subintegrifolia
Amorphophallus sp. (Gambia)
Aristolochia Gigas Sturtevantii
Aroidæ (Niger Territory)
Bassia Parkii
Bauhinia natalensis
Burbidgea nitida
Cassia sp. (Sierra Leone)
Coffea arabica var. mexicana
Coffea sp. (Sierra Leone)
Erythroxylon Coca. (*true* Ceylon)
Fordia cauliflora
Godwinia Gigas
Rhynchospora aurea
Strychnos sp. (W. Trop. Africa)
Tacsonia sanguinea
Vanilla sp. Macassar yields Vanilloes of commerce.
Alstonia verticillatus
Aristolochia labiosa
Aristolochia tricaudata
Bauhinia sp. (Sierra Leone)
Camœnsia maxima
Cassipourea sp. (Natal)
Cæsalpinia sp. (Sierra Leone)
Caryota Rumphiana
Cherimoyer (Anona sp. Andes)
Chrysophyllum sp. (Sierra Leone)
Cordia monoica
Cycas Seemanni
Dermatobotrys Saundersiæ
Elœodendron orientale
Gardenia sp. (Sierra Leone)
Gardenia sp. (N. Queensland)
Legume (Natal)
Legume (Zululand)
Legume (Rio de Janeiro)
Nephrosperma Van Houtteana
Pandanus sp. (Sierra Leonè)
"Runner, coloured flowers" (Brisbane)
Sarcocephalus cordatus
"Plant from Sierra Leone"
"Small tree, Sierra Leone"
Strobilanthes cuspidatus
Strobilanthes gossypinus
Dillenia sp. (Sierra Leone)
Kigelia sp.
Roupellia sp. (Sierra Leone)
Ilex paraguayensis
Doryanthes Guilfoyleii

From Botanic Gardens, Ceylon.

Cacao "Red"
Areca glandiformis

From Botanic Gardens, Saharanpur.

Pennisetum triflorum
Ficus foveolata
Catalpa Kœmpferi
Anogeissus acuminata
Anogeissus latifolia.
Lagerstrœmia regina.
Wendlandia puberula.
Sterculia elata.
Heftage madablota.

NAME.

From Botanic Gardens, Saharanpur. *Continued.*

Butea frondosa.
Peach "Roem".
Ipomœa rubro cœrulea.
Ehretia serrata.
Beaumontia grandiflora.
Phœnix humile.
Dillenia indica.
Amaryllis, Hybrid.

From Botanic Garden, Calcutta.

Phœnix rupicola.
Wallichia disticha.
Bambusa siamensis.
Phœnix paludosa.

From Botanic Garden, Singapore.

Vateria sp.
Gnetum edule.
Hoppea sp.
Xerospermia sp.
Livistona chinensis.
Areca sp.
Ochrosia borbonica.
Dracæna gracilis.
Aristolochia Roxburghiana.
Semecarpus Anacardium.
Caryota urens.
Verschaffeltia splendida.
Sinesanthrus fibrosus.

From Botanic Garden, Hong Kong.

Macadamia ternifolia.
Biota orientalis.
Neevesia thyrsoidea.
Doryanthes Palmeri.
Viburnum odoratissimum.
Lagerstrœmia subcosta.
Clematis Meyeniana.
Coffea bengalensis.
Pinus sinensis.
Camellia reticulata.
Cæsalpinia vernalis.
Hedychium coronarium.
Cæsalpinia Nuga.

From Botanic Garden, Bombay.

Crotalaria sp.

From Botanic Garden, Bangalore.

Soymeda febrifuga.
Poinciana elata.

From Botanic Garden, Adelaide.

Hakea pandanicarpa.
Eucalyptus grandifolia.
Polyalthea Holtzeana.
Eucalyptus cornuta.
Eucalyptus pyriformis
,, leucoxylon
,, rostrata
,, Lehmanni
,, corynocalyx
,, calophylla
,, gomphocephala
,, miniata
,, gigantea
Vitis acitosa
Elæocarpus australe
Acacia aculeaticarpa
,, drepanocarpa
,, sentis

APPENDIX II.- Continued.

NAME.

From Botanic Garden, Adelaide.—*Con.*

Acacia Simsii
,, auriculæformis
,, longifolia
,, cyanophylla
Adansonia Gregorii
Pithecolobium pruniosum
Spondias Solandii
Alina cymosa
Elœocarpus cyaneus
Aliphitonia excelsa
Cæsalpinia Tara
Fuenela rhomboidea
Tristania conferta
Heptapleurum venulosum
Melalcuca symphyocarpa
,, Preistana leiostachya
,, hypericifolia
Cochlospermum Fraseri
Pittosporum bicolor
Melaleuca genistifolia
Hakea auriculata
Callistemon brachyandros
,, salignus
Ganophyllum falcatum
Metrosideros paradoxa
Hakea cucullata
Myrosporum Cunninghamii
Nephelium Cucocarpum
Brachychiton diversifolium
Hemicyclia sepiaria
Agonis flexuosa
Brachychiton paradoxum
Cassia Brewsterii
Callistemon rigidus
,, speciosus
Callistris verrucosa
Casuarina stricta
,, humilis
Cupania semiglauca
Doryanthes Palmeri
Dysoxylum Schultzei
Frenela intratropica
Elœodendron tomentosum
Syncarpia laurifolia
Helicia australasica
Grevillea Chrysodendrum
,, heliosperma
,, mimosoides
,, robusta
Gardenia megasperma
Rhus rhodanthema
Zanthoxylum parviflorum
Nephelium tomentosum
Sterculia aurifolia
,, heterophylla

From Botanic Garden, Melbourne.

Macadamia ternifolia
Morinda jasminoides
Sterculia diversifolia
Syncarpia laurifolia
Sypoum glandulosum
Telopea speciosissima.
Pittosporum rhombifolium.
Grevillea robusta.
Tecoma australis.
Doryanthes Palmeri.
Owenia venosa.
Eustrephus latifolius.
Amnobium alatum.
Notelœa longifolia.
Sterculia accrifolia.
Angophora lanceolata.
,, subvelutina.
Acacia juniperina.
,, decurrens.
,, cyanophylla.
Myrsine variabils.
Stenocarpus salignus.
Callistemon phœniceus.
Hymenosporum flavum.

NAME.

From Botanic Garden, Melbourne.—*Con.*

Kennedya rubricunda.
Casuarina suberosa.
Acacia salicina.
Cordyline Bæucri.

From Botanic Garden, Natal.

Watsonia densiflora.
,, ,, alba.
Celtis Kraussiana.
Gomphocarpus sp.
Anona senegalensis.
Cordyla africana.
Scaevola Lobelia.
Calodendrum capensis.
Agapanthus umbellatus var. albus.
Dais cotinifolia.
Apodytes dimidiata.
Clerodendron glabrum.
Morua iridioides.
Gomphocarpus physocarpus.
Combretum erythrophyllum.
Tephussia Kraussiana.
,, grandiflora.
Oncoba Kraussiana.
Gloriosa virescens.
Turcea obtusifolia
Dissotis incana.
Zanthoxylon capense.
Limnanthemum Thunbergianum.
Strelitzia augusta.

From Botanic Gardens, Jamaica.

Amyris Plumieri.
Samadora indica.

From Botanic Gardens, Grenada.

Ptychosperma alba.
Cycas media.
Cola acuminata.
Sobralia macrantha.
Catostemma fragrans.
Roses, assorted.
Eucalyptus, sp.
Cryptomera elegans.
Cyphomandra Betacea.
Cryptomera japonica.
Cupressus funebris.
Croton (var).
Acacia sp.
Dictyosperma alba.
Ceropegia Sandersoni.

From Botanic Gardens, St. Vincent.

Catostemma fragans.
Caryota urens.

From Botanic Gardens, Antigua.

Livistona subglobosa.
Thrinax sp.

From Botanic Gardens, British Guiana.

Euterpe sp. near utilis.
Guadua angustifolia, Kth.
Borassus flabelliformis.

From Messrs. Parke, Davis & Co., U.S.A.

Serenoa serulata.

From J. B. Beach, Esqre., U.S.A.

Roses, assorted.

From Messrs. Haage & Schmidt, Germany.

Cupressus pyramidalis.
Biota orientalis.
Cupressus funebris.

APPENDIX II.—Continued.

NAME.

From Messrs. Hagge & Schmidt, Germany.—*Continued.*

Cupressus guadalupensis.
Casuarina equisetifolia.
Chomæcyparis Lawsoniana.
Cedrus Deodara.
Biota elegantissima.
Casuarina quadrivalvis.
Chamæcyparis pisifera.
,, squarrosa.
,, plumosa.
Juniperа Bermudiana.

From the Secretary Agri-Horticultural Society, Madras.

Strychnos Nux vomica.

From J. Campbell, Esqr., Jamaica.

Yams.

From Messrs. Wright, Layman & Co., London, England.

Casia Absus (?)

From Dr. Nicholls, Dominica.

Tous les mois.

From — Rand, Esqr., Para, Brazil.

Cacao.

From M. Buysman, Esqr., Holland.

Herminiera elaphroxylon.

From Dr. Henderson, Jamaica.

Pimenta officinalis.

From Messrs. Thos. Christy & Co., London, England.

Polygonum sachalinense.
Menthol.

From Messrs. Hugh, Low & Co., London, England.

Cypripedium Harrisianum.
,, Sedenii.
,, venustum.
,, Volonteanum.
,, Lawrencianum.
,, javanicum.
,, Curtisii.
,, bellatulum.
,, Lawsonianum.
Dendrobium Pierardii.
,, Wardianum.
,, Crassinode.
,, Phalænopsis Schroderianum.
,, Dearei.
,, albo sanguineum.
,, formosum giganteum.
,, Findleyanum.
,, thyrsiflorum.
,, Brymerianum.
Cœlogyne pandurata.
Vanda cœrulea.
,, Amesiana.
Ærides Fieldingii.
,, expansum Leonix.
Angræcum sesquipidale.
,, articulatum.
,, citratum.
Saccolabium Blumei.
Vanda Kimballiana.
Phalænopsis rosea.
,, Schilleriana.
,, amabilis.
,, grandiflora.
,, Luddemaniana.

NAME.

From Botanic Gardens, Rio Janeiro, Brazil.

Attalea speciosa.
Elæis guineensis.
Coffea liberica.
Veronia macrophylla.
Uncaria sp.
Herminiera elaphroxylon.
Sesbania paulensis.
Pinanga Kuhlii.
Acacia leucocephala.
Crotolaria sempervirens.
Indigofera cassivides.
Arcca madagascariensis.
Indigofera Anil.
Sabal princeps.
Daubentonia supctiana.
Carapa guianensis.
Oreodoxa oleracea.
Latania borbonica.
Enterpe oleracea.
Pandanus utilis.

From Queensland.

Rubus flavus "Indian Raspberry."

From Dr. M. M. Child, U.S.A.

Phyllocactus multiflora.
,, americana.
,, sp.
Cereus McDonaldi.
Rhipsalis paradoxa.
Cereus speciossimus.
Phyllocactus Folli.
,, rosea grandiflora.
,, Fcastii.
,, bicolor.
,, Aramanthimus.
Echinopsis Eggersii.
Stapelia sp.
Cereus Dr. Regel.
Geranium, Lady Compton.
Adlumia cirrhosa.

From H. W. Dihm, Esqr., U. S. T. Nurseries, Trinidad.

Areca alba.
Amaryllis.
Pandanus utilis.
Caryota sobolifera.
Phœnix (3 or 4 kinds).

From L. Libert, Esqr., Trinidad.

Sabal glaucescns.

From J. C. Lewis, Esqr., Trinidad.

Fruit trees :—
No. 1, albis, yellow.
,, 2, Fruita de conda.
,, 3, yellow, Bell apple.

From C. W. Meaden, Esqr., Trinidad.

Cacao pods.
Erythrina umbrosa.

From E. Masson, Esqr., Trinidad.

Cacao pods.

From E. Waterman, Trinidad.

Panax Victoria.

From Ranghasammy, Trinidad.

Areca Catechu.

From R. Spooner, Esqr., Trinidad.

Chrysanthemums.

From George Vahl, Esqr., Trinidad.

Vegetable seeds (various.)

From His Honour Mr. Justice Nathan, Trinidad.

Orchids.

From J. Bailey, Esqr., Trinidad.

Panax Victoria.
Coleus.

From Mr. Francis, Trinidad.

Crotons.

APPENDIX III.

METEOROLOGICAL RESULTS, TRINIDAD ROYAL BOTANIC GARDENS, FOR THE YEAR 1893.

Station 130 feet above Sea-level.

MONTH.	BAROMETER.		THERMOMETERS.								WIND.					
	REDUCED READINGS.		DRY & WET BULBS.				Maximum.	Minimum.	Mean Temperature, Blackened Bulb in Vacuo.	Mean Temperature, Thermometer on Grass.	Direction.	Humidity.	Tension of Aqueous Vapour.	Rainfall.	Dew Point, 7 A.M.	Dew Point, 3 P.M.
	7 A.M.	3 P.M.	7 A.M.		3 P.M.											
	Bar.	Bar.	D.	W.	D.	W.										
	In.	In.	°	°	°	°	°	°	°	°		°		In.	°	°
January ...	29·973	29·890	69·30	67·66	81·45	73·80	85·80	65·51	114·41	62·25	E.&N.	78·	·673	3·43	66·38	68·60
February ...	29·994	29·947	70·00	68·48	82·66	73·81	86·07	67·11	114·00	62·00	E.&N.	75·	·672	1·85	67·31	67·89
March ...	30·016	29·965	69·16	67·46	84·70	74·12	87·51	65·16	123·67	60·67	E.	72·	·650	0·19	66·14	67·25
April ...	29·999	29·946	71·96	70·62	81·46	75·63	88·93	67·53	118·00	63·00	E.	84·	·759	3·61	69·62	71·67
May ...	29·988	29·938	75·13	74·86	81·93	76·10	88·10	70·20	111·70	67·20	E.	78.	·759	11·35	70·41	72·20
June ...	30·013	29·957	76·75	74·93	82·34	76·44	89·18	69·	110·00	65·89	E.	80·	·812	10·19	73·67	72·48
July ...	29·993	29·944	74·67	73·54	81·96	77·13	87·55	69·27	104·89	64·81	E.	84·5	·826	13·28	72·73	73·90
August ...	30·092	29·946	74·26	73·16	83·96	81·12	88·44	69·79	...	...	E.	87·	·887	16·32	72·36	79·25
September...	29·994	29·930	76·27	74·86	82·70	78·86	89·33	70·33	167·33	70·03	E.	86·	·866	11·73	73·86	76·29
October ...	29·912	29·845	75·03	74·00	83·48	78·12	89·70	70·48	163·61	69·12	E.&N	84·	·840	5·47	73·06	74·53
November...	29·944	29·880	74·20	73·00	82·93	79·06	87·96	69·53	163·00	68·00	N.	82·	·798	7·84	72·13	73·13
December ...	29·936	29·882	73·35	71·28	82·31	75·13	86·72	69·06	160·00	68·89	N.	78·5	·733	7·23	69·75	70·32
Average for year.	29·987	29·922	73·34	71·98	82·49	76·27	87·44	68·58	131·87	65·52	E.&N.	80·75	·772	7·70	70·61	72·19
Mean daily height of Barometer	29·954 inches.				Mean Annual Temperature		78·01						Total Rainfall		92·49 inches.	

APPENDIX III.—Continued.

RAINFALL FOR THE ISLAND OF TRINIDAD FOR THE YEAR ENDING 31ST DECEMBER, 1893.

No. of Station	Diameter of Gauge, Govt. or Private.	STATION.	January.	Feby.	March.	April.	May.	June.	July.	August.	Sept.	October.	Nov.	Dec.	Total.
	In.														
1	8 G.	St. Annc's—Royal Botanic Gardens ...	3·43	1·85	0·19	3·61	11·35	10·19	13·28	16·32	11·73	5·47	7·84	7·23	92·49
52	8 G.	Port-of-Spain—Police Station ...	1·83	1·99	...	...	14·20	10·32	13·33	7·65	6·79	5·04	7·65	6·25	...
64	8 G.	Royal Gaol ...	2·20	1·80	0·26	2·67	10·35	6·77	13·03	8·14	5·33	1·69	5·81	3·40	61·45
5	5 G.	St. Joseph—Police Station ...	1·53	2·11	0·52	2·64	2·71	8·96	12·36	6·94	8·66	5·44	8·52	4·06	64·45
6	5	Tunapuna Village—Macoya Estate ...	0·63	2·24	0·15	...	7·98	8·26	13·01	8·54	7·37	7·04	...	5·72	...
44	8	Arouca—Bon Air ...	1·17	1·73	...	1·94	...	9·03	9·81	8·20		...	...	...	...
9	5	Cumuto—Santa Teresa ..	3·09	3·57	3·08	6·51	24·48	11·00	14·16	7·63	8·21	3·59	14·33	12·12	111·77
49	5	Arima—Garden Estate ...	...	...	...	3·30	12·53	9·60	12·42	...	...	6·73	...	7·14	...
7	5	Arima ...	...	...	...	...	...	...	...	...	7·39	7·14	16·53	10·37	...
11	5	Toco—La Sagesse ...	3·12	2·49	3·21	2·95	12·18	9·30	16·04	6·85	3·22	2·79	11·14	9·53	82·82
10	5 G.	Toco—Police Station ...	3·70	3·01	3·56	3·43	12·27	...	...	...	3·43	3·89	12·38	14·11	...
14	5	Couva—Exchange Village ...	0·52	0·40	0·10	4·26	7·55	6·95	8·31	12·19	8·20	8·57	7·39	4·75	69·19
15	5 G.	Couva—Police Station ...	1·57	0·30	0·28	5·73	9·62	7·80	7·51	10·78	8·16	9·15	11·20	6·56	78·66
19	8	Montserrat—Tortuga Estate ...	...	...	...	...	...	...	...	...	...	...	...	...	...
18	5 G.	Montserrat—Police Station ...	1·70	2·54	0·55	5·60	10·57	9·67	12·47	10·93	5·88	5·21	11·04	5·69	81·85
25	5 G.	Oropuche—Police Station ...	1·95	2·14	0·38	6·37	7·92	10·10	5·77	8·42	4·12	2·89	9·43	5·32	64·81
26	8	Savana Grande—North ...	2·84	3·64	0·10	6·41	11·90	10·16	14·26	9·78	6·94	2·80	19·08	9·34	97·25
27	5	Cedros—Police Station ...	2·20	2·84	2·16	8·33	5·25	4·89	4·04	6·90	4·10	2·20	6·24	6·57	55·72
60	...	Cedros—Columbia (C.W.) ...	2·55	1·25	1·90	6·80	6·10	4·81	5·75	8·99	5·66	2·85	6·00	10·00	62·66
72	...	Cedros—St. Marie Estate ...	2·80	2·77	2·28	8·67	4·39	5·05	4·56	6·79	4·66	3·02	6·07	6·87	57·93
73	...	Cedros—La Retrait Estate ...	3·25	4·05	1·95	9·65	8·50	10·55	6·90	8·05	6·85	3·95	8·40	6·55	78·65
2	5	Tucker Valley ...	2·07	1·06	0·33	3·56	10·20	9·28	9·86	11·21	13·55	9·19	8·88	10·49	89·68
21	8	Sangre Grande—Sta. Estella Estate ...	3·61	5·34	2·30	6·95	20·48	9·26	10·51	5·98	5·31	3·59	14·84	16·58	104·75
22	5 G.	Princes Town—Police Station ...	1·90	3·91	2·65	5·19	7·40	8·62	12·89	11·43	3·87	4·84	16·20	9·91	88·81
16	8	Claxton's Bay—Mt. Pleasant Estate ...	1·49	2·56	1·29	4·61	7·38	6·26	10·13	10·25	4·22	5·83	10·68	2·24	66·94
31	5	Mayaro—St. Joseph Estate ..	2·45	...	...	...	...	...	...	...	...	...	...	...	...
32	5 G.	Mayaro—Police Station ...	3·56	3·04	0·84	9·30	11·11	13·01	7·29	11·28	3·00	6·43	17·38	15·61	101·85
12	5 G.	Chaguanas—Perseverance Estate ...	2·33	0·10	0·45	0·43	6·26	9·21	6·69	8·17	7·05	12·04	5·96	10·25	68·94
50	8 G.	Chaguanas—Convict Depôt ...	2·71	1·68	0·78	4·70	11·09	7·86	13·81	11·74	7·65	5·55	10·62	8·73	86·92
61	...	Chaguanas—Petersfield (D.S.P.) ...	2·14	...	...	...	...	...	...	...	10·53	10·39	8·52	10·76	...
8	...	Tumpuna—Police Station ...	4·51	1·40	0·90	2·15	27·65	10·49	11·26	13·33	13·32	6·20	12·19	19·13	122·53
28	5	Erin—La Ressource Estate ...	2·19	3·05	2·50	5·79	4·70	7·12	7·60	8·07	2·18	2·68	7·53	6·93	60·34
46	8	Erin—Chatham ...	2·82	3·85	2·20	11·12	10·70	18·15	11·70	14·75	6·40	3·32	9·82	6·17	101·00
29	8 G.	Moruga—Police Station ...	2·20	2·02	2·10	6·52	10·21	6·95	8·75	9·36	6·43	3·62	12·80	9·24	80·20
30	8 G.	Moruga Road—Rest House ...	5·63	7·34	2·78	9·15	14·35	16·83	13·46	13·63	8·26	10·30	15·93	18·37	136·03
33	...	St. Juan—Barataria Estate ...	...	...	...	...	...	7·69	13·03	3·98	7·36	7·11	6·66	5·91	...
34	...	Naparima—Harmony Hall Est. (H.H.)	1·36	4·75	1·82	6·94	9·75	12·43	14·73	12·87	4·93	4·43	13·17	7·12	94·30
35	5	Naparima—Tarouba Estate (T.B.) ...	1·35	3·53	1·45	4·84	7·70	9·37	11·42	11·87	5·80	4·13	12·64	6·60	80·70
36	... P.	Naparima—Williamsville Est. (W.V.) ...	1·34	3·98	...	...	...	...	...	...	4·76	1·81	7·19	8·92	...
38	... P.	Naparima—Union Hall Estate (N.) ...	1·80	2·73	...	...	...	...	14·84	...	4·48	3·60	11·92	5·14	...
39	... P.	Naparima—Petit Morne Estate (P.M.)	1·63	2·60	1·09	4·53	7·87	10·70	10·37	9·18	2·15	4·25	13·81	6·35	74·53
40	... P.	Naparima—Golconda Estate (G.C.) ...	1·26	3·23	0·32	5·02	7·42	9·56	9·45	8·91	3·66	4·05	11·10	7·29	71·27
41	... P.	Naparima—Cedar Hill Estate (C.H.) ...	1·89	2·55	2·15	4·66	8·08	10·63	13·43	9·01	3·39	4·23	14·10	8·64	82·76
42	... P.	Naparima—St. Madelène Usine (U.S.M.)	1·13	2·70	...	...	...	11·43	...	...	3·64	4·01	13·24	8·41	...
59	... P.	Naparima—Plein Palais (P.P.) ...	1·30	2·76	1·97	6·22	7·23	...	11·39	10·51	6·27	4·52	10·88	6·15	...
45	8 P.	Naparima—Wellington Estate ...	1·46	2·41	0·32	7·30	8·00	10·20	8·71	5·92	4·38	3·68	9·89	8·32	70·59
56	5 P.	Naparima—Craignish Estate ...	1·74	3·17	...	5·49	6·08	10 02	11·41	8·20	5·48	3·95	14·48	8·86	...
47	8 G.	San Fernando—Lewisville ...	1·72	3·25	1·25	5·84	7·40	8·24	13·01	12·94	6·00	4·23	12·60	6·65	83·13
51	8 G.	Maraval—Police Station ...	1·96	2·62	0·94	5·34	13·90	9·65	16·46	21·93	10·27	10·23	8·64	12.64	114·58

APPENDIX III.—Continued.

RAINFALL FOR THE ISLAND OF TRINIDAD FOR THE YEAR ENDING 31ST DECEMBER, 1893.—CONTINUED.

No. of Station.	Diameter of Gauge, Govt. or Private.	STATION.	January.	Feby.	March.	April.	May.	June.	July.	August.	Sept.	October.	Nov.	Dec.	Total.
	In.														
53	8 G.	Diego Martin—Police Station ...	1·80	1·00	0·78	3·63	9·22	7·34	13·22	11·94	13·00	8·77	7·16	8·06	85·92
54	8	Maracas Bay ...	3·75	2·80	3·52	8·20	8·68	7·85	22·11	16·57	15·16	13·29	16·84	18·47	137·24
55	8 G.	Maracas—Government School ...	0·70	1·49	1·04	3·69	8·64	...	13·75	8·32	7·53	7·13	10·36	10·72	...
57	8 G.	Blanchisseuse ...	3·41	3·26	2·51	5·64	13·59	8·51	14·53	7·98	5·82	7·15	12·58	19·82	104·80
58	8 G.	Cap-de-Ville ...	2·32	5·34	0·84	7·37	9·72	9·42	6·92	9·71	5·01	5·93	9·15	5·16	76·89
62	8	Valencia ...	3·22	5·04	1·35	5·02	19·60	12·20	11·84	5·36	12·82	5·50	8·28	18·31	168·54
63	8	La Brea ...	1·02	1·64	0·67	6·16	6·66	6·48	8·00	6·60	...	8·22	...	5·00	...
43	8	Hicacos—Constance Estate ...	...	5·23	1·90	6·45	6·87	10·42	4·43	7·63	4·62	2·33	3·50	7·49	...
65	8	Carapichaima ...	...	...	...	...	...	6·84	...	...	...	10·00	8·42	7·60	...
66	8	Nariva—The Cocal ...	...	...	...	...	...	...	...	...	...	...	...	...	...
68	8 G.	Manzanilla—Police Station ...	4·15	3·72	1·12	3·79	19·70	9·33	9·07	7·00	5·26	7·10	13·63	14·76	98·63
3	8 G.	Santa Cruz—Police Station ...	2·00	1·66	1·19	4·77	8·99	6·15	15·32	12·35	10·08	9·48	11·00	17·14	100·13
69	5	Couva—Brechin Castle Estate ..	1·42	1·18	0·59	6·26	9·66	8·71	9·60	11·49	8·56	10·81	9·15	5·10	82·53
70	5	Couva—Rivulet Estate ..	1·35	1·56	0·61	6·53	9·66	7·52	12·98	11·22	4·38	10·51	12·92	8·96	88·20
71	5	St. Helena Estate ...	...	...	...	...	...	...	...	...	...	...	...	...	...
74	5	La Plaisance Estate ...	1·47	2·15	0·44	...	...	...	...	...	5·01	4·03	...	...	...
76	5	Caroni—Curepe Estate ..	...	...	...	...	...	...	...	...	...	...	...	...	...
77	5	Caroni—McLeod Plain Estate ...	...	...	...	...	...	...	...	...	...	...	...	...	...
78	5	Caroni—Frederick Estate ...	0·96	1·15	0·18	2·84	13·10	10·14	12·50	9·38	7·85	9·10	12·16	6·79	86·15
79	...	Cedros—Beaulieu Estate ..	...	...	0·79	...	...	...	...	...	...	...	...	...	...
80	8 G.	Siparia—Rest House ..	2·78	2·59	3·16	4·90	9·85	13·92	13·29	4·42	7·00	3·46	11·83	9·61	86·81
81	8	Gran Couva ...	...	...	...	...	...	...	...	...	...	...	...	...	...
82	5	Tacarigua—El Dorado Estate. ..	...	3·12	0·25	3·01	10·15	9·15	12·47	10·14	6·38	7·80	...	6·89	...
83	8 G.	Carenage—Police Station ...	3·11	0·72	5·58	5·53	11·89	6·36	12·78	14·40	10·41	5·19	9·35	6·33	91·70
84	8	Guapo—Adventure Estate ...	2·29	2·62	0·98	6·68	6·61	9·92	10·39	9·43	5·88	5·61	10·75	4·66	75·82
85	8	Princes Town—Fairfield Estate ..	1·35	...	...	...	...	...	...	...	...	...	...	...	...
86	8	Princes Town—Lothians Estate ..	2·05	0·35	1·91	2·44	8·46	9·66	16·11	9·11	4·26	5·37	16·75	9·44	85·91
24	8 G.	Maraval Reservoir ...	2·43	3·32	0·73	5·38	17.13	10·28	16·84	17·21	14·98	10·76	13·68	13·90	126·64
67	8 G.	St. Ann's Reservoir ..	2·56	1·96	0·48	3·98	11·52	10·51	13·79	15·68	10·07	7·64	6·67	7·55	92·41
87	5	Oropuche—Nelson Estate ..	1·16	1·34	0·32	4·51	5·58	8·65	4·14	7·55	3·67	2·58	7·22	5·03	51·75
88	8	Cedros—Perseverance Estate ...	3·06	1·26	1·71	6·86	3·80	3·86	3·22	5·56	2·79	1·91	4·36	7·78	46·17
89	8 G.	Savonetta—Phœnix Park Estate ...	1·22	1·42	0·71	5·49	8·80	7·16	9·89	10·10	6·21	7.52	11·16	5·61	75·29
90	8	Gran Couva—La Gloria Estate ...	1·84	2·76	1·31	6·69	10·24	11·39	9·84	8·02	4·36	5·31	11·81	7·67	81·24
91	8 G.	Dabadie ...	1·29	2·54	0·66	4·25	18·79	16·41	16·50	14·04	12·05	7·48	15·47	13·35	122·83
92	...	Cunupia—Mon Plaisir Estate ...	1·67	1·27	0·51	2·84	13·92	8·66	13·07	9·11	10·19	7·72	13·46	9·73	92·15
93	...	Arouca—Laurel Hill Estate ...	1·14	2·35	...	...	...	...	...	...	...	...	...	7·37	...
94	...	Naparima—Philippine Estate ...	1·41	2·50	0·57	5·97	7·94	11·46	10·55	8·88	4·70	4·25	10·28	7·06	75·57
95	5 P.	Naparima—Corinth Estate ..	...	...	...	...	...	...	...	10·79	3·60	3·46	11·72	6·46	...
96	...	San Juan—Aranjuez Estate ...	1·46	2·21	0·36	2·42	8·92	7·30	12·75	6·67	7·94	6·21	6·12	6·21	68·57
97	8 G.	Mucurapo—Woodbrook Estate ...	1·59	1·53	0·34	3·76	11·60	9·31	12·86	10·43	7·42	4·87	6·95	5·44	76·10
	...	Monthly Average, and Mean for year all Stations	2·11	2·53	1·29	5·28	10·34	9·29	11·29	9·93	6·64	5·82	10·71	8·67	85·75

APPENDIX III.—Continued.

TRINIDAD—ROYAL BOTANIC GARDENS.

ANNUAL RAINFALL, 1862 TO 1893, INCLUSIVE.

Year.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total Rainfall in each year in Inches.	Decades.
	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.		
1862 ...	0·00	·66	·77	·25	1·41	8·47	10·36	9·57	11·97	6·60	10·06	3·03	63·15	In the decade 6 years above and 4 years below 30 years average.
1863 ...	1·54	2·71	1·45	·85	1·26	9·12	10·12	10·53	12·11	6·24	4·30	6·57	66·80	
1864 ...	2·51	·53	·36	·04	8·15	4·96	7·17	12·06	8·04	6·53	5·94	6·61	62·90	
1865 ...	2·62	3·20	1·07	7·98	3·22	5·64	10·35	14·83	7·32	14·62	4·81	9·62	85·28	
1866 ...	2·24	3·91	1·44	1·09	1·45	6·59	7·83	12·34	5·87	10·11	8·17	6·82	67·86	
1867 ...	1·31	6·36	·83	1·32	2·33	5·30	12·20	15·21	10·45	7·87	·67	2·71	66·56	
1868 ...	2·06	·82	3·20	·64	4·17	7·78	11·35	6·73	5·46	4·66	8·31	1·03	56·21	
1869 ...	·08	·93	·74	·41	·69	5·52	10·17	8·74	8·86	5·15	6·30	5·87	53·46	
1870 ...	2·61	·56	1·46	1·51	4·65	8·81	11·91	9·00	10·63	3·98	5·94	8·29	69·35	
1871	6·62	1·40	2·89	·92	3·97	8·84	11·73	12·97	7·87	4·37	10·73	3·27	75·58	
1872 ...	1·45	·07	·74	·39	3·14	7·09	5·45	10·82	3·07	4·80	9·89	3·04	49·95	In the decade 4 years above and 6 years below 30 years average.
1873 ...	1·78	1·08	1·98	·53	0·00	4·31	5·04	8·37	5·80	10·34	3·48	1·31	44·02	
1874 ...	3·47	1·96	3·67	5·16	2·51	12·28	12·28	11·20	9·38	6·42	3·66	4·29	76·28	
1875 ...	3·39	·91	·56	·42	2·61	4·15	12·62	7·22	11·95	10·85	3·74	2·48	60·90	
1876 ...	3·26	1·03	1·78	1·67	6·65	11·17	12·23	15·18	12·03	7·04	5·95	3·96	81·95	
1877 ...	2·14	0·00	7·46	3·38	3·19	8·43	8·35	12·94	6·39	6·68	7·66	5·48	72·10	
1878 ...	3·44	·70	0·00	3·22	4·99	5·78	5·42	8·88	11·15	5·89	8·72	3·05	61·24	
1879 ...	1·52	2·76	4·56	3·03	3·08	14·92	6·86	10·35	6·15	3·54	4·28	4·38	65·43	
1880 ...	11·72	6·53	·67	2·32	3·90	7·83	6·30	17·39	7·47	5·74	10·51	1·96	82·34	
1881 ...	·57	·65	·23	1·60	4·66	11·05	7·82	10·90	10·59	3·36	12·06	2·23	65·72	
1882 ...	1·33	2·38	·73	1·57	3·74	6·33	5·93	8·40	4·93	5·86	10·29	1·50	52·99	In the decade 4 years above and 6 years below 30 years average.
1883 ...	1·56	·71	·26	3·37	5·89	10·91	13·66	10·26	5·53	3·99	6·06	8·30	70·50	
1884 ...	3·43	2·50	4·40	1·51	2·91	6·84	5·71	8·70	5·03	5·05	5·14	5·66	56·88	
1885 ...	1·30	·89	1·49	·43	5·27	3·44	5·87	4·56	6·08	4·08	5·37	4·44	43·22	
1886 ...	3·32	1·97	3·27	3·83	4·49	9·70	17·48	8·15	6·73	12·59	8·54	6·75	86·82	
1887 ...	2·69	1·46	1·67	1·08	3·98	7·40	5·51	9·93	5·07	5·84	7·60	11·86	64·09	
1888 ...	8·37	1·79	2·41	2·28	3·46	11·92	6·89	7·02	5·53	5·06	7·76	2·95	65·44	
1889 ...	0·94	0·85	4·16	1·05	6·34	11·66	12·14	11·73	3·76	6·30	7·38	7·48	73·79	
1890 ...	7·76	0·51	2·09	7·62	5·14	9·68	12·89	11·65	3·37	10·98	5·93	5·28	82·90	
1891 ...	3·17	0·92	0·03	1·44	2·54	5·54	11·88	4·26	7·44	5·77	6·66	4·09	53·74	
Avg. Monthly Rainfall for 30 years, 1862–'91	2·94	1·69	1·87	2·03	3·65	8·04	9·45	10·32	7·53	6·67	6·86	4·81	*65·91	
1892 ...	1·93	2·19	1·85	7·59	11·55	16·26	15·55	9·21	3·57	11·49	5·40	4·69	91·14	
1893 ...	3·43	1·85	0·19	3·61	11·35	10·19	13·28	16·32	11·73	5·47	7·84	7·23	92·49	

*Average Annual Rainfall for 30 years—1862 to 1891 = 65·91 inches.
Average to date or 32 years—1862 to 1893 = 67·5 „

J. H. HART, F.L.S.,
Superintendent Botanical Department.

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BULLETIN

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CONTENTS:

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1893.

COCOA CURING IN CEYLON.

The following information received from Dr. Trimen, Director of the Royal Botanic Gardens, Ceylon, will no doubt be of great interest to Planters in Jamaica.

"You ask about Cocoa curing. We always carefully wash off with repeated ablutions every particle of mucilage from the seeds. No doubt this lessens weight, but much improves the sample and I think one of the principal reasons for the generally high price Ceylon cocoa fetches in London is the clean bright look of the bean. Another and perhaps more important thing is thorough drying. On estates this is always done by a current of hot air drawn by a fan through a small house, the seeds being spread out in layers on trays and turned over several times. No Planter here would allow a speck of mould to be seen on a Cocoa bean. I gave a description of the ordinary style of drying house for Cocoa to Sir W. Robinson of Trinidad a few years ago and he printed it in the "Agricultural Record" of that Colony for 1890. I enclose a leaflet which is distributed with Cocoa seed to the *native* villagers."

DESCRIPTION OF CEYLON COCOA DRYING HOUSE.

"The house is about twice as long as broad, built of brick, and is provided with double doors, but with the exception of the opening for the ingress and egress af the hot air, is hermetically sealed. The interior is fitted with a number of upright frames into which slide, one above the other, the trays upon which the beans are spread; these should be made of narrow pieces of split bamboo, not of wire or coir-matting. The heating apparatus is outside in contact with one end of the building, and consists of a large stove standing in a short tunnel which opens into the house. At the other end of the building, also outside, is a powerful fan, fitted in another short tunnel; this is worked by hand (three or four coolies needed) and by itsr apid revolutions draws the air through the house. By passing over and round the stove the air is dried and heated; that which passes out is hot and damp. The flue of the stove passes under the floor of the house and contributes to warm it. A drying house of this sort is very simple and its cost only about 120 rupees; it does its work perfectly, and nothing more elaborate or costly is required.

"It is found desirable here to dry Cocoa as slowly as possible, provided the risk of mould be avoided This appears in the interior of the beans in twelve hours and on their outside in about twenty-four in wet weather if they are left cold, but by passing them rapidly through the hot air house, so as to have them hot when taken out, it is found that they will remain for a night or so in the store without injury.

"As the annual average number of rainy days in Ceylon is from 80 in dry districts, to 328 in the wet, and Cocoa is grown only in the moist regions of the Island we may assume that at least four-fifths of the Cocoa exported from that Colony is dried artificially. The rainfall in the best Cocoa Districts of Trinidad appears to average between 80 and 100 inches. The total yield as before stated is 12,500 cwt. representing an enormous crop and an immense number of people dependent upon it."

"INSTRUCTIONS TO NATIVE CULTIVATORS OF THE CACAO OR CHOCOLATE TREE, 1884.

"1. *Localities, soil, climate, &c.*—Cacao is a completely tropical plant, and its cultivation should not be attempted above 2,500 feet, and only in warm situations well sheltered from wind. Flat ground is better than sloping. The climate must be moist, but a well-marked dry season, if not too long, is no disadvantage. The soil should be deep and well drained; good forest soil is, of course, best, but that of native gardens is generally very suitable.

"2. *Planting.*—The seeds must be sown as soon as possible after they are gathered, as they quickly spoil for germination after becoming dry. Germination commences soon and proceeds very rapidly, and the young plants are very impatient of being transplanted, unless with the adoption of such precautions as will prevent any injury to the roots. Arrangements must, therefore, be made either for growing the seeds in a nursery in such a manner as to allow at least a foot between each seedling, so that they may subsequently be taken up with the earth about their roots, or for sowing them singly in bamboo or other pots or for putting two or three seeds in each place it is intended a tree shall occupy, afterwards allowing only the strongest seedling of these to remain. The last plan is the best for native cultivators. In plantations the trees should stand at from 10 to 15 feet apart, according to the richness of the soil, 12 feet being a good average distance.

"3. *Cultivation.*—It is necessary to shade the seedling plants when young: this is effected by branches fastened in the ground of any tree which retains its withered leaves—as cinnamon, mora, &c. There is no occasion to provide any permanent shade in most parts of Ceylon, but shelter from wind is of great importance. Plenty of light and a free ventilation of air are essential for the production of good and abundant crops. The ground under the trees must be kept perfectly free from weeds, and may be littered with decaying leaves and other vegetable matter. Manure is very beneficial. The trees should be kept from growing higher than 10 or 12 feet, and the primary branches be encouraged to assume a horizontal direction; redundant shoots from these or from the trunk must be pinched off when young. The principal trunk and branches should be kept very clean, and great care should be taken that the small and delicate flowers are not rubbed off or injured.

"4. *Gathering.*—A first crop may be expected on good soil in the third year. The fruit must be quite ripe before it is gathered; this is known by the rind having a yellowish colour when cut into. The pods should be cut off cleanly with a knife, and not too closely to the stem. They can be easily split by a blow from a wooden mallet, and the seeds and pulp are then taken out and put into baskets to be carried to the curing place.

"5. *Curing.*—The seeds should be heaped together to "sweat." This may be done in pits or boxes, or better on a platform covered with coir matting; the seeds should be covered over with

matting, gunny bags, or a tarpaulin. Every other day they must be thoroughly turned over until the process of fermentation has gone far enough, which will be in seven, eight or nine days; on the proper duration of this depends the goodness of the sample. The mucilage and pulp round the seeds is now ready to be washed off, and this washing requires several repetitions with plenty of water. As soon as clean they should be at once spread out on mats in the sun to dry, avoiding, however, the extreme heat of the day, and in about three days they will be fit for the market. In wet weather the drying must be done by artificial heat in the house.

"When well dried the "beans" should be perfectly clean, with a thin pale cinnamon-brown skin, of one colour all through, and entirely free from damp or mouldiness.

HENRY TRIMEN, Director, R. B. G.

COCOA CURED AT THE HOPE INDUSTRIAL SCHOOL.—II.

Account sales of 3 brls. Cocoa received ex S. S. "Don" from Kingston, Jamaica and sold by the undersigned for account of the Jamaica Government through Messrs. Lascelles DeMercado & Co., Kingston, Jamaica.

T. G.	3 Barrels Cocoa ...		4	2	7		
	Tons	2	4				
	Dft.		6		2	10	
			3	3	25 @ 66/6 per cwt. ...	...	£13 4 3
	Discount 2½ o/o ...					...	0 6 7
							12 17 8

CHARGES.

Freight @ 50/ & 5 o/o ...	...	£0	12	0
Wharf Charges 6/. Disct. 9d. Stamp 3d.	...	0	5	6
Insurance on £15 and Stamp	...	0	2	6
Printing and advertising 1/. Fire Insurance 3d.		0	1	3
Brokerage	...	0	2	8
			1	3 11
			11	13 9
Commission 2½ o/o on £12 17 8	...		0	6 5
Nett proceeds due 11th February, 1893	...		11	7 4

E. & O. E.

London 17th January, 1893.

E. A. DEPASS & Co.

INSTRUCTION IN THE CULTIVATION OF THE GRAPE VINE.—III.

PLANTING YOUNG VINES.

Vines can be planted at any time of the year, but they will do much better if planted any time before May; as they get more light and warmer nights than if planted at the end of the year. Vines will grow in almost any kind of soil, but a good sandy loam suits them best.

The Vine must be planted so as to be exposed to the morning sun; if they can have the sun shining on them all day, so much the better; but vines must have sun from early morn to past midday to do any good.

To give the vine an advantage, a hole about 6 ft. square and 18 inches deep should be dug, and if the soil is of a stiff nature one-fifth of sand, one-fifth of burnt rubbish and a load of short stable manure should be well mixed up with the soil. If the soil be very dry it should be watered so as to make it a little moist; when well mixed together the hole should be filled up with the soil. It is not advisable to plant vines in ground that has not been dug out or trenched to a depth of 18 in. At the same time, if anyone is going to plant a large number of vines, and the soil is favourable, the ground can be well dug 12 in. deep and a good supply of stable manure forked in at the same time. If the soil has been dug and filled in again, as I advised in the first instance, then the soil should be allowed to settle for at least a week before planting the vine; in the latter instance the vine can be planted as soon as the ground is dug. A dull day should be chosen for planting out the vines, if a dull day is not to be had, then the vines should be planted out in the evening. Every morning they should be covered over with something to keep the sun off for a few days till the vines have taken hold.

When the vines are being planted out, care must be taken to see that the roots are laid straight out from the centre; also that the base of the new growth just touches the soil, so that roots can form from this part. As soon as the vines are planted, the ground should have a copious supply of water; to wash the soil well in between the roots. After the first watering if done thoroughly the vines will not need watering again for about 14 days. After that the vines should never be allowed to want for water till the end of September, by which time the vines should have made good growth. From September to January the vines should be kept without water to allow the cane to ripen.

When the vines are first established, a strong stick should be fixed for the vine to run up. The first season's growth should be concentrated into one main stem, so that as fast as the laterals and tendrils grow they should be pinched off.

Disbudding and Stopping Vines.

As soon as the vine begins to send out its shoots, care must be taken to have all buds rubbed off which are not required. As soon as the shoots get about three inches long they should show fruit if there is going to be any on the first growths. Most eyes that break will give off two or thre growths. At the first disbudding, if there are three growths, the weakest one at each eye can be rubbed off; but if there are only two growths and of about the same strength, then care should be taken to rub the one off the furthest from the old wood, so as to avoid forming a long spur. After all but the best growths have been rubbed off at each eye, care must be taken not to let any more growths spring from the base of the first side growths. Do not allow the growths too close together; ten inches from one growth to another will be a good distance. It will be prudent not to thin the last extra growths off till it is seen what fruit there is; if there are no signs of fruit when the growths are about six inches long, it may be taken that there will not be any unless it comes on the laterals, as is often the case with black grapes. As soon as the disbudding is all over, the side shoots of the Vine will soon have made about eighteen inches of growth. At this stage all growths except the leaders should be stopped at the end of the growth by having the point pinched out. The growths with fruit on can have the point pinched off at the third leaf past the bunch; those side growths without any fruit on must be pinched back to about the same distance. Soon after the points of the lateral have been pinched off, sub-laterals will begin to show; these must be allowed to grow till they have made five or six leaves; then they must be pinched back to one leaf; as fast as they keep growing the process must be repeated.

It is not wise to allow fruit to remain on the leading growths, so if there is any, it should be pinched off at once. Unless the Vine is a good age, has a good main trunk, and is in good condition, it should not be allowed to carry all the bunches that come on; ten good bunches are better than thirty bad ones, and there is nothing that will ruin Vines so much as over-cropping.

The leading growths should not be stopped until the vine has been growing about four months, then it can be stopped by having the point pinched out, this will cause the trunk of the vine to thicken. All the laterals must be kept of the leading growths.

As the Vine gets covered with foliage the Vine should get a great deal more water than it received during the first few weeks; the soil must never be allowed to get anything like dry. When the Vine is coming into flower, it should have a good watering to carry it over that period, after that, it should receive a copious supply of water every week till the fruit begins to colour; at this period water should be kept from it for a few weeks.

ALFALFA OR LUCERNE.

(Medicago sativa, Linn.)

This plant is cultivated in many semi-tropical and tropical countries as a fodder-plant. It is nearly allied to the clovers, and has a tre-foil leaf, purple flowers, and a pod of a double spiral. It is well worthy of a trial in Jamaica as a forage plant.

In India, according to Dr. Watt's "Economic Products of India," the seed is sown broadcast on ground well broken up and manured. Lime is the best manure. The amount of seed required is from 30 to 50lbs. to an acre. It comes to perfection in about 6 weeks, and from 4 to 8 crops can be cut in the year. On good soil the yield is 10,000lbs. to 15,000lbs. to the acre for one cutting. Seed is generally procured from the third crop. One sowing is said to last from 2 to 10 years according to soil and manure. Where there is no rain, it is irrigated five times each crop, or every time it droops. The crop should be cut before flowering. In Cuba, it is said to be grown as Guinea grass is in Jamaica.

Reports from the United States are favourable to its value as a forage plant. The *Colorado Agricultural Colleg*e reports "alfalfa an entire success. If the lands is kept well irrigated two crops can be taken the first season, yielding three and four tons to the acre. The second season three cuttings can be made, yielding 7 tons per acre. This year the second crop grew 42 inches in thirty days, so thick and heavy one could not walk through it. When once well rooted it appears to be an impossibility to kill it. Ploughing it under, like Clover, only makes it grow better. After having been ploughed under and the land sowed to oats, 3 tons of Alfalfa per acre were cut after 42 bushels of oats per acre had been harvested. Wheat, corn, and potatoes are raised with excellent success after ploughing it under, and without interfering with the stand of Alfalfa the next year. Of the Clovers, Alfalfa will always head the list in this region. In some respects it is unequalled, as it has unrivalled vigour of stem and root, the latter qualification enabling it to survive our seasons of scantiest water supply which the grasses will not do as a general rule."

In Louisiana, Alfalfa does well on dry, good land. The soil in northern Missouri is reported as not adapted to it, but in the southern part it is a success. In South Carolina, Alfalfa is thoroughly adapted to the soil and climate, and is considered most valuable. It is reported also as well suited to west Florida. In Kansas it withstands the drought, and proves a valuable forage plant.

To those who will undertake to experiment with Alfalfa, sufficient seed (3 lbs.) will be supplied free to plant a square chain. If any consider it desirable to make a larger sowing, more seed will be obtained at cost price. Applications should be sent at once to Director of Public Gardens, Gordon Town P.O., in order that seed may be obtained from abroad.

IMPROVED BEE-KEEPING FOR SMALL SETTLERS.

(*a*) The methods adopted by our peasantry with regard to the management of bees, and the production of honey, are of so crude and unscientific a nature, and are indeed based rather more upon superstition than on a knowledge of the habits of bees; that unless such bee-keepers can be persuaded

to adopt a more modern and scientific system the industry of bee-keeping in Jamaica will still in general remain stagnant, and all but un-remunerative, as it has been for years past.

(*b*) The common plan for removing the honey from the hive is quite barbarous; the bees are made to leave the hive by the use of smoke. Many of them get singed and burnt by the careless way in which the smoke is applied, and the flavour of the honey is spoiled; the combs are then scooped out, without regard to the different grades of honey which a hive always contains. These combs are then placed upon a sieve and chopped up; the product being caught in a receptacle below.

(*c*) The honey thus obtained is a mixture of bee bread,—or pollen—the juices of young bees (or larvæ) and exuviæ and excreta,—which if known of by the general public, they would be more careful to ascertain from what source they get their honey. Indeed I have been informed from good authority, that a shipment of honey of this kind was once made from here, and on arrival at its destination it was found to be of such bad quality that it was sold to a firm of blacking manufacturers at the rate of 6d per gallon. The bees thus deprived of all their honey combs are again returned to the empty hive to get on as best they may.

(*d*) A much better plan would be to make several holes in the top of the hive and place upon it another box of somewhat smaller dimensions, in the roof of which there has been previously fixed a piece of comb as an attraction for the bees to ascend. As the hive increases in wealth and population and the honey season advances the bees will soon turn their attention to the upper box or "super" and as their instincts always lead them to store their honey in the upper part of the hive it will be speedily filled with dainty white combs which will contain the most beautiful honey. It will be seen that by this arrangement not alone is the store-house kept separate from the nursery, or lower box, with its pollen, brood-foods, and larvæ and exuviæ which are always associated with the honey when the nursery and larder are not separate; but on the improved plan the honey can be removed without disturbing the hive proper, and if the "super" be again prepared as mentioned above and replaced, the operation may be performed two or three times during the honey season, and perhaps at each removal as much as a gallon of good honey will be obtained, making, say three gallons in all, worth 2/6 or 3/ per gallon. One stock will therefore yield between 7/6 and 9/.

(*e*) If this be compared with the usual method, the fable about the goose and the golden eggs may be applied, for by the old plan we got, say, half as much honey, and that of a very inferior quality, and at the same time stand a chance of losing our bees by depriving them of all their honey at one time.

(*f.*) Of course the results obtained by the above improved method are not to be compared with those of a still more complicated and indeed highly scientific plan, known as the movable comb hive system, where as much as 1 cwt. of honey per hive is not at all infrequently obtained. But as this plan would require a rather more lengthy explanation than space at command will permit, and as at the same time the method and apparatus would be somewhat beyond the means of the general Jamaican peasant Bee-keeper,—it may as well be left out of view—for the present at least.

(*g*) Not alone is the present system of management open to vast improvement; but the type of bee itself may also be improved. For instance, suppose we have six hives of bees, the results from each may be very different; at the beginning of the honey season we place upon each a "super", two of our six stocks start ahead with a will, and fill their "supers" as fast as they are replaced, the other four perhaps refuse to enter, or after all only partially fill their "supers," then they may each swarm two or three times thus furnishing us with an increase from which we hope to have great results in the future; but our apiary has not been increased with a type of bee whose instincts lead them to amass honey, far in excess of their needs, but with a type whose nature impels them to start new colonies, and thus this type will be strongly impressed upon the bee life of the future in our apiary. The peculiarity will be reversed with the two good stocks which on account of constantly being deprived of their storage honey, have had no encouragement to swarm, and as the object of bee-keeping is to get *honey* and not swarms, the Bee-keeper should endeavour to restrict the multiplication of undesirable and small strains, and seek the slower increase of those which give the best honey results.

(*h.*) This may be perhaps one cause of the unremunerativeness of our native Jamaican bees as compared with the imported strains, which I and other more advanced Bee-keepers have obtained from other countries (America, England and Italy) where bees have been carefully kept for generations.

(*i.*) It may be well to mention that bees play a great part in the production of crops. Nature seems to have placed honey in the flowers, not so much for supplying food for bees and other insects, but that fertilisation of plants may be accomplished.

The bee in flying from flower to flower gets dusted with pollen from the anthers or male organs of blossoms, and in this way it is conveyed to the stigmas, or female organs. It is interesting to note that when a bee starts on a foraging tour she confines herself to one description of flowers, for perhaps if this were not so the mixture of different pollens might interfere with their proper actions of fertilisation.

(*j.*) It will therefore be seen from this action of bees on plants that the agriculturist owes as much to the "little busy-bee," as he does to his own skill and experience in tilling the soil and in choosing his seeds.

H. S. (Junior.)

FERNS : SYNOPTICAL LIST.—XVI.

Synoptical List, with Descriptions of the Ferns and Fern Allies of Jamaica, by G. S. Jenman, Superintendent Botanical Gardens, Demerara, (continued from Bulletin, No. 40.)

5. *Pteris mutilata*, Linn.—Rootstock small, fibrous, clothed with dark blackish scales; stipites tufted, very slender, channelled, 2-8 in. l. naked; fronds thin, light green, pellucid, naked, 3 in. to a span l. half or two-thirds as w. at the base, the upper part simply pinnate, with a linear-oblong ter-

minal segment, and several usually shorter spreading lateral ones, the lower one or more pair of which are again similarly pinnate, the ends rounded and the points apiculate, ½-¾ in. l. ¼ in. w. the margins even or crenulate, and cartilaginous edged; rachis slender, pale, narrowly winged in the upper part; veins open, dichotomously forked; sori marginal, falling a little short of both apex and base; barren fronds with shorter stipites and broader segments.—Hook. Sp. Fil. Vol. 2 t. 131 A.

Var. *P. concinna*, Hew. Stipites 1-1½ ft. l.; fronds ¾-1 ft. l. 5-8 in. w. bi-tripinnate, formed of a terminal pinnæ and 2-4 similar, but usually narrower and shorter, lateral ones 2-6 in. l. and 1-1½ in. w. the lowest pair of which are branched at the base and petiolate, all slightly echinate on the costæ above: final segments ¾-1¼ in l. 2-3 li. w. decurrent on the inferior side, a notch on the superior, the point blunt, often slightly apiculate, the sinuses more or less obliquely open; veins forked, the lowest pair springing from the costæ.—Plum. Fil. t. 51.

Plentiful on calcareous rocks and banks at 2,000-4,000 ft. alt. in dry woods; gathered by Mrs. Seed Roberts above Prospect, St. Andrew. It possibly attains a larger size than I have described. The variety *concinna*, first described by Heward in 1838, (Mag. Nat. His. new series, p. 435), is common about Christiana, Manchester. It looks very different at first sight, and shows a tendency towards *Swartziana*, the pinnæ being similarly notched and decurrent at the base, with the lowest vein springing from the costæ, but the smaller fronds gradually pass into the type.

6. *P. Swartziana*, Agardh.—Stipites cæspitose, 1½-2 ft. l. glossy light or dark brown, channelled slightly scaly at the base, arising erect from an oblique or upright rootstock; fronds bi-tripinnate, 1-2 ft. l. ¾ 1 ft. w. thinly chartaceous, naked, light or dark green, composed of a long terminal pinna and few or several similar opposite erecto-spreading sub-distant lateral ones, 5-10 in. l. 1-1¾ in. w. sessile, or the lowest pair which are once forked at the base, very shortly petiolate, terminating in a narrow linear acuminate sharply serrated segment; ½-1½ in. l. the slender costæ echinate on the upper side; final segments oblique, linear oblong, bluntish, broadened and rather decurrent at the base, the narrow cuneate sinus obliquely cut through the centre; veins simple, or forked from the middle, the lowest pair from the base, and springing from the costæ in the shortly decurrent membrane; sori of contiguous segments separated by the incision of the sinus, and falling more or less short of the serrated apex.—Hook and Grev. Icon. Fil. t. 142. *P. biaurita*, Swartz.

Infrequent in damp mountain forests at 2,000–3,000 feet alt. in the eastern parishes. A strictly forest plant, not very common, distinguished from its allies by the more slender stipes, rachis, &c., the simple or forked from the middle, viens, serrated segments, the oblively inscised sinus, and the lowest pair of veins springing from the costa instead of the midrib from which the rest spring, and thinner and more pellucid texture.

7. *P. longipinnula*, Wallach—Rootstock erect, the nascent fronds bud-like and coated with small appressed gray scales; stipites erect, channelled, naked or with a few of the bud-scales at the base, straw-coloured, 2–3 ft. l.; fronds bi-tripinnate, 2–4 ft. l., 1½–3 ft. w., pale green, naked chartaceous, with a terminal pinna and 6–12 opposite or sub-opposite distant spreading lateral ones, ¾–1½ ft. l., 2–3 in. wi., spinulose on the costæ above, the lower petiolate, the lowest pair once forked at the base, terminating in a caudate segment, and cut down almost to the costæ into linear-oblong entire segments, rounded at the point, straight or slightly falcate, 1–1½ in. l., ¼ in. br., cartilaginous edged, the sinuses sharp or rounded; veins close, spreading, forked; sori falling short of both apex and base.—Hook. Sp. Fil., vol. 2 t. 134.

Common in the moist forest on the banks of St. George's Spring, Chesterfield, St. Mary. In the form and other characters of the fronds it is absolutely identical with the Indian and Malayan plant of the name and differs from *quadriaurita* by the sori falling short of the base as well as the top of the segments, its ampler size, different colour, and chiefly in the character of the rootstock.

8. *P. quadriaurita*, Retz.—Stipes cæspitose, 1 2½ ft. l. slightly scaly and occasionally rather asperous at the base, channelled, pale or dark glossy brown, arising erect from an upright rootstock; fronds 1¼-2 ft. l. ¾-¼ ft. w. bi-tripinnate, chartaceous, light or dark green, rachis and costæ coloured like the stipes, with a terminal pinnæ and several similar pairs of spreading or erecto-spreading lateral ones, which are 6-8 in. l. 1½-2 in. w. rather widest at the usually sessile base; final segments lenear-oblong, straight or subfalcate, obtuse, ¾-1 in. l. 2-3 li. br. and a longer straight terminal one, the sinuses acute or rounded; veins close, forked, all springing from the rib; sori falling short usually of the apices, which are not serrated.—Hook. Sp Fil. vol. 2. t. 134. B.

Var. *P felosma*, J. Sm.—Fronds as large and parts as broad, but stipites, rachis, &c., more slender, texture thinner, segments close, with no open space between, costæ with larger echinæ on the upper side.—*P. asperula* J. Sm.

Var. *P. nemoralis*, Hook.—Fronds much smaller, pinnæ more numerous, 3-5 in. l. ¼-3 in. w. branches to the lowest pair 1-2.

Var. *B. affluentus*, Jenm.—Fronds 2-3 ft. l. 1-2 ft. w. on stipites 2-4 ft. l.; pinnæ throughout fully pinnatifid, the lowest 2-3 pairs with 2-3 branches similar to the lateral pinnæ on their under sides.

Common in one form or another throughout the country from sea level up to 6,000 ft. alt. inhabiting chiefly open or half shaded situations and waysides. The colour of the stems, &c., varies from a light straw to dark chestnut. The first variety is a weaker, but not smaller plant, with closer segments, and emits while fresh a strong feline smell. The last is found at the higher ranges, has numerous pinnæ, marked by the 2-3 lower ones on each side having 2-3 deflexed branches each. The second, a mountain form too, is only marked by its smaller size, numerous pinuæ, firm texture and compact habit.

9. *P. biaurita*, Lin.—Rootstock upright; stipites cæspitose, erect, 1½-2½ ft. l. naked or slightly scaly, channelled, bark-brown or light-green; fronds erect, bi-tripinnate, 1¼-2½ ft l. ¾-1¼ ft. w. naked, chartaceous light green; pinnæ in 6-15 opposite, sessile, erecto-spreading pairs, with a similar terminal one, the lowost pair onco forked on the lower base, 6-9 in. l. 1½-2½ in. w. deeply pinnatifid through-

out, terminating in a caudate point; segments linear-oblong, straight or subfalcate, 1-1¼ in. l. 2 li. w- blunt, an open rounded sinus between; veins pellucid, close, spreading at a wide angle, all forked except those springing from the narrow transverse costal arch which spans from rib to rib of the segments; sori falling little short of the apex.—*Campteria*, Presl., Plum. t. 15, (venation not shown).

Var. *subpinnatifida*.—Fronds smaller, paler; pinnæ irregularly lobed, or lobate-sinuate; veins occasionally united beyond the costal arcs.

Frequent among brushwood and grass in half-open places among the lower hills. Not nearly so common, but closely resembling *quadriaurita*, the pinnæ less deeply pinnatifid, sinuses more open and rounded, and clearly distinguished by the curved veins which uniformly connect the bases of the ribs of the ultimate segments.

10. *P. podophylla*, Swartz.—Rootstock, erect, 6-8 in. thick, the crown scaly; stipites 4-8 ft. l. cæspitose, stout, erect, 1½ in. thick, faintly channelled, the base muricate, and clothed with linear acuminate dark scales; fronds pedatiform, spreading horizontally, 3-4 ft. each way, subcoriaceous naked, dark glossy green; primary divisions three, the central not branched again from the base, and, longest, 2-4 ft. l. ¾-1½ ft. w. lateral divisions usually four-times branched, the branching occurring outwardly in succession, each branch shorter than the preceding and all oblong in shape; pinnæ very numerous, approximate, spreading nearly at right angles, a similar terminal one, 6-9 in. l. 1¼ in. w. the inferior reduced, sessile, passing gradually at the apex into a serrato-entire, acuminate point; within this cut deeply into short, broadly subacute, falcate segments ½-¾ in. l. ¼ in. w. with an acute or rounded sinus between, the costæ above spinulose; vein-meshes 1-3 seriate, with or without free exterior branches, the transverse costal areolæ very shallow, reaching from rib to rib; sori continuous from the sinus, falling short of the finely spinulose-serrate apex.—Hook. Gard. Ferns, t. 55. *Litobrochia*, Presl.

Common in wet situations in open and half open places from 4,000-6,000 ft. alt. The fronds spread sub-horizontally, and the gradual shortening of the exterior branches gives them a somewhat circular outline. The pinnæ are a uniform width from the base outwards, and narrower than in any of the local allies. The petioles are only muricate at the base, the upper parts being quite smooth. This and *gigantea* are among the noblest plants in the fern flora.

11. *P aculeata*, Swartz.—Stipites 1½-2 ft. l. stramineous, slightly scaly at the base, freely beset throughout with short prickles; fronds ample, naked, thin and pellucid, pale green, tripinnate below, 3-4 ft. each way, tripartite, the lateral divisions greatly developed on the lower side, 1½-2 ft. l, 1 ft. or more w. petiolate, the inferior pinnulæ largest; pinnæ of the central division equilateral, contiguous, longest 1-1¼ ft. l. 2½-3 in. w. deeply pinnatifid and passing gradually into the serrate acuminate apex, the lower petiolate, the upper sessile, terminal pinnæ similar to the lateral; final segments contiguous 1½-2 in. l. 4-5 li. w, broadest and connected at the base, the sinuses sharp or rounded, serrate, especially in the acuminate outer part, but not spinulose-toothed; rachis and costæ stramineous the former distinctly muricate below; veins fine, costal areolæ narrow, extending completely from rib to rib, a single row between this and the sinus, areolæ of the segments 1-2 serial with copious free clavate exterior branches; sori falling short of the dentate point of the segments.—*Litobrochia*, Presl. Plum. Fil. t. 5.

Infrequent; gathered on Mount Diablo, 2000 ft. alt. the only locality from which I have seen the true plant. It is distinguished by the freely prickly stipites, costal areolæ reaching uniformly from base to base of the ribs of the final segments, pale straw colour, thinner texture, and deeper serration than of its allies. I have not seen the rootstock. There is much confusion in herbaria and books in regard to this species, and indeed to the whole group, but to one who has had a field and forest acquaintance with them each is sufficiently distinct, even in minor characters, as to be readily recognized by herbarium specimens alone, which unavoidably do not show the chief characters of such large plants.

12. *P. Kunzeana*, Agardh.—Rootstock woody, stout, decumbent, shortly repent, the extending end densely clothed with narrow ferrugineous scales; stipites tufted, strong, erect, 1½-3 ft. l. green or brown, the scales of the rootstock ascending the base, smooth and faintly channelled; fronds ample, tripartite, tripinnate, deltoid, about 2 ft. l. 2½ ft. w., glabrous, dark glossy green above, pale beneath, subcoriaceous; central division larger, equilateral, otherwise similar to the lateral which are distant by the naked rachis and deeper on the inferior side; pinnæ 6-10 to a side, with a similar terminal one, ¾-1 ft. l. 1½-3 in. w., the acuminate spinulose-serrate apex forming a segment 1-2 in. l. within this deeply pinnatifid into broadish, spinulose-serrate subfalcate, acute, segments, ¾-1½ in. l. ⅓-½ in. w.; rachis channelled, light green, costules spinulose on the upper side at the base of the final ribs; vein-meshes 1-2 or 3 seriate, the exterior branches free, and a single line of long narrow costal areoles that span from rib to rib or not; sori short of the top of the segments; involucres silvery.—Hook. Sp. Fil. vol. 2. t. 139. *Litobrochia*, Presl. Common in moist woods among the lower hills, ascending to about 2,000 ft. alt. Grisebach in his flora mistakingly united it with *podophylla*. It is darker and stiffer than the preceding and not so lax as the next, possessing, as well, several other minor individual features in the fronds. The nature and vestiture of the rootstock however clearly distinguish it. Sloane was its first discoverer.

CONTRIBUTIONS TO THE DEPARTMENT.

Library.

Colonial and Consular Reports. [Hon Colonial Secretary.]
Kew Bulletin No. 73, January, and Appendix I., 1893. The Export of Cape Fruit. [Kew.]
Plantas novas cultivadas no Jardim Botanico do Rio de Janeiro. [Director, Bot. Gard.]
Bulletin, Colonial Museum, Haarlem. Feb. and Sept., 1892 and Jan., 1893. [Editor.]

Transactions for 1892. Schedule of Prizes for 1893. [Massachusetts Hort. Soc.]
Agri. Gazette of New South Wales, November and December, 1892. [Dept. of Agri. New South Wales.]
Contributions from the Bot. Laboratory of the Univ. of Pennsylvania, No. 1. [Professor Henry Primble.]
Bulletin, Nos. 18 and 19. [Louisana Bureau of Agri.]
Planters Monthly, Honolulu. January, 1893. [Editor.]
Agri. Record, Trinidad. November, 1892. [Editor.]
Barbados Agri. Gazette and Planters' Journal, February, 1893. [Secretary.]
West Indian and Commercial Advertiser, February, 1893. [Editor.]
Sugar Cane, February, 1893. [Editor.]
Chemist and Druggist, January and February, 1893, Nos. 664-669. [Editor.]
Farmer and Fruit Grower, Florida Despatch, January, 1893, No. 1-3. [Editor.]
Times of Ceylon, December, 1892, January, 1893, Nos. 51 & 52, 1, 2, 3. [Editor.]
Botanical Gazette, January and February, 1893. [Editors.]
Torrey Botanical Club, Bulletin, January and February, 1893, Nos. 1 & 2. [Editors.]
Reports of Sec. of Agri., Washington for 1888-91. Pro. of ninth annual Convention of Agri. Chemists. [Hon. J. M. Rusk.]
Report of St. Vincent Bot. Station, Oct.-Dec., 1892. [Curator.]

SEEDS.

From Botanical Station, St. Vincent :—
Catostemma fragrans.
From Rev. E. B. Key :—
Portlandia grandiflora.
From Botanic Garden, British Guiana :—
Euterpe edulis.
From Botanic Gardens, Saharanpur :—
Dendrocalamus Hamiltoni, Bambusa tulda, Salvadora persica, Arundinaria spatheflora, var aristata.
From Botanic Gardens, Trinidad:—
Cycas circinalis.
From Botanic Gardens, Calcutta :—
Phœnix rupicola, Wallichia disticha.
From Botanic Gardens, Hong Kong :—
Viburnum odoratissimum, Biota orientalis, Cæsalpinia nuga, Cæsalpinia vernalis, Lagerstrœmia subcostata, Doryanthes Palmieri, Reevesia thyrsoides, Coffea bengalensis.
From Forest Department, New South Wales :—
Eucalyptus rostrata, E. leptophleba, E. pilularis, E. corymbosa, E. melliodora, E. hemiphloia, E. corynocalyx.
From Mrs. Allwood :—
Mignonette.

PLANTS.

From Rev. E. B. Key :—
1 Caladium argyrites, 3 Cacti, 1 Eichornia.
From Dr. Henderson :—
11 Lycaste spp., 10 Odontoglossum spp., 2 Cypripedium caudatum, var roseum.
From Mr. A. DeMontagnac :—
4 Epidendrum bicornutum, 1Catasetum tridentatum, 1 Rodriquezia secunda, 4 Bromeliads, 3 other plants.
From Mr. G. S. Jenman, Demerara :—
Sugar Cane seedlings.
From Mr. J. T. Palache :—
34 Hippeastrum Johnsonii.
7 " aulicum platypetalum.
17 " "crimson and green."
15 " Empress of India.
3 Sprekelia formosississima.
From Mrs. Heaven :—
6 roots white Tigridia.
1 " Antholyza œthiopica.

No. 42. April, 1893.

BULLETIN

OF THE

BOTANICAL DEPARTMENT,

JAMAICA.

CONTENTS:

PRICE—Two-pence.

[A Copy will be supplied free to any Resident in Jamaica, who will send Name and Address to the Director of Public Gardens and Plantations, Gordon Town P.O.]

JAMAICA:
GOVERNMENT PRINTING OFFICE, 79 DUKE STREET, KINGSTON.

1893.

DISTRIBUTION OF GRAPE VINE PLANTS.

A number of cuttings of the best English Grapes were last year received from the Royal Horticultural Society's Gardens at Chiswick, through the kindness of the authorities at Kew. These have been grown by Mr. W. J. Thompson of the Botanical Department in the King's House grounds by permission of His Excellency the Governor, and rooted plants are ready now for distribution.

Application should be made at once to the Director of Public Gardens and Plantations, Gordon Town P. O., stating the number of plants required. The price is 2d. each plant, delivered in Kingston. Special arrangements will be made with those requiring 50 or more.

The following descriptions of the grapes are from a valuable work on the subject, "Vines and Vine Culture" by Mr. Barron, who has charge of the Chiswick Gardens.

ALICANTE:—Fruit quite black, with a thick bloom, large, of a true ovate shape; flesh squashy; flavour somewhat earthy, unless well ripened; skin thick and leathery bunches large, averaging from 2lbs. to 6lbs. in weight, very broadly shouldered, conical and regular, closely set; stalk very stout; Late. Very handsome, and easily cultivated.

BLACK HAMBURGH, OR FRANKENTHAL:—Fruit deep bluish-black, covered with a fine bloom, large, roundish-ovate; flesh firm, yet tender, juicy, and with a pleasant, rich flavour; bunches medium, ovate with broad shoulders, compact. A mid-season Sweetwater. This is the chief Grape in cultivation in England.

BLACK MONUKKA:—Fruit purplish-red, small, long-ovate, or in shape like an acorn; flesh firm, tender, seedless, very sweet and pleasant to the taste; branches very large, long-tapering. A distinct Sweetwater variety, of Indian origin.

GROS COLMAN:—Fruit black, with a thick bloom, large, round; flesh thick, coarse, with a poor watery flavour; bunches medium, broadly shouldered, well set. An extremely handsome and excellent keeping, late, vinous Grape.

MUSCAT OF ALEXANDRIA:—Fruit greenish-yellow, golden when highly ripened, large, long-ovate; flesh firm, juicy, sweet and rich, with a high Muscat flavour, bunches large, long-tapering. A very handsome and excellent, late Grape.

RAISIN DE CALABRE:—Fruit white, medium-sized, round; flesh firm, and possessing little flavour; branches long-tapering. A late, vinous Grape, which keeps well.

ROYAL ASCOT:—Fruit purplish-black, large, ovate; flesh very firm with a strong, piquant, plum-like flavour; bunches small, short, compact, well set. A mid-season vinous Grape.

ROYAL MUSCADINE:—Fruit greenish-white, small, round; flesh firm, juicy, sweet, and exceedingly pleasant; bunches small, long-tapering, compact, well set. A good, open air, early Sweetwater Grape, also known as White Chasselas.

TREBBIANO:—Fruit greenish-white, changing to pale amber when fully ripe, large, ovate; flesh firm, sweetly flavoured, but not rich; bunches very large (one example weighing 26¼lbs. has been grown) broadly shouldered, well set. A late, vinous Grape.

WHITE FRONTIGNAN:—Fruit greenish-white, small, round; flesh firm, yet juicy, and very richly flavoured; bunches medium, long-cylindrical, well set. A mid-season Muscat Grape.

EARLY ORANGES.

The following is a copy of correspondence in regard to the steps suggested to be taken to accelerate the production of early crops of Oranges in this island.

The suggestions are, (1) choice of site: shallow, rocky sub-soil, light soil, warm position on side of hill, adequate amount of rain; (2) manuring; (3) pruning to allow of free play of sun and air; (4) budding from early varieties; (5) seedlings from early varieties.

All these suggestions are well worthy of trial, and I may add, (6) irrigation, where possible, from the termination of the crop to the time when the fruits are forming.

Personally I agree with Mr. Bunyard, who proposes No. (5) and says:—"I cannot suggest any "plan except evolution *i.e.*, selecting the earliest fruits from the earliest trees, and continuing the "process through many generations."

The following note from a lecture which I delivered last February states my views on the subject of budding in Jamaica:—"Mr. Cradwick, the Superintendent at Hope Gardens, has lately been successful to some extent in budding oranges on a lime stock by cutting down the branches of the bushes, and budding when they began to make a fresh start. The precaution should be taken of budding as the rains come on. If this method can be carried out, we shall be in a position to grow oranges of any particular size, flavour, &c. But the caution is necessary that they will have to be thoroughly cultivated as they are in Florida.

"But another point in the physiology of plants has here to be taken into account, and that is the effect of cross-fertilisation. The pollen of flowers is conveyed by insects from plant to plant, and Darwin has shown that in nature, and as a rule, plants benefit by cross-fertilisation. The ovary fertilised by pollen from another flower rather than its own, yields more seeds and these produce larger and stronger plants. Generally pollen is only operative when carried to flowers belonging to the same species, but I think there is no doubt that in the different species of Citrus, the fruit itself is affected by pollen of different species, and still more by different varieties of the same species. The

flower of a good orange tree, perhaps, will be fertilised by pollen from inferior varieties or from a Seville orange, and the result may be that not only the seed but the whole fruit may be affected, so that we shall have a fruit which is neither a good sweet orange nor a good Seville, and seeds which will grow up into trees yielding fruit of some intermediate character.

"I do not think that a thoroughly good orange will have any but thoroughly good seeds, but if cross-fertilisation with an inferior variety has taken place, then the fruit will tell the tale, and warn us against the seed. Now, if this be true, that cross-fertilisation affects the fruit, how can we ever expect to have good fruit for export so long as there is such an abundance of inferior trees? There is no use whatever in going to all the expense and trouble of budding the best varieties, unless first some pains be taken to extirpate the worthless varieties, and secondly it is determined to thoroughly cultivate them."

The climatic conditions are so much against the operation of budding that, in my opinion, it will not be found worth while ever to adopt it in the island. But there is a mode of grafting, viz., inarching, which has been practised with great success for years in the Gardens, and thousands of these grafted oranges have been distributed. Appended to the correspondence from Kew is a letter from Mr. Geo. Syme to the "Gleaner" newspaper in March, 1884, describing this method as practised in Castleton Gardens, where Mr. Syme was at that time Superintendent. There is no evidence that any attempt has been made to adopt this plan by any of the orange growers in the island.

Royal Gardens, Kew, 14th February, 1893.

Sir,

I am desired by Mr. Thiselton-Dyer to inform you that an application has been received at Kew from the Director of Gardens and Plantations at Jamaica, for information in regard to the steps to be taken to accelerate the production of early crops of oranges, and thus improve the value of an important industry in the Island.

2. The subject is one in which the Governor, Sir Henry Blake, is deeply interested, and there are good grounds for believing that if the wishes of his Excellency could be carried out, Jamaica would occupy a very advantageous position as regards its oranges in the markets of the United States and Canada. It would in fact come first into these markets and anticipate by a month or so the orange crops of Florida and California.

3. There is no doubt about the desirability of the object to be sought. The difficulty is to suggest some simple and practicable means whereby it can be attained. Kew has taken some trouble in the matter and the result of inquiry, on this side, is contained in the enclosures which I have the honour to forward with this letter.

4. The opinion of two of the most successful growers of fruit trees in this country—Messrs. Rivers and Bunyard, tends to show that a careful selection of the site for orange cultivation is of great importance. Warm sheltered spots are essential. The trees should be highly cultivated, and the branches somewhat severely thinned to allow plenty of light and air to penetrate into them. Under these circumstances "budded trees" are likely to be more easily controlled than seedling trees as the buds could be selected from the earliest fruiting sorts already existing in the Island. Further budded trees on fully matured stocks come into bearing in two years so that little time is lost in the procees.

5. Actual experiment can alone decide the best stock to use for budding purposes. In Florida and in the Mediterranean region the sour or Seville orange is generally used. Mr. Rivers on the other hand prefers the lemon stock. Both these might be tried as also the Pumelo or Shaddock stocks. The budding of oranges in Jamaica has hardly been practised at all. It is a simple process and its influence in improving the quality and production of oranges cannot be over-estimated.

6. There are several very early sorts of oranges known, and it might be desirable to introduce some of these for trial in the Island. Mr. Rivers speaks of one called the "Egg orange" (although it is round) which ripens about three weeks in advance of the ordinary St. Michael's orange. If a few plants of this were obtained it might be budded on to stocks in Jamaica and probably prove very useful.

7. Another early orange is described in the extract taken from Mr. Moore's work on "Orange Culture in Florida" as the "Thornless Bell" or the "September Orange." This is not so good as the ordinary Florida fruit but it possesses several good points: (1) it is best when it is gathered before it yellows on the tree, (2) it cures with a skin as thin as the Sicily oranges, and (3) it possesses early ripening qualities and a wonderfully prolific nature.

8. It may also be possible to utilize very late oranges. The object should be to supply the northern markets at all times when oranges are in special demand and to confine the production or at least the shipments as much as possible within those limits. The capabilities of orange production in Jamaica are exceptionally favourable, and provided, the subject were dealt with in a skilful and enterprising manner the value of the industry could be enormously increased.

I am, &c.,

D. Morris.

Edward Wingfield, Esq., C.B.
Colonial Office, S. W.

Royal Gardens, Kew, 4th January, 1893.

Dear Mr. Bunyard,

I wish to ask you for information for the Government of Jamaica in regard to orange culture. The point is one of general application to fruit trees, so it is not necessary for you to know anything specially of the treatment of orange trees. The Jamaica Government is wishful to set to work to try and procure very early crops of fruit so as to forestall the Florida oranges. Jamaica is much further south than Florida but the distance of Jamaica from the Northern markets almost cancels its advantages as

regards climate. If, however, the growers of Jamaica oranges could hasten the ripening of their crop by a month or so they would obtain very substantial advantages. We may assume that they already plant their oranges in suitable soil and in warm and sheltered valleys. The question is: Whether it be possible by selecting a hotter soil, say on limestone; by judicious pruning; by the use of certain manures; by grafting from known early trees on to certain stocks; by propagating by seed from early trees or by any other method to secure earlier crops of fruit? You have had so wide an experience in regard to fruit trees and the controlling influence brought to bear upon them in this country that your opinion would have a special interest in the present inquiry. If you could find time to favour us with an expression of your views we should be very glad.

Very sincerely yours,

D. Morris.

George Bunyard, Esq.

Mr. G. Bunyard to Royal Gardens, Kew.

The Old Nursaries, Maidstone, January 6th, 1893.

Dear Mr. Morris,

I have thought over the forwarding of ripening in Jamaica oranges. I cannot suggest any likely plan except "evolution," *i.e.*, selecting the earliest fruits from the earliest trees and continuing the process through many generations. In this country we use glass and walls to bring on crops, neither are of avail there, and the only way I can see at all likely is by planting on shallow, rocky sub-soils, or by paving the base of the trees, taking advantage of the warmest spots, and by severe thinning of the trees to allow a free play of sun and air, digging in stones 6 to 8 inches over (as is done with Figs here) would also help a little.

I am, etc.,

George Bunyard.

Mr. T. F. Rivers to Royal Gardens, Kew.

Sawbridgeworth, January 7, 1893.

Dear Mr. Morris,

I have one orange which ripens in my house about three weeks in advance of the ordinary St. Michael's, this is called the Egg Orange, but it is not the Maltese Egg. It was sent here with other varieties from St. Michaels and is one of the best sorts that I have. It is early, fertile, always good but not egg-like, as it is generally round. When Professor Emory M. Smith came here last summer he told me that one of the most profitable in some orchards in California, was named the "Rivers late Orange." I have no recollection of having sent this orange, but it is quite true that I have a late orange which ripens with me in April and May, about three months after the ordinary oranges. This orange might do very well in Jamaica, as it would, by its tardiness, rather anticipate the orange season. Do you think the orange likes limestone?

I use the lemon as a stock. I could not say whether any stock would produce precocity. Raising seedlings is uncertain and would take many years. Out of a thousand seedlings one or two might differ in precocity. I should think the choice of a site would be the most important factor.

T. F. Rivers.

Mr. T. Hanbury, F.L.S., to Royal Gardens, Kew.

La Mortola, Vertimiglia, Italy,
18th January, 1893.

Dear Mr. Morris,

In reply to your note of the 9th instant, I would say, I fear my experience and the information I can give is worth but little as regards oranges. I have a fair quantity here and a large quantity at Alassio, but they all seem to ripen about the same time, viz.: the middle of December, but are sweeter and better for hanging a month later on the trees.

We are on the nummulitic limestone, a warm position on the steep sides of a hill, but the orange trees like a lighter soil with more moisture and do better on the plain at Alassio, that place producing the best flavoured oranges on the Riviera.

In my opinion it is a great point to get a nearly pipless orange with a very thin skin and hardly any pith between the flesh and the skin, such oranges are produced at Sewtow in China, and it would be worth while for the Jamaica people to get seeds or even young trees from thence.

An excellent artificial manure, especially prepared for orange trees and largely used in Florida, is sold by Mr. G. B. Forrester, 169 Front Street, New York. I have imported it on two or three occasions.

I am making further enquiries and shall not fail to address you if I can get any information worth sending.

The common remark of English frequenting this coast is "how poor the oranges are," in my garden I have some good kinds. It is best to graft the Bigaradier or bitter orange, that being the most robust of all.

In Jamaica, if they do not already possess it, they should get the great pipless oval Jaffa orange, very much liked by some people for its lusciousness, but to my taste it is deficient in the fine flavour possessed by a good St. Michael round orange.

Believe me, &c.,

Thomas Hanbury,

Extract from "Orange Culture" by the Rev. T. W. Moore, p. 114.

A late maturing orange has already been mentioned in these pages, but there is an early variety that nursery men pass over in their catologues, yet which should not be despised. Like the Lemon grown in this state its treatment has not been such as to bring out its merits. Under no circumstance is it as good an orange as the ordinary Florida Fruit, when the latter is matured. But the "Thornless Bell" is edible in September, and is best when gathered then before it yellows on the tree. When permitted to turn on the tree it looses that sufficiency of acidity which it possesses earlier and which prevents its being insipid—the common objection to it. Instead of a thick rind it then cures with a skin as thin as that of the imported Sicily orange, and with which it will probably compare favourably as to general quality. Let it be understood that all that is claimed for this "September Orange" as it might be designated, are its early ripening qualities and its wonderfully prolific nature.

The Cultivation of the Orange.

To the Editor of the "Gleaner."

Sir.—I had not the pleasure of listening to Dr. Neish's lecture on the "Cultivation of the Orange," but I have had great enjoyment in reading it, as it was reported in the *Gleaner* of 22nd inst. It is not often the privilege of a body of agriculturists to listen to a lecture like his, on a subject to them of special interest in which the historical, statistical, scientific and highly practical phases are so judiciously blended. It is to be hoped that the lecture will be freely and widely published.

Dr. Neish is of opinion that some of the seedling orange fruits grown in the island "are so good and so suitable for our trade that they are not likely to be surpassed" by those of imported trees: and he only recommends our cultivators to give trial to one exotic subvariety, viz., the "Selecta" of the St. Michael. A plant of St. Michael fruited here last year, but I regret to say the fruits were, in every respect, inferior to the ordinary Jamaica sweet orange. The majority, before maturity, burst their rinds and even when ripe were comparatively sour. It does not follow that what is an excellent variety in the Azores will continue to present the same degree of excellence, under somewhat changed life-conditions, in the Antilles. Fruits, like men, are, specifically and individually, much affected in character by the cultured or scholastic influences of their environs; and I think with Dr. Neish, that to improve the orange-trade interests, one of the first steps to be taken is to select stock plants of the best known sweet orange trees in the island, bestow on them distinctive names, and then propagate them, true to character and names, by budding and grafting, that they may be "generally distributed throughout the island." "With a special view to ascertain the best native kinds" Dr. Neish very considerately suggests, that, "it would be advantageous to bring about a competitive exhibition of fruits." A considerable sum of money, even Government funds, might be most profitably expended in this service, in offering liberal prizes for a series of sets of fruits, representing degrees of comparative quality, each set proved to have been gathered from a certain tree. The trees bearing the marketable fruits of the first class might then be ascertained, and with the permission of the proprietors, every effort at propagating the plants should be made.

Under the head of propagation, Dr. Neish has explained at some length, a means of layering orange tree branches, of moderate thickness, by which they are induced to develop roots, and in time might, of course, be severed from the tree and established in the soil on their own respective individualities; but even Dr. Neish thinks the plan has little besides simplicity to recommend it and, very properly, advises those interested to propagate the sweet orange by means of grafting and budding,—for the theory and *modus operandi* of which he also refers the interested cultivator to horticultural works. The propagation of certain sweet orange plants, as well as improved varieties or individuals of other tropical fruit and economic trees and shrubs by these means, is very important, because, unfortunately, in the case of several. it cannot be done faithfully to type by means of seed.

And now, if I may be allowed to supplement what has been brought forward by Dr. Neish, I would beg to recommend and describe, briefly as possible, a system (by no means new) of inarching or grafting by approach, by which propagation of such plants may be ensured, and which, by its simplicity and perfect adaptability to the atmospheric and other cultural conditions obtaining here, recommends itself, above all other modes of grafting, to the non-professional operator.

Procure seedling orange plants, sweet or sour, one to two years old, from the thickness of a goose quill to half an inch in diameter. Place them singly in good soil, well compressed in bamboo pots and nurse them until properly established. They will then be ready as stocks on which to inarch the improved or favourite variety. Tie each pot separately to a branch of the favourite, strong enough to bear it up, and at the same time, at a point from which the middle portion of the stock can easily, and without much pressure, reach and lie parallel to a twig or small branch of the tree of or about the same diameter. The operator should now cut away leaves and spines, if present, at and near to the point on the stock above indicated, and then with a sharp thin bladed knife, cut out of both stock and scion a longitudinal slice, from two inches to 2½ inches or even 3 inches long, gradually deepening, about the middle of each cut, to near the pith or half-diameter, at the same time taking care that the cuts may be so straight and in width, at least, equal, so as to readily allow their surfaces to meet without resorting to too much force. So important is it that the cuts on both stock and scion should be, at least, of the same width that, theoretically the corresponding inner or lower edges of their barks should, when opposed, come into perfect contact; and with the biginner it will be as well for him to consider this as being absolutely essential to success. Having thus fitted stock and scion, they should now be bound together with threads of cotton or worsted, or with shreds of calico or bast from the inner bark of the mahoe tree. The tying material must not be drawn so tightly as to either cut into or bruise the bark, the object being merely to keep the edges of the wounds in contact. In addition to such tying, it is nearly always necessary to wrap the wounds with shreds of calico, previously saturated with a solution of wax, oil, etc., purposely to keep out rain as well as to exclude dosiccating air.

Procure equal weights of bees wax and common resin. To a quarter of a pound of each add a teaspoonful of cocoanut oil, or even animal fat; put into a vessel and boil. This must be done close to the tree on which the operation is being performed. The shreds of colico should be one inch wide, and long enough to thoroughly wrap the wound. When ready take hold with the hands of both ends and let all but the ends sink into the boiling wax until saturated, then draw it across the edge of the vessel to dislodge all excess of wax and allow it to cool until it can be touched by a damp finger with impunity. This part of the operation is of the utmost importance, inasmuch, as the application of the waxed cloth too hot, will scald the tender bark and thereby neutralize all hope of success; on the other hand, if applied too cold it is rendered unsuitable for the purpose intended.

When the requisite temperature has been attained, the waxed shred must be wrapped tightly and carefully round the wound; and this completes the operation. Kind nature will accomplish the rest. It is now only necessary to keep the soil in the pot moist; and to prevent undue evaporation the space between the surface of the soil and the top of the pot should be stuffed loosely with either moss or hay. If the tree sought to be propagated is of moderate size a hundred or perhaps two hundred pots might be fixed to it at one time. It would cost very little more to water and otherwise nurse two hundred in-arched plants than it would one hundred. In about six or eight weeks after the operation, with a view to aid in weaning, if I may so express myself, the scion from the parent tree, a notch should be made in the scion, immediately below the point of union, reaching almost to the pith. In two weeks thereafter the notch ought to be deepened, but not widened, through and slightly beyond the pith; and finally in a week or two weeks more, if the weather is moist, the scion should be severed and the new plant taken from the tree, shaded from the sun, and for a time most carefully nursed. It may be well to state that the beginner should not attempt to sever the scion from the parent tree unless when its leaves are developed and matured. When it is evident that the plant is out of all danger, and when active growth has set in, the stock, above the graft, should be cut back, a piece at a time, until finally fore shortened to the upper end of the grafted part. I much regret that so very simple an operation should require such a lengthy description as this, but without the aid of one or two simple diagrams I have, in justice to the subject, found it imposible to curtail it. I have moreover to say that as (simple as the above operation is,) I may have failed to make it understood to your readers, I shall therefore be glad to give oral instruction with example to any one visiting Castleton. For the theory and details, descriptive and illustrative, of grafting in all its modes, I beg to refer readers to "Baltet's Art of Grafting," published, I believe, at the office of *The Garden*, 37 Southampton Street, Covent Garden, London

The popular opinion in Jamaica that the majority of the seeds of a sweet orange will produce sour orange plants is not quite well founded, though there need be little surprise felt if a goodly proportion of the trees are productive of sour fruits. It may be safely asserted that there are few good sweet orange trees in this island so isolated from inferior varieties, sour fruited Shaddock, Grapefruit, Citron, Lemon, or Lime Trees as to be beyond the influence of the fecundating pollen of the latter. It is inferentially chiefly to this influence, rather than to an inherent tendency in the issue, that many seedlings, raised from sweet orange seed, exhibit what may be and are termed degenerate or unmarketable fruits. I gladly grant that there is in a fertile plant an inherent tendency to produce, in characteristics, variable issue, but this providentially over-ruled and in a great measure held in check by the prepotent law of sap-relationship or heredity, formulated in the words—"like produces like." And in this faith I would suggest that, just as early as possible, gardens, pastures and woodlands should be cleared, and rigorously kept clear, of most of the unprofitable fruit trees above-named, with a view to ensure an extensive increase of seedling sweet orange trees.

From observations extending over four and a half years in Jamaica, I find that sweet orange trees generally bear a heavy and a light, or moderate, crop of fruit alternately. I am of opinion that what I have called the light crop might, in a general way, be made to assume the proportions of a good and profitable one, by the judicious application of suitable and requisite manure. For the manure to have this effect it should be applied as a top dressing, and partly or wholly worked into the soil, about the *close of crop*, in the season of *abundance*.

I am, Mr. Editor,

Faithfully yours,

Geo. Syme, Castleton Gardens.

March 26th, 1884.

FERNS: SYNOPTICAL LIST.—XVII.

Synoptical List with descriptions of the Ferns and Fern-Allies of Jamaica, by G. S. Jenman, Superintendent, Botanical Gardens, Demerara, (continued from Bulletin No 41.)

13. *Pteris bulbifera* Jenm. n. sp.—Rootstock upright fibrous, with bulb-like, aggregated buds, that are clothed with dense, appressed, rusty coated scales; stipites 1½–2 ft. l. tufted, stiffly erect, channelled, with the persistent scales of the buds at the articulate base; fronds ample, 3–4 ft. l. and as w. deltoid, bi-tripinnate, subcoriaceous, naked, dark green glossy on the upper side, paler beneath, pinnæ in opposite or alternate pairs, the lowest largest and often branched again at the base on the inferior side, petiolate, 1–1½ ft. l. 4–8 in. w. with a long tapering serrated point 3–4 in l. terminal one similar, deeply pinnatifid only, or the inferior fully pinnate within, segments subfalcate or straight, 1½–4 in. l. ⅓–½ in. w. tapering, finely acuminate and spinulose-serrate at the end, with an open rounded sinus as wide as the segment between, rachis glabrous, brown or stramineous, with generally a few distant short spines on the upper part, the costæ spinulescent above; veins forming 2–4 rows of fine areolæ,

occupying the whole space, having no exterior free veinlets, and with or without two unequal, disconnected narrow costal areolæ between each pair of ribs; sori continuous below the outer spinulose, serrate part of the segments.—*Litobrochia.* Presl.

Infrequent in very wet forests above 2,000ft. alt., gathered at Tweedside, St. Andrew, and on Mt. Diabolo, St. Ann. Distinguished by the singular, separate, development of the fronds, (the individuality of each of which produces the articulation of the stipes), less evident tripartite habit, conspicuously long (especially the terminal) and very acuminate segments, broad and rounded sinuses, fine and copious areolation of the veins, devoid of exterior free branches, with disconnected (or entirely absent) costal areoles. The incipient fronds at first are like several nutlets or small bulbs aggreated together, each distinct, with its own separate rootlets, and coated with minute black and glossy subulate scales, which are mixed with dense, gray, scurf. The buds eventually burst and the frond develops, leaving the vestiture surrounding the base of the stipe. Though growing in community, with a common centre of origin, each frond is as it were a separate, independent plant. The occasional spine that occurs on the rachises, must not cause the species to be confounded with the copiously armed *aculeata.*

14. *P. gigantea,* Willd.—Root-stock very stout, upright, scaly, stipites cæspitose, stout, erect, channelled, 4–6 ft. l. 1 in. thick, scaly only at the base, prickly throughout, fronds erect, deltoid, tripartite, 4-6 ft. each way, dark, green, naked, coriaceous, the lateral divisions nearly as large as the central, but more developed and branched at the base on the inferior side than the upper; pinnæ 1–2 ft. l. 4–6 in. w. uniform in width from the base outwards, sessile or shortly petioled, deeply pinnatifid; segments ligulate, 2–4 in. l. ⅓–½ in. w. the apices acute or acuminate and serrate with rather bluntish teeth beyond the lines of sori, which extend from the close or open sinus; rachis and costæ channelled, dark or pale brown, the former more or less prickly, the latter spinescent on the face, veins forming 1–2 series of areolæ, with exterior free branches, the transverse costal areolæ narrow, reaching from rib to rib—*Litobrochia,* Presl. Plum. Fil. t. II.

Infrequent in very moist forest at 2,000–3,000 ft. alt.; gathered at Dollwood, St. George, Portland Parish. The species may be readily recognised by its large size, even in Herbaria specimens, the pinnæ being twice or thrice larger than in any of its allies. The final segments are not falcate, but spread right and left, nearly horizontally, are serrate only in the outer part, whether fertile or not and the serration is coarse and not spinulose as in the two preceding. The central division in this and its nearer allies have the pinnæ opposite, while in the lateral they are more or less alternate. Plumier's figures show a portion of the top of a frond, and part of the base of a stipe. It is represented in Sloane's Herbarium, collected by Dr. Houston in 1730.

15. *P. laciniata,* Willd.—Root-stock stout, fleshy and greenish, shortly repent, stipites 1–2½ ft. l. stout, fleshy, light green, strigose; fronds 3–5 ft. l. 1½–3 ft. w. dark green, paler beneath, membrano-herbaceous, bi-tripinnate, hirsute on the fleshy rachis and costæ; pinnæ large, subovate, acuminate, usually broadest at the base, 1–1¾ ft; l. ½–1 ft. w. the lower petioled; pinnulæ 3–6 in. l. 1½ or 2 in. w. deeply pinnatified, slightly adnate at the base, apex tapering, entire; ultimate segments oblong, curved, ½–1 in. l. 2–4 li. w. the sides entire or in the interior ones lobed or pinnatifid, the end rounded an even, veins rather open, simple or widely forked; sori continuous from the sharp sinus, not reaching the top of the segment; involucres pale, silvery, ciliate.—*Lonchitis hirsuta,* Linn.

Frequent in very moist woods, near streams, ascending to 4,500 ft alt. Resembling *Lonchitis* exactly in appearance and texture, from which the free veins and exclusively lateral sori separate it. The substance is thin and membranous, very flaccid, densely pellucid-dotted, the frame work fleshy and green, and everywhere hispid. The hairs magnified are beautifully translucent, jointed, and full of liquid. Plumier's fig. 20, appears to be intended for this, but shows the abundant sori exclusively confined to the sinuses, as in *Lonchitis.* Sloane first gathered it—on the "Banks of the Rio d'Ore; St. Maries on the northside."

16. *P. heterophylla,* Linn.—Stipites densely tufted, slender, 6-10 in. l. channelled, green, naked, arising from a fibrous scaly rootstock; fronds separately sterile and fertile, ovate-acuminate, 5-10 in. l., 3-5 in. w. firm but herbaceous, naked, bright green, the upper side glossy, bi-tripinnate; pinnæ few, erecto-spreading, subdistant, the lowest largest and bipinnate, the several next above simply pinnate, passing gradually into simple segments at the apex with a similar terminal one; final segments distant, oblique, linear-oblong, or ovate, ¼-1¼ in. l. 1½-2 li. w. blunt or acute, the base cuneate-stipitate, margins even in the fertile, deeply and uniformly serrate in the barren fronds; rachis and and costæ green naked, both flattened or margined in the outer part; sori continuous to almost the apex of the segments; involucres pale and rather silvery.—Sloane, t. 53. f. 2. Plum. t. 37.

Common on wet rocks at low elevations in or near the beds of streams, abundant in the eastern parishes up to 2000 ft. alt. A pretty, distinct, looking plant of no close local affinity, of very lax habit, all the segments being ¼-¾ in. apart, with coarser cutting, but somewhat the habit of *Onychium.* It grows only near shady springs and in woods on calcareous rocks over which water constantly trickles, in strong tufts, with numerous grass green quite erect fronds, the barren outside, and fertile, rather taller, inside.

17. *P. incisa,* Thunb.—Rootstock, wide-creeping, clothed with fine subulate scales; stipites scattered, strong erect, subangular, dark, polished, naked, 1½-2½ ft. l,; fronds 4–8 ft. l. 2–4 ft. w. tripinnate, sub-coriaceous, naked, dark green and glossy above, glaucous beneath pinnæ erect, spreading in distant sessile opposite pairs, 1½–2 ft. l. 6–10 in. w. ovate-lanceolate, the acuminato apex entire; pinnulæ sessile, in opposite pairs, usually sub-distant, lanceolate, 3–5 in. l. 1–1¾ in. w. pinnate at the base, pinnatifid in the outer part, terminating in a rather long, broadish, subentire point; final seg-

ments oblong (the smaller deltoid—oblong) blunt or acute, ½–1 in. l. 2-4 li. w. broadly adnate at the base, entire or the inferior sinnate or shallowly and roundly lobed; veins prominent beneath, pellucid, forming a row of costal areolæ, the numerous branches of which are free or casually united; sori reaching from bottom to top of the lobes.—*P. vespertilionis,* Labil. *P. glauca,* Moritz.

Frequent among brushwood on open hillsides and the skirts of forests at 5000-6000 ft. alt. This, like *viscosa,* is subscandent in its larger states. It has a general bluish tinge, like the bloom on certain kinds of fruit. The lowest, and reduced, pair of pinnules lap over the opposite pair on the face of the rachis. The venation is variable,—quite free in parts, or with a line of costal areoles, the exterior branches free or more or less anastomosing near the margin. The colouring of the different parts is beautifully clear and bright, especially of the rachis and costæ, both of which are channelled.

18. *P. deflexa,* Link.—Rootstock stout, woody, obliquely erect, clothed with narrow dark rather spreading scales; stipites cæspitose, strong, channelled, asperous beneath and scaly at the base, 2-4 ft. l. light or dark brown; fronds coriaceous, rigid, dark green and glossy above, paler beneath, naked except the ribs beneath which are rather puberulous, tripartite, quadripinnate, 2-3½ ft. l. and about as w. subdeltoid, central division equilateral, the basal divisions distant and their primary branches on the lower side much enlarged, the inferior 1-1¼ ft. l. ¾ ft. w. bi. (or rarely tripinnate), the branches on the upper side much reduced and simply pinnate, or tripinnate at the very base; ultimate segments linear, ½-1½ in. l. 2 li. w. straight or curved, mucronate, spinulose at the base above, subdistant, free on the superior side of the base, adnate on the lower, barren segments broader, and the margins spinulose-serrate in the outer third, rachis and costæ rather scabrous, slightly scaly in the axils, brown, channelled, veins simple or forked, the lowest in barren fronds often springing from the costæ; sori reaching from the base to the mucronate apex of the segments.—*P. stridens,* Agardh. Plum. t. 160 in part.

Frequent in the primeval forest of the higher ridges and peaks above 6,000 ft. alt. attaining the highest elevation of any member of the genus. A large plant, the most rigid, hardly excepting *aquilina,* of any. Only full-grown plants exhibit the tripartite habit. The continental forms have much smaller divisions and final segments a third to a sixth smaller—hence Agardh named the Jamaica plant *P. stridens;* the habit and other characters are however the same in both. Plumier's figure, on the right of the page, is an exact representation of a young frond.

19. *P. aquilina,* Link.—Rootstock pencil-thick, wide-creeping subterraneous; stipites scattered, erect, 1-3 or more ft. l. naked, stramineous; fronds large, deltoid or elongato-deltoid, tri-quadripinnate 2-4 ft. l, about as w. coriaceons and rigid, pale green, upper side naked, under coated with very fine light silky tomentum; pinnæ approximate or more or less distant, the outer part simply pinnate; tertiary with a straight linear apical segment and similar or much shorter close lateral ones ¼-½ in. l. 1-1½ li. w., rachis and costæ stramineous, ribs slightly puberulous-scaly; veins fine, forked or simple; sori continuous around the lobes, with a slight interior involucral valve as well as the normal exterior one.—*Pœsia,* St. Hil. *Ornithopteris,* Agardh.—Eat. Fer. N. Am. Pl. 35.

Var. *P. esculenta,* Forst.—Final segments, especially in the outer part of the primary and secondary divisions where they are most apart, connected at the base by an arc-like auricle.

Var. *P caudata.* Linn.—All divisions more open, the longer final segments 6-8 li. apart, longer, narrower and not connected by the shallow transvere auricle, but the outer slightly decurrent, the terminal caudate, 1 1-¼ in. l. 1-½ li. w.; hardly less tomentose beneath—Plum.t. 29. Sloane t. 63.

Most abundant from about 2,000 ft. alt. upwards covering open hillsides and ridges, waysides and the skirts of forests throughout the colony. Plants in shade are more lax and straggling in habit, and often reach as much as 12ft. high, supported by other vegetation. All the forms are less compact and vary in other particulars more or less from the European brake-fern or bracken. The rachises &c. are sometimes chestnut brown, and the ribs of the ultimate pinnules and segments are flat on the under side and scariose-margined. A cross section of the petiole shows several distinct bundles of vessels. The varieties are equally common. The species is nearly universal, extending as far north as the arctic regions. The double involucral valves would entitle this and the next species to both generic and tribal distinction.

20. *P. viscosa,* Moore.—Rootstock wide-creeping, slender, finely scaly; stipites scattered, distant, rather slender, 1–1½ ft. l., dark-colored; fronds pale green, coriaceo-herbaceous, tuberulous-scaly and viscid, tri-quadripinnate 4–6 ft. l. or more, 2–4 ft. w., composed of several distant alternate spreading or erect-spreading, ovate pinnæ, which are 1–2 ft. l., ½–1 ft. w.; pinnulæ close or sub-distant, lanceolate, sessile, 5–8 in. l., 1½–2 in. w., the acuminate apices, bidentate-serrate; tertiary segments numerous, ¾–1 in. l., ¼ in. w., the outer part entire and acute or blunt pointed, within deeply pinnatifid, final lobes short, deltoid-ovate, blunt, 1–1½ li. l. by nearly the same w., rachis costæ, &c., reddish brown, rusty-glandulose, and flexuose or the former zigzag; veins free, forked, pinnate flabellate; sori continuous on the lobes; involucres double.—Hook Sp. Fil. vol. 2, t. 121 B. and vol. 3 t. 141 C. *Pœsia,* St Hill. *Ornithopteris,* Agardh.

Common, growing among brushwood, upon which it is subscandent, and along the skirts of forests, often in company with *P. incisa,* from 5,000-6,000 ft. alt. Every part is densely glandulose—viscid, the pinnæ nearly sessile, and their lower pinnules reduced especially the lowest of all on the superior side, the rachises and costules reddish. In a fresh state the interior valve of the involucre is clearly visible, and the veins pellucid. The colour is a bright peculiarly light green.

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BULLETIN

OF THE

BOTANICAL DEPARTMENT,

JAMAICA.

CONTENTS:

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JAMAICA:
GOVERNMENT PRINTING OFFICE, 79 DUKE STREET, KINGSTON.

1893.

EXPERIMENTS IN THE CULTIVATION OF VEGETABLES.—VIII.

Potatoes—Castleton Gardens.

Names of Potatoes grown at Castleton Gardens (16 Potatoes of each).	Date of Planting	First appearance above Ground.	Days from Planting	Date when tops were dead. Potatoes ready to dig.	Days from Planting.	Number of sets planted.	Number of sets lifted.	Number of Saleable Potatoes.	Weight of Saleable Potatoes.	Gross Weight of Potatoes	Total Weight of Potatoes lifted.	Max. temp. during time Potatoes were in ground.	Min. temp. during time Potatoes were in ground.	Rainfall.	Number of days rain fell
									ozs.	ozs.	lbs ozs.				
Sutton's Lady Truscott ...	14.2	25.2	11	4.5	79	21	18	1 5	3 7	5 5	6 04	73.3	63.4	4.65	25
Sutton's Magnum Bonum ...	14.2	1.3	15	29.5	104	25	23	1 5	2 4	5 2	7 08	74.2	61.7	17.67	44
Sutton's Triumph ...	14.2	28.2	14	6 5	81	22	20	2.2	5	7 8	9 12	73 5	63.4	6.76	27
Sutton's Reading Hero ...	14.2	25.2	11	29.5	104	22	16	0.8	2	3	3 00	74.2	61 7	17.67	44
Edgecote Purple ...	14.2	3.3	17	29.5	104	22	18	1.0	1 3	2 2	2 08	74 2	61.7	17.67	44
Sutton's Matchless ...	14.2	25.2	11	4.5	79	26	24	2.0	3 5	6 8	10 04	73.3	63.4	4.65	25
The Dean ...	14.2	2.3	16	29.5	104	20	18	1.6	2 2	2 6	3 00	74.2	61.7	17.67	44
Sutton's Supreme ...	14.2	25.2	11	29 5	104	29	24	2.08	4	7 1	10 12	74.2	61.7	17.67	44
Sutton's Fiftyfold ...	14.2	28.2	14	29.5	104	28	28	2 2	6 5	9 5	16 12	74.2	61.7	17.67	44
Rivers' Royal Ashleaf ...	14.2	6.3	20	6 5	81	28	22	2.0	2 3	4 7	6 08	73.5	63.4	6.76	27
Schoolmaster (Turner) ...	14.2	1.3	15	16.5	91	27	25	1 7	2 8	4 3	6 12	74.8	63.8	8.96	33
Sutton's Red-Skin Flourball ...	14.2	2.3	16	29.5	104	21	20	1.05	2 8	4	4 08	74.2	61.7	17.67	44
														E.	J.C.

Potatoes—Hope Gardens.

Names of Potatoes grown at Hope Gardens (16 Potatoes of each)	Date of Planting.	First appearance above ground.	Days from Planting.	Date when tops were dead and Potatoes ready for digging.	Days from Planting.	Number of sets planted.	Number of sets lifted.	Number of Saleable Potatoes per set.	Total number of Potatoes per set.	Weight of Saleable Potatoes per set.	Gross weight of Potatoes per set.	Total weight of Potatoes lifted.	Max. temp. during time Potatoes were in ground.	Rainfall.	Number of days on which rain fell.
										ozs.	ozs.	lbs.			
Sutton's Flourball ...	27.1.93	13.2.93	17	4.5.93	97	21	17	1.6	2.4	5.6	6.1	6½	94.4	1.70	8
" Abundance ...	"	"	"	4.5.93	"	24	20	3.5	6.5	7.6	8.8	11	"	"	"
" Satisfaction ...	"	"	"	4 5 93	"	22	22	2.6	5.8	5.2	6.5	9	"	"	"
" Perfection ...	"	"	"	4.5.93	"	18	13	2.0	3.0	5.0	6.2	5	"	"	"
" Best of All ...	"	"	"	4.5.93	"	28	22	4.0	6.0	8.6	10.2	14	"	"	"
" The Dean ...	"	"	"	4.5.93	"	12	8	5.2	10.2	12.0	14.0	7	"	"	"
" Lady Truscott ...	"	"	"	4.5.93	"	19	16	2.0	4.0	5.5	6.8	6½	"	"	"
Reading Russett ...	"	"	"	4.5.93	"	28	19	2.0	3 6	4.4	5.1	6	"	"	"
" Hero ...	"	"	"	4.5.93	"	26	24	2.0	4.0	4.0	5.8	8	"	"	"
Edgecote Purple ...	"	"	"	4.5.93	"	28	22	0	3 8	0	3.8	4	"	"	"
Triumph ...	"	"	"	4.5.93	"	24	23	3.1	6 5	7.10	13.8	9½	"	"	"
Magnum Bonum (Turner) ...	"	"	"	4.5.93	"	16	12	5.0	13.9	6.0	14.0	10	"	"	"
Schoolmaster ...	"	"	"	4.5.93	"	30	27	3.3	5 5	8.8	9.4	16	"	"	"
White Beauty of Hebron ...	"	"	"	4.5.93	"	30	28	2.1	3 7	6.8	7.4	13	"	"	"
Imperator ...	"	"	"	4.5 93	"	32	31	3.7	7.9	6.6	8.8	16	"	"	"
Sutton's Supreme ...	"	"	"	4.5.93	"	34	34	2.6	5.5	7.7	9.9	18	"	"	"
Triumph ...	"	"	"	4.5.93	"	30	30	2.7	4.6	3.7	4.8	8	"	"	"
Matchless ...	"	"	"	4.5.93	"	30	24	2.9	5.8	4.6	6.0	9	"	"	"
Windsor Castle ...	"	"	"	4 5.93	"	32	32	3.4	5.7	5.5	6.5	13	"	"	"
Nonsuch ...	"	"	"	4.5.93	"	30	25	2.0	6.0	3.5	4.4	7	"	"	"
Fiftyfold ...	"	"	"	4.5.93	"	30	No return.						"	"	"
Rivers' Ashleaf ...	"	"	"	4.5.93	"	30	No return.						"	"	"
White Elephant ...	"	"	"	4.5.93	"	30	26	3 0	4.0	4.9	5 5	8½	"	"	"
Sutton's Seedling ...	"	"	"	4.5.93	"	30	28	3.6	6.4	10.0	10.7	12	"	"	"
Early Rose ...	"	"	"	4.5.93	"	28	28	1.4	3.6	2.8	3 3	6½	"	"	"

N.B.—Although there was not much rain, the Potatoes were irrigated with waste water. About ¾ of a chain of land yielded Potatoes to the value of more than £1.

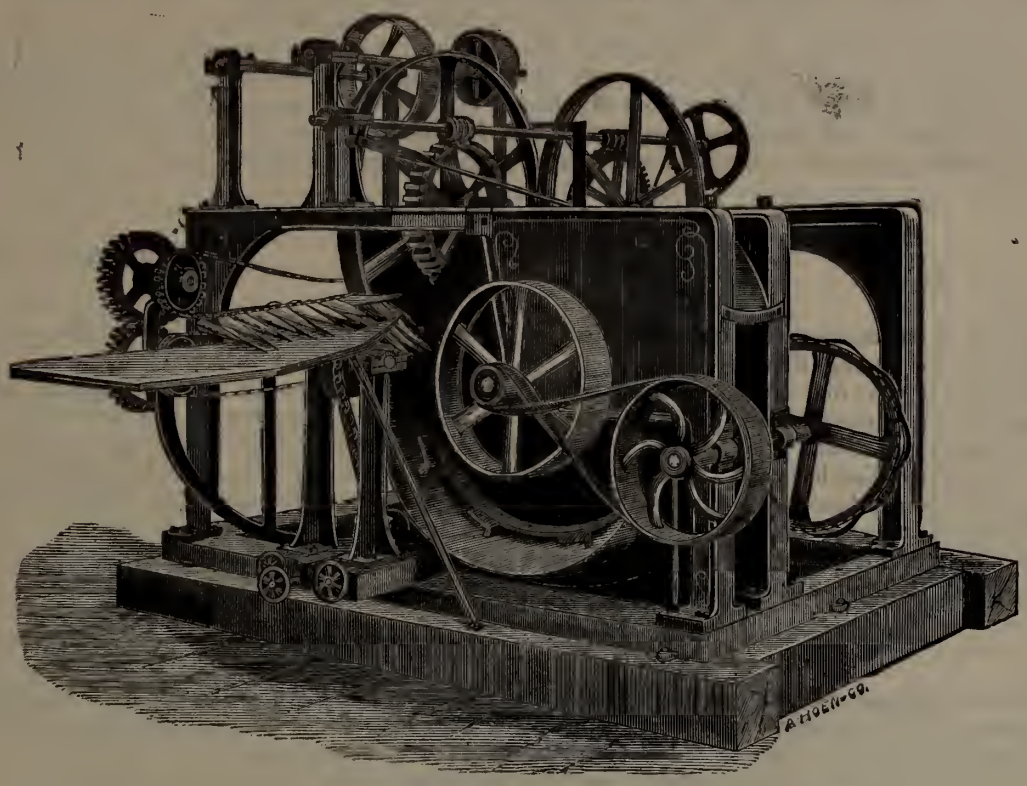
W. C.

SISAL HEMP.

There are a large number of young plants now ready at Hope Gardens for distribution at the rate of £4 per thousand. Application should be made to the Director of Public Gardens and Plantations, Gordon Town P.O.

Enquiries are continually being made by the Department as to the progress in the improvement of Fibre Machines.

Although there is not at present adequate information about the Albee Smith Fibre Machine, an Electro Type is subjoined, forwarded from Messrs. Gillespie Bros., New York, through the Hon. the Colonial Secretary. The Agent in Jamaica is Mr. J. C. Elliott, Hayes P.O.



SHEEP DIP SUGGESTED FOR CATTLE TICKS.

The following letter has been received from Messrs. Wm. Cooper & Nephews, Berkhampstead, England with reference to an enquiry whether their Sheep Dipping Powder is a remedy also for Cattle Ticks.

The papers referred to have been sent to the Jamaica Institute, where they may be consulted by those who are interested in the subject. They include amongst others :—

Sheep Farming. A Treatise on Sheep. their management and Diseases. By W. Sutherland.
The World's Sheep Farming for Fifty Years, 1843-1893. By Wm. Cooper & Nephews.

Chemical Works, Berkhamsted, April 11th, 1893.

W. Fawcett, Esq., Director of Public Gardens and Plantations, Gordon Town, P.O., Jamaica.

Dear Sir,

In reply to your favor of the 13th March, we never *recommend* our Dipping Powder for use upon any other animal than the Sheep.

As a matter of fact however, we believe it is constantly used for dressing Cattle and is said to be a most excellent preparation for the purpose. For the destruction of parasites it is admittedly unequalled.

It is of course a p ison and if you decide to recommend it for Cattle, we advise that after thoroughly mixing at the strength advised on the directions, the sediment should be allowed to settle, and the water then p oured off for use. This is not done in the case of Sheep which do not lick themselves.

Nobody we believe doubts the pre-eminence of our powder in all the qualities necessary for a successful Sheep Dip.

It is almost everywhere used as a Government remedy for Scab, while for ticks and lice and in promoting the growth of the wool the evidence of its superiority is overwhelming.

We enclose a few papers which bear upon these subjects.

Any supplies you require may be obtained either from our House at Galveston, U.S.A., or from here direct.

We are, Dear Sir,
Yours faithfully,

Wm. Cooper & Nephews.

MANURES FOR BANANAS.

The question of Manures for Bananas will soon become a very important and pressing subject for Planters in Jamaica, as the soil will become exhausted through continual cropping except in very favourable situations.

Experiments are necessary to determine the proper components for special artificial manures for particular soils and also to ascertain the particular months of the year most suitable for the application of different manures.

As soils and climate vary in character, so that the number of hands to a bunch, the length of time a plant takes to produce a bunch, &c., varies in consequence—experiments should not be confined to any one locality, but ought to be carried out in as many different spots as possible.

This problem is one in which the Government is willing to help planters.

Experimental stations as advocated by some, would be very costly, as it would be necessary to purchase land, put experienced men in charge, and supply labour for planting and carrying on the experiments.

The following is a copy of a letter from Mr. Henry Cork, and the plan suggested by him appears to be simple in character, and promising the best results, for the experiments would be carried out by men experienced in this particular cultivation and keen to note the slightest improvement in the fruit.

Henry Cork Esq., to Director of Public Gardens.

10th April, 1893.

Dear Sir,

Referring to our conversation on the subject of Banana Manures, I am willing to offer you the following facilities for testing them.

I will place at your disposal 10 acres or less of my growing bananas of different ages on which you could make any experiment either in cultivation or manuring which appeared to you desirable. I would find all the labour and there would be no expense to the Government beyond the cost of the manures which you thought desirable to try. This plan would involve less expense to your Department than any other and would be a better test as you would have the use of stock and implements which could not be otherwise available to you.

A complete account of the cost of the operations and the yield of fruit would be kept for your information including Rainfall, Temperature, &c.

I am, &c.,

HENRY CORK.

It has been determined therefore that sufficient manure shall be supplied free to five experienced Banana planters, in situations which may be considered the most favourable for the experiments. Application should be made to the Director of Public Gardens and Plantations, Gordon Town, P.O.

Mr. J. J. Bowrey, Government Analyst has been consulted, and the following notes have been drawn up for conducting the experiments.

It will be seen that the total area to be experimented with is two acres and one square chain.

The experiments are framed not only to bring out what will give the largest results but also the best results taking cost of manure into account.

The Basic Slag should be applied at one time and that as soon as possible. The other manures should be applied in divided doses 3 or 4 times a year, at intervals, of 2 or 3 or even 4 months—at the small intervals, if it is required to hasten growth so as to have the fruit at some particular time of the year. The planter will know at what time it will be best to give the manures so as to produce the fruit when required.

These manures should not be applied to the soil before or during heavy rain.

To secure even distribution, the manures should be mixed with a large bulk of dry powdery earth before they are applied. After being sprinkled the soil should be hoed or lightly stirred in some way.

If irrigation is employed care must be taken that the manure is not carried away.

Except where thorough watering can be carried out mineral manures alone cannot effect much good without organic matter in the soils, hence all Banana trash, stems, &c., ought carefully to be buried or at least lightly covered with earth.

The amount of bananas in the soil might be increased by growing belts of blackeye peas or cow-beans between the rows of bananas, cutting them down when the pods are forming, and burying lightly close round the bananas. By green manuring with beans *nothing* is withdrawn from the soil, while carbon and nitrogen obtained by the beans from the air are added.

The place selected should be as level as possible, and the soil uniform in quality.

Twenty-one plots of one square chain each should be marked off by stakes, and one tenth of the amount of manure mentioned in the table below applied to each plot.

It will be satisfactory to have the plots duplicated according to the following plan so that for instance P. K. N. is applied in 1 & 1a; A. G. in 2 & 2a, &c. It would be advisable to have the plot marked 11 treated with two tons of cattle manure.

1	2	3	4	5	6'	7
8	9	10	1a	2a	3a	4a
5a	6a	7a	8a	9a	10a	11

Area.	Weight of Manure (in cwts.) necessary for experimental plots of one acre in area.							
	P.K.N.	A. G.	Basic Slag.	Sulphate of Ammonia.	Sulphate of Potash.	Nitrate of Potash.	Nitrate of Soda.	Chloride of Potassium.
(1) 1 acre ...	3	...	...	...	...	...	...	...
(2) " ...	1½	...	...	...	...	...	...	...
(3) " ...	...	3	...	...	...	...	...	...
(4) " ...	...	1½	...	...	...	...	...	...
(5) " ...	...	...	...	1½	2	...	...	...
(6) " ...	...	...	...	...	...	...	2	2
(7) " ...	...	...	5	1½	2	...	...	...
(8) " ...	...	...	5	...	...	2½	...	...
(9) " ...	...	...	5	...	...	...	2	2
(10) " ...	...	...	5	...	...	...	3	3

SUGAR CANE DISEASE.

The following copy of a letter from the Director of Kew Gardens has been transmitted by the Secretary of State for the Colonies.

Mr. Massee's report will be published later.

Royal Gardens, Kew, to Colonial Office.

April 6th, 1893.

Sir,

I have the honour to inform you that for some time past numerous communications have been addressed to this Establishment respecting a disease which has made its appearance in the West Indies amongst the Sugar Canes.

The injuries which the canes suffer from the attacks of insects, popularly known as "borers" have long been known, and have been now pretty completely studied. A tolerably exhaustive account, embodying everything that is at present ascertained, by Mr. Blandford, will be found in the number of the Kew Bulletin for July and August of last year.

The disease which is now complained of is of a more insidious kind, and is due to the attacks of a minute fungus. Considerable discussion has arisen as to whether the mischief is produced by one fungus or by several, and further as to whether the attacks of the fungus precede, follow, or are concomitants of the injury inflicted by the borers.

Such material for investigation as has been hitherto sent to Kew from the several Botanical Establishments in the West Indies has been inadequate, and has only yielded ambiguous results. I, however, received a letter early this year from Mr. John R. Bovell, Superintendent of the Botanical Station at Dodd's Reformatory, Barbados, from which I enclose an extract advising me of the dispatch of a very complete series of diseased canes

I entrusted these to Mr. George Massee a well-known expert in Mycology, who made a careful study of them in the Jodrell Laboratory at Kew. I enclose a copy of the preliminary report with which he has furnished me. This completely establishes that :—

The disease is due to a fungus, a species of *Trichosphæria* which, like many allied minute fungi, has the peculiarity of possessing more than one reproductive phase. These different phases have been mistaken for distinct fungi, but as a matter of fact they are not so, but are capable of reproducing one another.

The *Trichosphæria* is evidently a very destructive parasite. It can effect a lodgment on the young leaves of the Sugar cane, but not on the mature ones. But it readily takes advantage of any wound such as is produced by the removal of young shoots or by the different kinds of "borers." It is this latter circumstance which has led the malady which the fungus produces to be regarded as having some connection with the "borers."

No practical remedy can be suggested to check the progress of the disease beyond the careful destruction by *burning* of every diseased cane.

I may be permitted to suggest that a copy of this letter should be communicated to the Government of Barbados and to such other of the West Indian Colonies, interested in sugar production, as the Secretary of State may deem desirable.

I may add that Mr. Massee proposes to published a detailed account of the *Trichosphæria* which possesses many points of scientific interest, in the "Annals of Botany."

I am, &c.,

W. T. Thiselton Dyer.

ALFALFA.

A Correspondent, Mr. C. P. Nosworthy, writes as follows:—

"I am glad to see that in Bulletin No. 41 you are advocating the cultivation of Alfalfa, and am only surprised that it has not been introduced before, for it is a most wonderful forage. It would be the very thing for Vere and other dry parishes.

Before I came to Jamaica 25 years ago I spent some time in the Argentine provinces, not far from Cordova, amongst a colony of Scotchmen who are amongst the best Farmers.

It was a vast prairie very like Vere but no Trees and ten or twenty times larger, subject to extreme drought but Wells required to be only ten or twelve feet deep to get a supply of water.

Every Farmer cultivated two or three acres of Alfalfa, just in the same way that you recommend, and while all the grass perished, Alfalfa was the only thing that kept the stock alive or had any nourishment. It gave continual cuttings of three or four feet high and three or four times a year, requiring no irrigation and lasting 30 or 40 years, sending down enormous tap roots. It is a forage plant that nearly all Spaniards grow."

He also sends the following extracts from a Californian Newspaper:—

"Of forage plants California farmers will be able to, and undoubtedly will, make a showing unique in many features. While other sections than this produce Alfalfa, it is to be doubted whether any can make a more remarkable showing in the growth of that plant. Exhibits have been prepared showing the product of eight consecutive cuttings from the same field in one season and aggregating a growth of forty feet or more yielding at the rate of two or three tons to the acre at each cutting. Facts will be presented showing that a single acre of this extraordinary grass will keep from three to four head of horses or cows the year round, and from fifteen to twenty head of sheep or hogs. The wild grasses will not be neglected either, and alfileria and burr clover will be shown, with their peculiar qualities of self-curing into the most nutritious hay." . . . .

"One of the great incentives and aids to the cattle industry, and one that has practically worked a revolution in the old methods, is found in the cultivation of Alfalfa. Less than twenty years ago the occurrence of a dry season and the consequently limited amount of natural grasses necessitated in many cases the cutting of trees by wholesale in order that the starving animals might prolong their lives by browsing upon the leaves and twigs. Even this poor resort, however, failed and thousands perished from starvation. This led to experiment being made in the cultivation of forage plants of various kinds, and finally Alfalfa was hit upon as the best adapted to this climate and admirably fitted for stock of all kinds. Large areas were planted and great stacks of hay put up each season, to be fed out during the winter months or at times when the natural grasses were short. Range cattle from other parts of the State and from adjacent States and Territories, after reaching the limit of growth possible on wild feed, are brought to these Alfalfa regions and a few weeks' feeding on a mixture of hay and fresh grass puts them in good condition for the market."

FERNS: SYNOPTICAL LIST.—XVIII.

Synoptical List, with description, of the Ferns and Fern-Allies of Jamaica by G. S. Jenman, Superintendent Botanical Gardens, Demerara, (continued from Bulletin No. 42.)

Tribe VII. *Lomarieæ.*

Sori marginal, medial or subcostal, linear or oblong, running transverse with the veins; involucres exteriorly attached, inflexed or involute, free on the innerside, membranous or coriaceous, permanent or deciduous; fertile and sterile fronds uniform or distinct and different in form.

18. *Lomaria.*—Fronds of two kinds, sori marginal.

19. *Blechnum*—Fronds of one kind, sori nearer the midrib than margin.

This tribe is represented in all situations from the lowest to the highest altitudes.

Genus XVIII. *Lomaria.* Willd. Sori marginal, linear and continuous, filling when mature the whole space between the margin and midrib of the contracted pinnæ; involucres the same shape, continuous, inflexed or involute, the opposite valves connivent at first on the back of the costæ, at length open; receptacles formed of the transverse union of the otherwise free veins; fronds dimorphous, pinnate, coriaceous. The members of this genus are homogeneous in character of leaf, though they vary much in habit of growth. Most have creeping root stocks, some occupying trees, others the ground, one has a large stout upright trunk, and one, not represented in Jamaica, is twining, as in one species of the next genus, *Blechnum.* They are confined in range to the cool mountain regions. At first sight the line of sori seems as much costal as marginal, but close examination reveals the receptacle as really marginal, though the matured sporangia fill the entire dish on each side the costæ.

a. Rootstock freely repent; fronds essentially or fully pinnate; pinnæ broadly adnate.—Epiphytal.

b. Veins immersed, depressed beneath.

1. *L. onocleoides,* Spreng.
2. *L. attenuata,* Willd.

bb. Veins raised on both sides.

3. *L. Féei,* Jenm.

aa. Rootstock elongated, erect or decumbent; fronds essentially or fully pinnate; pinnæ fully adnate.—Terrestrial.

4. *L. L'Herminieri,* Bory.
5. *L. Plumieri,* Desv.

aaa. Rootstock stout, erect or decumbent; fronds pinnate; pinnæ free at the base.—Terrestrial.

6. *L. procera,* Spreng.
7. *L. Boryana,* Willd.

1. *L. onocleoides,* Spreng.—Rootstock finger-thick or less, long creeping up the stems of trees, densely clothed above with linear-subulate ciliate-edged scales; stipites several, erecto-spreading at the top of the rootstock, stiff channelled, naked, except at the dark coloured base, 2-4 in. l.; fronds narrow, 1-1½ ft. l. 1½-2 in. w. pinnate, coriaceous, naked, light green, paler beneath; pinnæ close acuminate or acute, broadest at the adnate base where they touch each other but are barely connected, 1-1¼ in l. ⅜ in. w.; narrowed at the base to two or three contiguous or subdistant much reduced lobe-like or merely rudimentary segments; rachis channelled down the face, sharp ridged beneath; veins spreading, simple and forked immersed, slightly depressed on the underside; fertile fronds rather broader, the pinnæ linear, ¼-⅓ in. apart, narrowed and then slightly dilated at the base, the lowest rudimentary,—Hook. Sp. Fil. vol. 3. t. 146.

Infrequent at 4,000-6,000 ft. alt, ascending trees in damp forests. The immersed veins are faintly channelled on the underside, the surface rather glossy, the apex of the fronds terminating in a lanceolate-acuminate entire pinnæ; that of the fertile frond being narrow and caudate. Much less frequent than the next species, which it closely resembles as a reduced form, and is probably only a variety of.

2. *L. attennata,* Willd.—Rootstock thumb-thick, freely repent, vertical on stems of trees, densely clothed at the top with long, linear-acuminate, ciliate-edged castaneous scales; stipites erect or nearly so, naked except at the base 4-8 in. l. strong and stiff, subcylindric, slightly channelled, dark brown beneath; fronds oblong-lanceolate, pinnate, 1½-2 ft. l. 2½-4 in. w. coriaceous, naked, light green, paler beneath, reduced at the base to distant merely rudimentary lobes; pinnæ close, broadest at the base, barely connected tapering outwards and acuminate, slightly curved, 1½-2 in. l, ½ in. w. or rather less, the margins entire, even; veins simple or forked, close, spreading, immersed, the surface depressed on the underside; fertile fronds broadly ovate-lanceolate, the pinnæ linear, 3-4 in. l. 1-2 li. w. not dilated at the base, or the inferior side very slightly decurrent 5-6 li. apart; sori continuous, involucres dark brown, entire.

Very abundant on trees in forests and by waysides from 3,000-6,000 ft. alt. A large and stronger plant than the preceding, but which it much resembles. The scales of the widely ascending caudex are very abundant, tapering very finely, undulate and ciliate-edged in the outer part. The barren and fertile fronds are thrown out in alternate tiers, several in each, but at different seasons of the year, generally. This is the common species found on trees everywhere within the altitudinal range mentioned.

3. *L. Féeii,* Jenn.—Rootstock free creeping, ascending the trunks of trees densely clothed in the growing part with linear-acuminate, fine, dark brown scales; stipites erecto-spreading, several, strong, cylindric, narrowly channelled, scaly at the base, 3–6 in. l.; fronds lanceolate-oblong, coriaceous, naked, pale, the underside paler, pinnate 1½-2 ft. l. 3–4½ in. w. with a lanceolate-acuminate terminal pinna 2 in. l. and roundly lobed at the base; pinnæ 2–2¾ in. l. ⅜ in w. straight or rather curved, spreading, very acuminate, those of the upper half of the frond, barely connected at the expanded bases, those of the lower half narrowed at the base and ¼–½ in. apart, the basal ones reduced; rachis channelled on the face, flat or rounded and dark in the lower part beneath; above this rather ridged; veins raised on both sides, spreading, simple and forked, the club-like apices forming a raised, connected, intramarginal line, the margin outside of this very thin, even or faintly serrulate in the finely acuminate part of the pinnæ, fertile fronds somewhat more slender, not wider, rather truncate at the base, the stipes somewhat shorter, the pinnæ linear, not dilated at the base, about ½ in. apart, involucres entire, finally open.—L. Plumieri, Fèe, Fil. Ant. t. 4.

Infrequent at 4,000 ft. alt. Ascending the stems of trees; gathered at Moody's Gap, a pass in the mountain chain between St. Andrew and Portland Parishes. Marked from the two preceding which it resembles in habit of growth colour and general aspect, by the pinnæ the frond of the lower half or third being narrowed toward the base and separated, and by the venations being prominent on both sides with clavate apices along the margin. As this is not the plant recognised by English botanists as Desvaux's *Plumieri,* I have found it necessary to adopt a fresh name for that employed by Fée in describing it.

4. *L. L'Herminieri,* Bory.—Rootstock terrestrial, erect, slender, elongated and reaching a span high freely coated above with fine castaneous scales; stipites clustered, scaly at the base, 3-6 in. l. dark brown beneath, green and narrowly channelled on the face, cylindric; fronds lanceolate or oblong-lanceolate, coriaceous, glabrous, pinnate, 1–1½ ft. l. 3–4 in. br. reduced at the base; pinnæ close straight or falcate broadest at the base where they are barely connected 1¼–2 in l. ½ in. w. acuminate or acute crenulate at the point the lower ones gradually or suddenly reduced, passing into shallow lobes 1 li. deep, veins close, forked, immersed, impressed on the under surface, spreading; rachis brown or darker, rather flat in the lower part, paler and somewhat ridged in the upper part; fertile fronds ovate, lanceolate truncate at the base rather broader, the linear pinnæ ½–1in. apart; involucres entire, dark colonred.—Hook. Gard. Ferns t. 40.

Plentiful, often hundred together, in infrequent localities at 5,000–6,000 ft. alt. in moist forests. While this is about the size and has much the aspect of all the preceding, it is a strictly terrestrial species. The lowest lobes are very shallow and slightly disconnected, but do not pass into rudimentary points.

5. *L. Plumieri,* Desv.—Rootstock terrestrial, decumbent or erect, elongated, moderately stout, scaly at the apex; stipites clustered, erect, ½–1 ft. l. scaly at the base, dark brown or blackish, flat and channelled down the face; fronds ovate-lanceolate, papyraceous, dark green and glossy above, paler beneath, naked, 1½–2½ ft. l. ½–¾ ft. w. fully pinnate at the base almost so above this, tapering at both ends, at the top gradually into an entire terminal pinnæ 2–2½ in l. ½–¾ in w.; pinnæ spreading, 2–5 in. l. ¾ in. w. less or more, the base broadly expanded, more so upward, the sinuses very acute in the upper part, usually open at the bottom of the frond, even-margined, or slightly serrulate at the acute or acuminate point, passing into shallow auricles at the base, which dwindle into mere glands, veins spreading obliquely, distinct but not raised, forked, 1 li. apart, with glandulose clavate apices; rachis strong, flat and slightly channelled on the face, broadly rounded beneath and purple-brown; fertile fronds the same size, but stipites much longer, pinnæ very narrow, an inch or more apart, with a dilated membranous base; involucres continuous, entire.—*P. divergens,* Kunze.

Infrequent in very damp forest, on stony ground, from 3,000 ft. alt. upwards; a species marked, its

terrestrial growth very dark clean green colour, open venation, papery texture, and fronds usually equally tapering to both ends but occasionally more or less abruptly reduced to the shallow broadly rounded basal lobes which pass into the paced glands that descend to the bottom of the rachis, and by the long more than usually distant, pliant, very narrowly linear fertile pinnæ. The species is based on Plumier's tab. 90. but represents a plant not reduced but broadest at the base, with more numerous, narrower and more rigid pinnæ than ours, much like an enlarged *attenuata*. Hooker too, in his Sp. Fil. describes a plant not reduced at the base; so that there seems to exist much confusion regarding the species.

6. *L. procera*, Spreng-Root –stock stout, short, decumbent or oblique, scaly; stipites clustered, strong spreading or pendent, ¾–1½ ft. l. thickly paleaceous, often asperous at the base; fronds pinnate, oblong or ovate-lanceolate, stiffly coriaceous, dull green, paleaceous on the rachis, costæ and ribs beneath, 1–3 ft. l. ½–1 ft. w.; pinnæ contiguous or apart 2–6 in. l. ½–¾ in. w., with a similar terminal one, acute or acuminate the base auricled or cordate, the lower not or little reduced; margin thin, reflexed, even or crenate; veins fine and very close; fertile fronds similar in shape and vestiture, but with longer stipites, the narrow pinnæ roun ded and free at the base; involucres revolute, coriaceous, dark, much broken at maturity.—Hook. Icon. Fil. t. 127 and 128; Gard. Ferns t. 23.

Most abundant on wayside banks and open hillsides from about 2,000 ft. alt. upwards, delighting in exposure to the sun and congregated in extensive communites, especially between 4,000–6,000 ft. alt. Variable, particularly in size, the pinnæ in different plants ranging from an inch to a foot-and-a-half long, but easily in every case recognised by its dense paleaceous vestiture. There is a frond in Sloane's Herb. mounted on the sheet with *Aspidium semicordatum* for which it was mistaken, gathered on the sides of Mount Diabolo, probably the first collected for the purpose.

7. *L. Boryana* Willd.—Caudex subarboreous, erect, 2–3 ft. high, very stout, densely covered with long dark subulate scales; stipites strong, cæspitose, erect—spreading ½–1 ft. l. more or less, scaly and with a tuft like those of the caudex at the base; fronds oblong or ovate-lanceolate, pinnate, bright green, naked except a slight deciduous vestiture along the ribs, coriaceous; rachis strong, channelled freely fibrillose, pale brown green beneath; pinnæ close on the lower subdistant, 4–7 in. l., an inch or less w. free and rounded at the base, upper ones gradually becoming more and more adnate and abruptly passing into the similar terminal one, the reduced lower ones suddenly passing into mere alternate gland-like scars on the face of the stipites which reach to the bottom, margin even or suberenulate in the outer part, veins close, spreading, forked or simple, the clavate apices glandulose on the upper side,; fertile fronds the same shape but broader, and with longer stipes, the linear pinnæ distant 8–9 in. l.; involucres revolute, much lacerated at maturity.—*L. magellanica*, Desv—Hook—Gard. Ferns, t. 52.

L. Schomburgkii, Klotzsch, *L. Ryani*, Klf.

Infrequent, a plant here and there, never abundant, in forest at 5,000–6,000 ft. alt. A fine species with the fronds spreading from the top of the caudex, which is stout at the base, and tapers to the top, and is densely covered with the long, dark, subulate vestiture. It has a very wide range—Southward to the Straits of Magellan, South Africa, and the Mascarene Islands.

No. 44. June, 1893.

BULLETIN

OF THE

BOTANICAL DEPARTMENT,

JAMAICA.

CONTENTS:

PRICE—Twopence.

[A Copy will be supplied free to any Resident in Jamaica, who will send Name and Address to the Director of Public Gardens and Plantations, Gordon Town P.O.]

JAMAICA:
GOVERNMENT PRINTING OFFICE, 79 DUKE STREET, KINGSTON.

1893.

EXPERIMENTS IN THE CULTIVATION OF VEGETABLES.—IX.

Potatoes—Castleton Gardens.

Names of Potatoes grown at Castleton Gardens.	Date of Planting.	First appearance above ground.	Days from Planting	Date when tops were dead. Potatoes ready to dig.	Days from Planting	Number of sets planted.	Number of sets lifted.	Number of Saleable Potatoes per set.	Weight of Saleable Potatoes per set.	Gross weight of Potatoes per set.	Total weight of Potatoes lifted.	Max. temp. during time Potatoes were in ground.	Min. temp. during time Potatoes were in ground.	Rainfall.	Number of days rain fell
									ozs.	ozs.	lbs ozs.				
White Elephant ...	17.2	25.2	8	16.5	88	30	30	2.7	7 2	9 7	18 04	72.5	64.8	17.01	32
Sutton's Windsor Castle ...	"	2.3	13	29.5	102	20	18	1.7	3 1	5 3	6 00	71.7	64.9	24.26	39
Sutton's Perfection ...	"	2.3	13	16.5	88	15	13	3.6	4	8 9	7 04	72.5	64.8	17.01	32
Sutton's Abundance ...	"	25.2	8	16.5	88	17	16	2.2	4	9 3	7 08	72.5	64.8	17.01	32
Sutton's Nonsuch ...	"	25.2	8	14.5	86	22	20	1.2	2 4	3 6	4 08	71.1	64.7	16.90	32
Sutton's Reading Russett ...	"	3.3	14	17.5	89	11	10	1.6	2 4	6 4	4 00	72.7	64.3	17.07	32
Early Rose (Kidney) ...	"	25.2	8	14.5	86	20	20	2.9	8 4	10 8	13 08	71.1	64.7	16.90	32
Sutton's Satisfaction ...	"	3.3	14	14.5	86	12	12	2.0	4	7 6	5 12	71.1	64.7	16.90	32
Sutton's Triumph ...	"	2.3	13	18.5	90	30	25	1.4	1 6	3 5	5 8	72.9	64.8	17.07	33
Sutton's Best of All ...	"	7.3	18	29.5	102	12	12	2.8	4 6	7 3	5 8	71.7	64.9	24.26	39
Imperator ...	"	1.3	12	18.5	90	18	17	2.8	4	6 8	7 04	72.9	64.8	17.07	33

E. J. C.

Potatoes—Hope Gardens.

Names of Potatoes grown at Hope Gardens.	Date of Planting	First appearance above ground.	Days from Planting.	Date when tops were dead and Potatoes ready for digging.	Days from Planting.	Number of sets planted.	Number of sets lifted.	Number of Saleable Potatoes per set.	Total number of Potatoes per set.	Weight of Saleable Potatoes per set.	Gross weight of Potatoes per set.	Total weight of Potatoes lifted.	M.x. temp. during time Potatoes were in ground.	Rainfall.	Number of days on which rain fell.
										ozs.	ozs.	lbs.			
Windsor Castle ...	24.2	9.3	16	19.5	85	32	26	1.9	4.9	3.6	4.9	8	93	4.30	17
Matchless ...	"	"	"	"	"	30	25	2.0	5.0	2.8	4.8	7½	"	"	"
Nonsuch ...	"	"	"	"	"	34	26	2.6	4.8	1.3	2.4	3½	"	"	"
Fiftyfold ...	"	"	"	"	"	32	28	1.7	2 6	1.4	2.0	3½	"	"	"
Red-Skin Flourball ...	"	"	"	"	"	28	28	1.4	3.4	2 8	3.7	6½	"	"	"
Sutton's Ashleaf ...	"	"	"	"	"	28	28	0.5	3.6	0.8	1.7	3	"	"	"
" Seedling ...	"	"	"	"	"	30	28	2.8	6.4	5.7	6.8	12	"	"	"
" Magnum Bonum ...	"	"	"	"	"	30	29	3.4	5.7	3.0	4.4	7½	"	"	"
" Reading Hero ...	"	"	"	"	"	30	27	1.6	2.0	1.4	1.7	30	"	"	"
" Perfection ...	"	"	"	"	"	30	28	3.5	6.2	6.8	8.0	14	"	"	"
" Triumph ...	"	"	"	"	"	30	30	3.0	5.0	3.7	4.8	80	"	"	"
" Lady Truscott ...	"	"	"	"	"	30	22	1.5	3.0	1.8	2.4	30	"	"	"

W. C.

SHIPMENT OF COFFEE IN PARCHMENT.

The advantages to be derived from exporting coffee in parchment, when there is any difficulty about milling, have already frequently been noticed in the *Bulletin;* See Nos. 8, 12, 14, 31.

The following correspondence is on the same subject.

Secretary, Institute of Jamaica, to Director, Public Gardens and Plantations.

Institute of Jamaica, May 12th, 1893.

To the Editor of the "Bulletin of the Botanical Department, Jamaica."

Sir,

In response to an appeal from the Clarendon Agricultural Society, the Board of the Institute appointed a Committee to visit the Show recently held at May Pen.

As a result of their visit, the Committee recommended that a special prize of two guineas be awarded to Mr. J L. Hibbert for his exhibit of coffee for export in parchment, and the Committee stated that "they wished by their award to point out to small settlers how desirable it is to export coffee in this manner as it does away with the expense of milling, and saves both time and trouble. In Central America, the owners of large plantations have given up the use of expensive milling machinery, because they find that it pays them better to export coffee in parchment, and it is hoped that merchants and buyers of coffee in the Island will give their attention to the question of the purchase of it in this form."

This prize was accordingly awarded by the Board.

As, however, their attention was drawn to a statement made by the Clarendon Agricultural authorities that there appeared to be some difference of opinion as to the advisability of the exportation, by settlers of coffee in parchment, the Board decided to invite the opinion of experts; and I am desired by them to ask you to be good enough to give publicity to the following report kindly supplied by Messrs. Park, Macfadyen & Co., which will, they think, prove of interest to all engaged in coffee planting.

I am, &c.,

Frank Cundall, Secretary.

Report from Messrs. Park, Macfadyen & Co.

Coffee Husking in London.

At the outset we would mention that the operation is chiefly applicable to coffee treated by what is called in some countries the "West India Preparation,"—i. e. to "washed" Coffees which are known by the trade here as "colory," and as these descriptions are most sought after by buyers, and command far higher prices than the qualities known as "unwashed," it is obvious that the Planters in their own interests should endeavour to market their crops in the former condition. In sending over Parchment Coffee, great care should be taken to have it thoroughly dried before shipment, as to a very great extent, this affects the market value. If not sufficiently dried, the Parchment becomes more or less musty in transit, and the colour deteriorates, thus seriously affecting its selling value, and from the fact that the outer layer of coffee in the bags dries on the voyage to a greater extent than the bulk in the centre, it is impossible for us when we dry it here before husking to obtain an even result. In addition to this, freight and charges have to be paid on extra weight, which is an absolute loss, and we may mention that we have received parcels in a damp state, which show a loss of 20 o/o, after drying, exclusive of the loss in weight, naturally caused by the removal of the Parchment. It will thus be seen that the Parchment should be dried thoroughly, especially as extra charges are incurred for drying here. On the other hand care must be taken not to over dry the coffee, as that impairs the colour to some extent. The advantages to be derived by Planters in forwarding their coffee in Parchment are several. The Parchment covering acts as a great protection to the bean while in transit, from all the deleterious influences to which it is necessarily subjected while in the close hold of Steamers, on Quays &c., and above all, it preserves the colour. This is probably the most important of all, as the finer the colour of the Coffee, the higher is the price paid by buyers, and it has been abundantly proved that Coffee husked here, fetches prices higher by several shillings a cwt. than the same Coffee when cleaned abroad. Planters are also enabled to market their crop, probably, several weeks earlier, then if they did it themselves, and a material saving of labour is effected in districts where it is scarce.

The total cost of receiving from ship, landing, husking, sizing, and all the usual operations is 2s. 6d. per cwt. which we believe is, at least, as cheap as it can ordinarily be performed by Planters, if not cheaper. The charge for drying is extra, and depends entirely on the condition of the parcel, but from what we have already said, it is a charge, which, in their own interests, Planters should never incur here. The loss in weight from husking varies largely according to the nature of the Parchment, and ranges from about 18 o/o. to 20 o/o. The whole of the various operations are carried out in Bonded Warehouses under the immediate supervision of the Officers of the Crown, which affords an important guarantee to Importers that the correct weight is returned to them. The Customs' duty is charged by the authorities on the husk.

We have occasionally received parcels of Coffee dried in the cherry to husk, but we cannot recommend this mode of shipment, though it is possible that in a few individual cases Planters might have found it desirable to adopt it. In the first place, it adds unduly to the charge for freight, the Coffee never turns out such a fine colour as it does if prepared as already detailed, and, of course, the loss in weight is much heavier, besides, it is much more difficult to work, and necessitates a charge of, at least, 3s. 9d. a cwt. The foregoing remarks apply *solely* to Coffee of the species *arabica*. As regards Liberian Coffee, we have no hesitation in advising, that, unless absolutely compelled, shipments should never be made in Cherry, as this species, even under favourable circumstances is most difficult to work,

YAM BEAN.

Pachyrhizus tuberosus, Spreng.

Dr. Macfayden, in his "Flora of Jamaica" page 286, called attention to the value of this plant as follows:—

"Flowers white. Seeds red. The root is formed of a number of simple cord-like fibres, several feet in length, stretching under the surface of the ground, bearing in their course a succession of tubers.

"The beans are poisonous; but the root affords a very plentiful supply of very wholesome food. The produce of three plants is usually sufficient to fill a bushel basket. The tubers may either be boiled plain, in which state they are a very good substitute for yams and other roots in common use; or they may be submitted to a process similar to arrow-root, and a starch obtained. This starch is of a pure white, and is equal in every respect to arrow-root. To the taste it is very palatable, is easily digested, and is employed for custards and puddings. Even the trash left after obtaining the starch, and which in the preparation of arrow-root is lost, may, when thoroughly dried, be formed into a palatable and wholesome flour.

"A very excellent flour may also be obtained by slicing the tubers, drying them in the sun, and then reducing to a powder.

"This plant is deserving of being more generally cultivated than it has hitherto been. It ought in a great measure to supersede the arrow-root in cultivation. It can be planted at any season of the year, and the roots are fit for diging in the course of four or five months; the return is infinitely greater than that from arrow-root, and the proportion of starch also is more abundant, so that it can be brought to market at so cheap a rate, as to admit of being employed by the calico-printers in place of potato-starch."

The "Kew Bulletin" for 1889, page 17, quotes from letters from Dr. Trimen, Director of the Botanic Gardens in Ceylon, pointing out that the pods when young are not poisonous, but may be eaten like French Beans. He wrote:—"They are quite new to Ceylon. . . . The young pods served like French Beans, are an admirable vegetable, tender and sweet. . . . What constitutes their superiority over the ordinary French Beans is the absence of any fibrous string along the sutures of the pod. The large size is also an advantage; they are often 10 or 12 inches long."

In Jamaica the seeds are generally sown in March or April. But they can be sown at any time. At Hope Gardens seeds were sown in September. The pods are ready for use as French Beans 7 months after sowing and when pods are quite ripe, 9 months after sowing, the yams are fit to dig. From one seed sown at Hope Gardens 5 yams were dug weighing altogether 14 lbs. They generally vary in size from one foot to 18 inches long, and 4 to 6 inches in diameter.

MANURES.

Asserted Retrogradation of Superphosphate of Lime.

A paper by Mr. L. Lefranc, recently published in the *Bulletin de l'Association des Chimists de Sucrerie et de Distillerie*, gives the results of a number of experiments made in 1889, and lately repeated, from which the writer concludes that superphosphate of lime undergoes rapid retrogradation when applied to arable land, the soluble phosphoric acid which it contains, and which constitutes its special value, passing, in eight days at most, into the insoluble state, that is, the superphosphate becomes really phosphate of lime, its commercial value being thus reduced by more than one-third, and he therefore thinks that instead of the superphosphate, cultivators should use the various phosphates of lime, ground bones, natural phosphates and slag phosphates, which after being properly crushed and sifted, supply at a low price one of the most indispensable elements for vegetable nutrition.—*Sugar Cane.*

A Good Plan is to Utilize Waste Bones.

The three following methods are strongly recommended, in the *Agricultural Gazette of N. S. Wales*, as simple and practical:—

"1. Put the bones into a manure-pile, especially of horse manure, which is kept well-moistened. They will gradually decay and disappear, enriching the manure to the full extent of their fertilising value.

"2. Bury them in the soil near the roots of fruit trees deep enough to escape the plough. If placed at a sufficient depth beyond the reach of the summer heat, an immense number of rootlets will cluster around each bone and gradually consume it entirely. Of course these rootlets must not be disturbed in the course of cultivation.

"3. Pack the bones with moist wood ashes mixed with some quick lime; the whole mass to be kept moist.

"In a few months the hardest bones will be reduced to a fine mush as valuable as superphosphate. The drawback to this method is that if precautions are not taking by covering the heap with soil, the nitrogen of the gelatine of the bones may be fermented into ammonia and lost in the atmosphere. Above all things, bones should not be burnt, for the most valuable part which furnishes the nitrogen is thus destroyed, and the bone-dust formed from burnt bones would be little more than half as valuable as that made from complete bones. When bones have been boiled, or better still, steamed in a vat under a pressure of 35 to 40 lbs., they can, when dried, be readily crushed in an ordinary maize-crushing mill, and form a very valuable manure. The soup that is made when the bones are boiled will contain a lot of valuable nitrogenous matter which should be added to the compost heap, and well mixed with dry earth before being applied to the trees and vegetables."

PESTS OF THE ORANGE AND PEACH TREES.

Mr. R. M. Cocking to Director of Public Gardens and Plantations.

Port Maria, 28th March, 1893.

Sir,

I notice in your Report on the "Coffee Leaf Fungi" you refer to the damage being done both to the coffee and orange trees in Manchester by the slug. I may add that the destruction to the trees is also going on in this parish, especially to the young orange trees (they do not trouble the bearing trees). A good remedy I find is to hoe around each tree some three feet and then sprinkle strong white lime, but this must be done during dry weather to have any effect. The Peach trees are doing well; I, however, nearly lost them about six weeks ago by the cochineal insect. I had to wash the trees with Jeyes' Fluid and water, and then paint them with white lime. This appears to have destroyed the insects, for the trees have thrown out leaves again.

I am, &c.,

R. M. Cocking.

FERNS: SYNOPTICAL LIST.—XIX.

Synoptical List, with descriptions. of the Ferns and Fern-Allies of Jamaica, by G. S. Jenman, Superintendent, Botanical Gardens, Demerara, (continued from Bulletin No 43.)

Genus XIX. *Blechnum*, Linn.

Sori costal or subcostal, linear or oblong, inserted on a special filiform receptacle, forming a transverse union of the veins parallel with costa and margin, but distant generally from the latter; involucres special, attached exteriorly, inflexed, free and opening along the inner edge; fronds pinnate or bipinnate.

This genus differs from the last by the fertile fronds not being contracted in the pinnæ, the lines of sori in consequence being distant from the margin. The species are few, but they abound greatly in individuals, and propagate largely by stoloniferous shoots that are thrown out from the rootstock, as well as by the ordinary generative course of spores.

a. Fronds pinnatifid in the upper part, pinnatifid in the lower.

b. Lower pinnæ adnate at the base and reduced to small deltoid segments.

1. *B. unilaterale*, Willd.

bb. Lower pinnæ free at the base and little if at all reduced.

2. *B. occidentale*, Linn.

3. *B. longifolium*, H. B. K.

aa. Fronds fully pinnate throughout, pinnate articulated at the base.

4. *B. serrulatum*, Rich.

aaa. Fronds bipinnate, twining.

5. *B. volubile*, Kaulf.

1. *B. unilaterale*, Willd.—Rootstock small, fibrous erect, the crown scaly; stipites tufted, several ½–5 in. l. slender, fibrillose scaly; fronds pinnate at the base, chartaceous glabrous, 6–10 in. l. 1½–2 in. w. tapering equally to both ends; terminating in a narrow entire, even or serrulate acuminate segment; pinnæ numerous, ½–1 in. l 2–3 li. w. close even-margined, straight or curved, acute, dilated (rather more on the upper side) and adnate at the base with a narrow sinus between which in the lower part of the frond is incised in the centre, inferior ones gradually reduced to mere broadly-based deltoid auricles, the lowest of which are apart; rachis slender, pale green; veins forked, close; sori subcostal, linear the upper line shorter, continuous or in short patches, not reaching the base or apex of the pinnæ.—*B. polypodioides*, Radd.

Common on banks and stony ground in exposed situations from 500–3,000 ft. alt. A small freely tufted stoloniferous species, marked from all the others by the broadly adnate pinnæ, which dwindle to small auricles at the base of the fronds.

2. *B. occidentale*, Linn.—Rootstock erect or oblique, usually small, fibrous and stoloniferons, the crown scaly; stipites tufted, ½–1 ft. l. fibrillose-scaly below; fronds ½–1¼ ft. 3–9 in. w., at first pink then bright green, naked or the ribs slightly puberulous, the lower part pinnate, the upper pinnatifid and then passing gradually into the acuminate entire serrulate point, pinnæ numerous, adnate above, below free and cordate-auriculate, subfalcate, acuminate or acute, 1½–4 in. l. ½–¾ in. w. the lower apart, and the lowest 1–2 pairs somewhat reduced and deflexed, the cartilaginous margin finely spinulose—serrate, as are also the costæ on the upper sides; veins free, close, forked; sori subcostal, falling more or less short at each end of the pinnæ, the opposite involucral valves connivent over the rib, but at length recurved and concealed by the matured sporangia.—Sloane t. 44. f. 2. Plum. Fil. t. 62. B.

Var. *minor*, Hook.—Stipites 1–2 in. l. fronds 3–6 in. l. ¾–1½ in. br, otherwise similar.

Most abundant on banks and open stony ground from sea level up to nearly 6,000 ft. alt.

The most generally diffused species, and though exceedingly variable in size the pinnæ numbering from a dozen to 6 dozen to a side and from 1–6 in. in length, unmistakable in any state. Distinguished from the preceding by the free cordate and but slight shorter lower pinnæ, and from the next by the more numerous pinnæ which dwindle usually imperceptably into the entire acuminate apex. There is a form with forked or repeatedly forked fasciated apex, divaricating fish tail-like. The small variety which is constant, is found at the higher elevations.

3. *B. longifolium*, H. B. K.—Rootstock upright, fibrous, scaly, stoloniferous, stipites 5–10 in. l. a few deciduous scales at the base; fronds relatively short, chartaceous, pale green, naked or the ribs slightly puberulous, 6–10 in. l. 4–6 in. w. truncate at the base and pinnate, above the pinnatifid, ab-

ruptly terminating in a pinna 3–5 in. l.; lateral pinnæ 3–5 to a side, shorter than the terminal, upper and lower usually slightly reduced the former free and cordate-auriculate, the inferior base narrowed and rounded, more or less separated or subdistant, the latter close adnate and slightly connected; margins cartilaginous and finely spinulose-serrate, veins fine forked, free or forming casual costal areolæ; sori reaching to the base and in the upper pinnæ shortly decurrent against the rachis.—Hook. Sp. Fil. t. 154.

Var. *B. gracilis*, Kaulf.—Stipites very slender, 2–8 in. l.; fronds 4–7 in. l. 1–2 in. w.; pinnæ 4–12 to a side, ¾–1¼ in. l. 3–5 li. w. upper adnate, lower free, terminal 2–3 in. l.

Common in infrequent situations, by the banks of rivers at low altitudes, plentiful on rocks by the side of Ugly river, St. Mary; less generally diffused than the preceding, from which it is marked by the fewer pinnæ, the upper not much reduced, and long terminal one, which is the largest of all. The variety varies in form and number of pinnæ from the preceding to this, and is quite a complete connecting link between them. It is found on banks and precipices in forests and lighter shade from 5,000–7,000 ft. alt.

4. *B. serrulatum*, Rich.—Rootstock free-creeping subterraneous, with erect branches, the growing parts densely scaly; stipites stiffly erect in tufts 2–3 together, ½–1½ ft. l., stramineous, naked or with a few minute scales at the base; fronds stiffly erect, coriaceous, pale green, oblong lanceolate, 1–2½ ft. l. 3–9 in. w. fully pinnate throughout; pinnæ very numerous, close, often imbricating, spreading, linear or ligulate, point blunt or acute, rounded, inequilateral and articulated at the sessile free base, attached transversely to the rigid, channelled, rachis, 2–6 in. l. ¼–¾ in. w. the fertile narrower than the barren, margin cartilaginous and finely serrated, sparse minute deciduous scales along the ribs, otherwise naked and glossy; veins very fine, close, forked and parallel, spreading, pellucid; sori costal, falling short of both base and apex.

Common in certain open situations in the central parishes, up to 3,000 ft. alt; gathered on Mt. Diablo; a communal species, the roots thickly and deeply ramifying under the surface of the ground, covering very wide areas. Generally the fronds are fertile only in the upper half, but occasionally they are so quite throughout. Eventually the pinnæ are shed, leaving the erect naked rachises standing. Like the bracken (*Pteris aquilina*) it perfers open fully exposed wet or dry savannahs or hill sides.

5. *B. volubile* Kaulf.—Root-stock strong, subterraneous, creeping, several in. l. beset with the bases of past stipites, the extending part finely scaly; stipites several, strong, channelled and angular below. thick as cord, 1–2 or more ft. l., fronds separately barren and fertile, the former short, simply pinnate, the latter twining, many feet high and bipinnate, pinnæ of the latter distant, in opposite or sub-opposite pairs, petiolate, consisting of a long terminal pinnule and 1–5 similar spreading lateral ones,the upper pinnæ in the frond becoming gradually reduced to a simple pinna without lateral leaflets: pinnulæ entire, 6–10 in. l. 1–2 in. b. 1½–3 in. apart, coriaceous, naked, glossy, with pedicels 1–6 li. l. rounded at the base, acuminate, acute or cuspidate at the apex, the margins even and cartilaginous; veins spreading free, close, single or forked, connected by a marginal line; sori costal or sub-costal, linear and continuous, reaching from the base nearly to the apex of the leaflets, deciduous; involucres revolute, deciduous.—Hook. Gard. Fern. X. 15.—*Salpichlæna*, J. Sm.

Infrequent, gathered by Purdie. The earlier fronds produced are not climbing, and are barren. They have a petiole a foot to 1½ ft. l., and a simply pinnate frond about the same length and width, with a long terminal pinna, 2–3 simple similar pinnæ to a side. In this stage the plants resemble somewhat *Acrostichum (Olfersia) cervinum* of reduced size. After this the fertile fronds appear one after another, arising as mere slender stems devoid of leaves, wavering about for support, till they reach a branch or young sapling to twine upon, which they ascend, reaching a dozen feet high or more, developing the pinnæ as they ascend, the first of which are usually largest and infertile, becoming gradually fertile, smaller, with fewer pinnules upwards, the upper and terminal ones being quite simple, the stems forming a dense entangled mass in time, the original, simply pinnate, frond by that time having quite disappeared. The involucres are quite cylindric at first, arising from beneath the sori and involutely covering it. At length they open out quite flat, revealing the lines of ruddy sori, when after a time both break up and gradually drop away, leaving only the raised receptacle as a slight ridge, barely separated from the midrib, as evidence of their former presence.

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PLANTS.

From Mr. J. F. Butters, Botanic Gardens, Port Elizabeth—

4 bulbs Cyrtanthus uniflorus.
4 " " spiralis
2 " " obliquus
4 " Watsonia iridifolia, var O'Brienii
4 " " spicata—Pink.
4 " " " —Scarlet.
3 " Antholyza sp.
2 " Crinum riparium.
50 " Freesia refracta-alba.
12 " Lachenalia aurea.
2 " Hæmanthus coccineus.
12 " Ornithogalum aureum.
6 " Satyrium coriifolium.

From Mr. J. B. Beach, Florida—

Apricots, Cherries, Pears, Persimmons and Pecan Nuts.

From Reasoner Bros. Florida—

Amaryllis Johnsoni, Acorus Calamus, Amaryllis Atamasco rosea, Nerium atropurpurea, Nerium roseum splendidum, Nerium roseum, Nerium double white, Nerium flavum, Abutilon Mdme. Chobert, A. Golden Ball, Macadamia ternifolia, Buphane toxicaria, Myrica rubra, Boussingaultia baseloides. Chrysanthemum up; Bigsonia capreolata.

From Rev. E. Bassett Key—

3 Plants Nymphæa Rudgeana.
1 white Lily.

SEEDS.

From Geo. Henderson, Esq., Jamaica—

Mahogany.

From Mr. Leonte Quesada, Jamaica—

2 lbs. Tobacco.

From Botanic Gardens, Glasnevin, Dublin

Aconitum album. A. pyrenaicum.
A. variegatum. A. japonicum. A. barbatum.
A. hispidum.
Anemone coronaria. A. sulphurea. A. alpina.
Aquilegia spectabilis. A. vulgaris Whitmaniana.
A. grandiflora alba. A. chrysantha. A. grandiflora.
Arabis blepharophylla. A nivalis.
Armeria vulgaris alba. A. purpurea.
Asphodelus albus. A. aurea. A. luteus.
A. racemosus.
Aster nova-angliæ.
Aubrietia deltoidea. A. grandiflora.
A. græca.
Balsamita grandiflora.
Betonica incana grandiflora.
Buphthalmum staticefolium.
Campanula medium. C. nobilis. C. speciosa.
C. pulcherrima. C. persicifolia. C. latifolia.
C. carpathica.
Clematis montana.
Cistus cymosus. C. corsicus.
Cytisus triflorus. C. sessilifolius.
Delphinium cheilanthum, D. elatum.
D. alopecuroides. D. hybridum. D. splendens.
D. magnificum. D. formosum. D Wheeleri.
D. discolor. D. exaltatum.
Eurybia Gunniana. E. parviflora..
Eranthis hyemalis.
Francoa appendiculata.
Fritillaria imperialis.
Funkia Sieboldiana.
Genista aurantiaca. G. sibirica. G. candicans.
Galega biloba persica.
Helianthemum rhodanthum. H. pilosum.
H. tomentosum.
Hedysarum neglectum.
Hesperis matronalis.
Heuchera glabra.
Hyacinthus candicans.
Iris missouriensis.
Linum candidissimum. L. grandiflorum rubrum.
L. perenne. L. narbonense.
Lilium carolinianum.
Lathyrus Sibthorpii. L. cæruleus. L. Drummondi.
Lupinus arboreus. L. polyphyllus albus.
Lunaria biennis.
Lavandula vera.
Marrubium vulgare.
Nepeta ucranica.
Orobus aurantiacus.
Papaver orientale. P. bracteatum.
Pæonia humilis.
Pentstemon ovatus. P. Richardsoni.
Potentilla formosa. P. Hookeriana. P. sulphurea.
P. chrysantha. P. splendens. P. Pennoni.
P. Dombeyi.
Primula japonica.
Prunella Webbiana. P. hyssopifolia.
Salvia bicolor. S. glutinosa. S. coerulea.
S. napiifolia. S. mollis. S. verbenaca.
S. nutans. S. argentea. S. grandiflora.
Saponaria calabrica.
Scilla amethystina. S. campanulata.
S. amœna.
Spirœa aruncus. S. filipendula.
Statice alpina. S. Oordarti. S. Gmelini.
S. latifolia S. speciosa.
Iceland Poppy.
Veronica Waldsteiniana. V. laciniata. V. hybrida.
V. maritima. V. saxatilis. V. (excelsa.)
V. fructiculosa. V. eminens.

From H. Cannell & Sons, Swanley, England—
Aster—perennial mixed.
Pansy—Dr. Sankeys striped.
Rhodanthe Manglesii.
Cineraria—Single mixed.
Dianthus Hedwigii
Balsam—Cannell's Perfection.
Hollyhocks—mixed.
Carnations—mixed.
Lupinus—mixed.
Acroclinium—mixed.

From Botanical Station, Antigua—
Thrinax sp.
Livistona subglobosa

From Botanical Station, St. Vincent—
Hernandia sonora.
Diplotropis brachypetala.
Dialium guianense.
Caladium Purdieanum (tubers.).

From Botanical Gardens, Demerara—
Solanum sp.

From Botanic Gardens, Durban, Natal—
Calodendron capense.
Tephrosia grandiflora, T. Kraussiana.
Apodytes dimidiata.
Ipomœa pes-capræ.
Cordyline africana.
Anona senegalensis.
Watsonia densiflora-alba
Limnanthemum Thunbergianum.
Dais cotinifolia.
Agapanthus umbellatus albus.
Moræa iridioides
Strelitzia augusta.
Combretum erythrophyllum.
Scaevola Lobelia.
Dissotis incana.
Clerodendron glabrum.
Gomphocarpus sp.
Zanthoxylon capense.
Oncoba Kraussiana.
Turræa obtusifolia.
Watsonia densiflora.
Celtis Kraussiana.
Gloriosa virescens.

From Botanical Station, Lagos, West Africa—
Chrysophyllum albidum.
Honckenya ficifolia.
Dialium guineense.
Lonchocarpus cyanescens.

From Botanic Gardens Saharanpur.—
Pennisetum triflorum, (2 lots.)
Lagerstrœmia Flos-Reginæ.
Wendlandia puberula.
Catalpa Kæmpferi.
Ficus foveolata.
Anogeissus latifolia.

From Govt. Gardens, Ootacamund—
21 Quarts Hill Rice.

From Agri-Horti. Society, Madras—
Strychnos nux vomica.
Lagerstrœmia Flos-Reginæ.
Colvillea racemosa.
Cassia renigera.
Dracæna surculosa.
Anogeissus acuminata.

From Botanical Gardens, Melbourne—
Kennedya prostrata.
Acacia spectabilis.
Acacia Moradenia.
Acacia leprosa.
Pongamia glabra.
Brachychiton diversifoium
Sesbania grandiflora.
Billardiera, (W. A.)
Phormium tenax variegatus
Acacia sp. A. decurrens.
Kennedya sp.
Schoenus sp.
Grevillea sp.
Fimbristylis sp.
Myoporine sp.
Boronia megastigma.
Terminalia sp.
Buchnera sp.
Eucalyptus ficifolia. E. leucoxylon.
E. polyanthema. E. melliodora. E. rostrata.
E. macrorhyncha.
Acacia cyanophylla.
" decurrens.
" juniperina.
" pycnantha.
" salicina.
" saligna.
Ammobium alatum.
Angophora lanceolata.
" subvelutina.
Callistemon phœniceus.
Casuarina suberosa.
Cordyline Baueri.
Doryanthes Palmeri.
Eustrephus latifolius.
Grevillea robusta.
Hymenosporum flavum,
Kennedya rubicunda.
Macadamia ternifolia,
Morinda jasminoides.
Myrsine variabilis.
Notelæa longifolia.
Owenia venosa.
Pittosporum rhombifolium.
Stenocarpus salignus.
Sterculia acerifolia.
" diversifolia.
Syncarpia laurifolia.
Synoum glandulosum.
Tecoma australis.
Telopea speciosissima.

No. 45. July, 1893.

BULLETIN

OF THE

BOTANICAL DEPARTMENT,

JAMAICA.

CONTENTS:

PRICE—Twopence.

[A Copy will be supplied free to any Resident in Jamaica, who will send Name and Address to the Director of Public Gardens and Plantations, Gordon Town P.O.]

JAMAICA:
GOVERNMENT PRINTING OFFICE, 79 DUKE STREET, KINGSTON.

1893.

DRAGON'S BLOOD TREE OF THE WEST INDIES.

There are several plants known in different parts of the world as Dragon's Blood, but the one to which attention is called in this note is a native of Jamaica, a tree about 30 feet high (*Pterocarpus Draco*, Linn.)

The common name is derived from the fact that when incisions are made in the bark drops of red sap ooze out, which flow slowly down the bark and gradually harden.

Jacquin in his "Selectarum stirpium americanarum Historia," published in A. D. 1763, states that formerly this red resin was imported from Cartagena to Spain as "Sangre de Dragon." He also says that the bark, wood, and leaves are full of an astringent sap, and that the inhabitants use the bark of the trunk and root for cleaning the teeth. He mentions the Island of Tierra Bomba as its native place, but Grisebach states that it grows in Jamaica, Guadaloupe, Trinidad and in Central and northern South America.

Other species of the genus *Pterocarpus* yield an astringent coloured juice which is of economic value. For instance the Kino which is recognised at the present day in the European and Indian Pharmacopœias is a product of *Pterocarpus Marsupium*, Roxb., which is also a valuable timber tree. Kino was originally brought from Africa under the native African name Kano, the sap of *Pterocarpus erinaceus*, Poir. Fluckiger and Hanbury in their "Pharmacographia" say "Duncan in the *Edinburgh Dispensatory* of 1803, while asserting that 'Kino is brought to us from Africa' admits that some, not distinguishable from it, is imported from Jamaica. In a later edition of the same work (1811), he says that the African drug is no longer to be met with, and alludes to its place being supplied by other kinds, as that of Jamaica, that imported by the East India Company, and that of N. S. Wales derived from *Eucalyptus resinifera*, Sm." This reference to Jamaica points to the *Pterocarpus Draco*.

It is possible that the wood may be of value in the arts like the Barwood of Africa, (*Pterocarpus erinaceus*, Poir.) or the Red Sanders Wood of India (*Pterocarpus santalinus*, Linn. f.).

It is important therefore to find out to what extent this tree is still growing in the island, and to submit specimens of the resin and wood to foreign markets. Any information with specimens of wood, resin, leaves, flowers, and pods will be thankfully received by the Director of Public Gardens and Plantations, Gordon Town P. O.

The tree has compound leaves, somewhat like the common cedar; yellow pea-like flowers, half an inch long; and a flat rounded pod, containing one seed.

EXPERIMENTS IN THE CULTIVATION OF VEGETABLES.—X.

Potatoes

Names of Potatoes grown at Hope Garden.	Date of Planting.	First appearance above Ground.	Days from Planting	Date when tops were dead and Potatoes ready for digging.	Days from Planting.	Number of sets Planted.	Number of sets lifted.	Number of Saleable Potatoes per set.	Total Number of Potatoes per set.	Weight of Saleable Potatoes per set.	Gross Weight of Potatoes per set.	Total Weight of Potatoes lifted.	Max. temp. during time Potatoes were in ground.	Rainfall. Inches.	Number of days on which rain fell.
										ozs.	ozs.	lbs.			
Windsor Castle ...	17.3.93	26.3.93	9	14 6.93	88	30	30	2.6	6.6	2 4	3.4	6½	93o	11.11	38
Sutton's Nonsuch ...	"	"	"	"	"	32	30	2.0	4.3	3 6	4 8	9.0	"	"	"
" Supreme ...	"	"	"	"	"	30	25	2.	10 0	3 5	6 6	9½	"	"	"
" Magnum Bonum ...	"	"	"	"	"	32	32	3.	4.0	3 8	4 8	8½	"	"	"
" Satisfaction ...	"	"	"	"	"	32	32	2.0	4.0	3 0	5 0	10 0	"	"	"
" Perfection ...	"	"	"	"	"	30	28	1.9	6.4	3 4	5 4	9½	"	"	"
" Reading Hero ...	"	"	"	"	"	32	32	0.6	2.4	0 5	1 0	2.0	"	"	"
" Seedling ...	"	"	"	"	"	30	30	2.0	6.9	6 0	4 8	9.0	"	"	"
" Triumph ...	"	"	"	"	"	30	30	1.3	4.6	3 6	4 8	9 0	"	"	"
" Reading Russet ...	"	"	"	"	"	30	30	0 6	2.4	1 2	1 8	3½	"	"	"
" Abundance ...	"	"	"	"	"	30	30	1 6	5.6	2 4	4 0	7½	"	"	"
" White Kidney ...	"	"	"	"	"	30	30	0 6	4.3	0 5	2 4	4½	"	"	"

W.C.

ONION SEED.

A supply of Onion seed has been received from Teneriffe, and small quantities will be distributed gratis to persons who desire to make experiments in the cultivation of Onions.

Application should be made to the Director of Public Gardens, Gordon Town, P.O.

PROFITABLE USES OF THE MANGO CROP.

Tons of the fruit of the common mango are wasted every year, when they might be made into excellent jelly. A correspondent has kindly furnished the following recipe for making mango jelly, and states that the common mango gives a bettor flavour than the No. 11.

Mango Jelly.

Pare and boil the mangoes, and when the pulp is soft, take it from the seeds, and press it through a brass or copper-wire sieve (*iron* wire spoils the colour) with a wooden spoon.

Weigh the pulp, and with an equal quantity of white sugar, boil until it jellies, when pour or ladle into bottles or jars.

The fruit must be frequently stirred during the first, and constantly during the second process.

The pulp should be thick after it comes through the sieve; if not, it must be reduced by more boiling before the sugar is added.

The mangoes are better green, but they shoud be perfectly *full*. A little lime juice can be used, if desired, for flavouring.

COCO-NUT BUTTER.

Information is occasionally sought about butter made from Coco-nuts. It is scarcely possible to make it, or use it, in tropical countries, but the following notes from the *Kew Bulletin* may be of interest to enquirers :—

The manufacture of butter from the Coco-nut has lately attracted some attention. The invention is due to Dr. Schlinck, a German Chemist, and is of considerable importance in Europe, inasmuch as it is cheap, wholesome and perfectly digestible. The butter is a pure white transparent mass, which melts at 67° F.

As it costs only 7½d. per lb. in Germany, it at once becomes a rival to the oleomargarines which are frequently made from the diseased fat of horse and sheep flesh.

It is well known that in milk many disease germs multiply fast, and are especially liable to be communicated to man from diseased animals. But Coco-nut butter does not afford a nutrient material for micro-organisms, and being a vegetable fat, there is no risk of infection.

This manufactured butter is free from fatty acids , and even if left exposed to air for more than a week, does not turn rancid, except in the top layer.

Owing to its high saponification degree, all adulteration is impossible.

It was proved in the German Hospitals that food, even pastry, prepared with this fat, was eaten without any inconvenience.

Coco-nut butter therefore meets all hygienic requirements. It is far superior to animal fat and butter, as well as to any of their other substitutes ; and further, on account of its perfect digestibility, it is well adapted for the use of patients suffering from impaired digestion.

The discovery was made by Dr. Schlinck in 1885, and has been patented. A factory was started in 1888 at Manaheim, and factories were also to be opened in Paris and Amsterdam in 1890. The demand is greater than the supply. As the invention is patented no details can be ob'ained about the manufacture.

It is however easy to make cocoa-nut oil, which can be used with great advantage in cooking and in other ways, in place of cooking-butter or olive oil. If this oil is put, while still hot, into hermetrically sealed tins, or into glass bottles using cotton wool with the stoppers, it ought to keep for an indefinite time.

A Correspondent writes on this subject as follows :—

" *Coco-nut oil.*—This article would command a very considerable local trade for cooking purposes, but for the defect of its soon becoming rancid. I was in correspondence some years back with the Boro-Glyceride Co. about their preparations, and have all the correspondence by me. The preparation did all it undertook to do.

" *Cocoa-nut preserves.*—Besides this, it is possible we might turn our coco-nut to account by desiccating with sugar, now that white sugar is free. I went to Schep of New York, the largest putter up of this, and he said he would give a good deal of money to prevent his Coco-nut Confection from becoming quickly rancid.

" Mr. A. in Kingston carried on the manufacture of cocoa-nut oil cold drawn, by hydraulic pressure, also of moringa oil. He kept the ripe cocoa-nuts in the outer husk, in a hot, dark room, till you could hear the kernel rattle. He then ran them on a circular saw, and of course the kernel dropped out. The oil that Mr. A. prepared from these nuts, was after 15 months, though kept in an uncorked bottle, perfectly sweet. Now, I believe, that the coco-nut preserves would not turn rancid if the nut were so prepared. There is in England and America a very large trade. I have the draft of the machinery and the *modus operandi* from America . It cost me something to get it, as it is a secret, and Schep guarded it with jealousy. Waste steam might possibly be rented in Kingston.'

TIMBER TREES.

The natural wealth of a country is to a very considerable extent estimated by its vegetable productions. These of course vary very much; some countries of the globe simply teem with valuable timbers and other vegetable products, whilst others, owing to climatic conditions, are almost barren wastes, and all the arts and devices of man cannot make them otherwise. In Jamaica we have a climate, or I might say variety of climates, capable of supporting the vegetable products of most of the temperate, sub tropical and tropical countries of the world, and we are indebted to other countries for the majority of our useful trees and plants, some of which have become so plentiful and common as to be looked upon as indigenous to the soil, by those who, perhaps, have never given the matter a thought.

The *Mango*, which is found almost everywhere from sea-level up to about 4,000 feet elevation, and upon the fruit of which the peasantry partially subsist during a portion of the year, was introduced from the *East Indies;* the *Breadfruit* which furnishes such a nutritious culinary fruit is a native of the *South Sea Islands;* the valuable *Logwood* which has proved to be a source of wealth to many in recent years who were fortunate enough to possess it in quantity, came hither from *Honduras*; the seeds of the invaluable *Guinea Grass* were *accidentally* introduced from the *West Coast of Africa*; *Coffee*, one of the principal crops of the Island, had its original home in *Abyssinia; Cocoa* is indigenous to *tropical America;* the *Nutmeg* is a native of the *East Indies*, whilst the *Cinnamon* comes from *Ceylon;* the *Akee* and the *Kola nut* were brought from the *West Coast of Africa;* whilst the *Orange*, *Lime*, *Lemon*, the *Shaddock* and the *Citron* had their original home in *India;* the *Granadilla* and *Sweet-cup*, the *Naseberry* and the *Cashew*, the *Sweetsop* and *Custard-apple*, the *Avocado Pear* and the *Guava* all come from *tropical America;* the *Fig* is a native of the *Mediterranean Region*, the *Loquat* of *Japan;* the *Wampee* and *Litchee* are from *China*, the *Clove* is from the *Moluccas*, whilst the *Betel Pepper* is fron *Java; Cinchona* is from *Peru* and *Bolivia* and the native *habitat* of the *Ginger* is *tropical Asia.*

This list might be added to almost *ad infinitum*, but enough has been said to show from what widely separated, and differently situated parts of the world the trees and plants that tend to supply our every day wants, were originally procured. The larger number of the plants introduced and established by our ancestors would appear to be such as they, no doubt, considered would be most useful in providing for the daily wants of the inhabitants, or in yielding substances used in the *arts* and *manufactures* of the world. In this they proved to be right, and it is a proof of the keen foresight, and great thoughtfulness with which they were possessed. It will be observed, however, that the list which I have given contains few or no trees yielding timber of any value. It must be admitted that there is a deficiency of useful timber trees in this Island. I am aware that there is a limited supply of *West Indian Cedar*, a most valuable timber, a small quantity of *Mahogany*, *Mahoe*, *Yacca*, and *Juniper Cedar*, and perhaps a few other kinds, but not in quantity, and the trees frequently grow in almost inaccessible places, or if they are easily got at, it is often difficult to get the timber to the nearest main road. What I wish to point out is that we have no trees in quantity, yielding timber which could take the place of the *Pitch Pine* and *White Pine* lumber now so largely imported. That valuable timber at one time was plentiful here is evident; old buildings and substantial articles of old furniture to be seen in some parts prove this; but through waste and, I am credibly informed wanton destruction in many instances, the supply has been reduced to a minimum.

Our *proprietors* and *planters* generally, have little or no time to devote to the subject of reforesting, even were they inclined to do so. There are thousands of acres of land now lying idle, suitable for the growth of *West Indian Cedar*, than which, I believe, there are few better timbers for all-round purposes. The tree is a native, is easily raised from seed, of fairly quick growth, and after being planted would require little or no care. Of other useful timbers the *Mahogany*, *Mahoe*, *Juniper-Cedar*, *Yoke*, *Broad-leaf*, *Yacca*, &c. should be extensively planted. But there is no reason why planting operations should be confined to the few valuable trees either indigenous, or naturalized here. At the commencement of these notes I gave the names of some of the fruit and other trees and plants introluced at one time or other from various parts of the world, and indicated the native country of each, merely to show the wide range we have to select from. If fruit trees, &c. from the places named thrive so well here, why not timber trees? There is no reason why they should not, and, as a matter of fact, the Public Gardens have proved that very many valuable *exotic* timber trees are admirably suited for various parts of this island, but beyond arousing a passing interest, and perhaps disposing of a few plants of several kinds, they have not succeeded in inducing landowners to plant timber trees to any appreciable extent. This is greatly to be regretted. The Department of Public Gardens is in a position to obtain seeds or plants from most parts of the world, but there is no use in putting its correspondents to the trouble of forwarding seeds, and in its incurring considerable expense in raising plants which are not likely to be accepted even as a gift, by those who have the land to grow them.

It must be borne in mind that seedling timber trees are not like *Roses, Crotons or Geraniums;* they cannot be kept in a nursery for years, re-potted, fresh cuttings made when required, &c. As soon as they have grown to a certain size they must be planted out, or they become stunted and worthless, and eventually perish.

This is a subject that deserves serious attention; valuable timber is exceedingly scarce in accessible places; even ordinary timber is fast giving place to brushwood, so that firewood is scarce in many parts and an expensive commodity and good fence posts are difficult to obtain at high rates: and this in a country where it would only be necessary to put in such plants by the thousand and allow them to grow; nature, in the majority of cases, would attend to their requirements.

W. Harris.

SUGAR CANE DISEASE.

In the May number of the *Bulletin*, was published a letter from the Director of the Royal Gardens, Kew, respecting a disease in Sugar Cane, which had been investigated by Mr. George Massee.

Mr. Massee's report and the extract from Mr. Bovell's letter therein referred to, are given below.

Extract from letter from Superintendent Botanical Station, Barbados, dated February 11th, 1893.

As the question of a fungus attacking canes which have not been first injured by the moth borer is still a very debatable point with those over your way who take an interest in the matter, I am sending you per Mail Steamer to-day, c/o Messrs Obree & Company, Southampton, a box containing (1) canes which have been just attacked by the fungus, and in which no shot or moth borers are present as yet, as far as I can see, without cutting up the cane. (2) Canes which have been attacked with the fungus a little longer and in which shot borers have entered but no moth borer. (3) Canes with fungi, shot borer and moth borer. (4) Canes killed by moth borer only.

Preliminary Report on the Sugar Cane Disease.

The abundant supply of living material, consisting of 18 large canes, illustrating every stage of the disease, sent to Kew for investigation by Mr. Bovell from Barbados, has enabled the vexed question as to the part played by fungi in connection with the sugar cane disease, to be conclusively settled.

Each cane was accompanied by a description of the supposed cause of disease, as, killed by "shot-borer", "moth-borer", "fungus", and in some cases two or all the above were described as being present on the same cane.

Microscopic examination showed the presence of the fungus in every cane, but in some instances, owing to the absence of fruit, its presence could not be detected by the naked eye.

Only one fungus, an undescribed species of *Trichosphæria* was found on the canes. The idea entertained by some planters that more than one fungus is connected with the disease, probably arises from the fact that the Trichosphæria has at least three distinct forms of fruit, very different in general appearance, and whose development depends on the relative vitality of the canes.

Stage I. Conidial condition, for the rapid reproduction of the species; appearing on the surface of wounded parts as a very delicate, dark-coloured velvety mass, or when old and very abundant, penetrating the internal tissue of the cane and producing a black charred appearance, due to the numerous chains of large olive-brown conidia.

Stage II. *Melanconium* form, bursting through the cuticle of old canes in the form of minute black pustules, often following the ravages of the "moth-borer" or "shot-borer" in dying or dead canes.

Stage III. The ascigerous form. Minute, black, hairy perithecia, present only on dead and more or less decayed portions of the cane.

The conidia from Stage I. obtained from a pure culture, were placed on the unbroken surface of *very young* leaves of lateral shoots of a healthy sugar cane plant growing in the Lily House, Kew Gardens; in five days the infected areas showed deep red blotches, and in fourteen days the conidial form of the fungus was perfectly developed, the mycelium in the meantime having passed into the shoot and adjoining leaves. Soon afterwards the young infected shoots decayed and dropped off, microscopic examination showing that the mycelium had passed into the tissues of the parent stem.

Further experiments showed that fully developed leaves and stems cannot be infected on an unbroken surface, nevertheless when the surface is broken infection is readily effected. A cane about 1½ inches in diameter was inoculated by cutting a deep slit and introducing mycelium from a pure culture of the conidia; in 16 days the cane was split at this point, and the central portion was found to be coloured red for a distance of 3 inches, and the mycelium had extended even bayond that distance; the microscope showed the presence of the dark olive conidia formed in tissues away from the light. Infection also readily takes place at points where lateral branches have been broken off.

Summary.

1. The experiments described above prove that the *young* leaves of the sugar cane can be infected by the spores of *Trichosphæria* falling on an unbroken surface, and further, that the fungus acts as a true parasite, eventually killing the plant.

2. In older plants inoculation can only take place when the surface is wounded, but when an entrance through a wound is once effected the fungus acts as a destructive parasite.

3. The frequent pre ence of both fungus and moth-borer or shot-borer in the same cane is explained by the above statement. Assuming the insect to first pierce the cane, the spores of the fungus would find a suitable place for development in the wound; hence the presence of one parasite prepares the way for another, and the combined action of the two soon ends in the destruction of the plant. Nevertheless the fungus is not entirely dependant on the previous presence of the insect, but readily finds entrance at broken points, and can alone kill the cane.

Protective Measures.

The conidia of the fungus will not germinate, neither will the mycelium grow in a 1 per cent solution of cupric sulphate, but spraying with the ordinary Bordeaux solution is in all probability not practicable other than in the case of an experimental plot, and would certainly have no beneficial effect on an infected area.

Remembering that the mycelium of the fungus extends, as a rule, far beyond the range indicated by its presence to the naked eye in a given cane; and further, that almost every cane—judging from the material examined—attacked by the "moth-borer" or "shot-borer," is also infested with the fungus, it would be unwise to use appearently sound portions of such canes for propagation. It was observed in those canes killed by the fungus alone, that the disease was oldest and most mature near the root, and this suggests the question—Was the cane, even if taken from a healthy stock, inoculated

with the fungus spores on the cut and exposed surface of the portion used for propagation? As a preventitive against this possible cause of inoculation, the cut surface might be painted with a solution of Bordeaux mixture immediately on being cut, and repeated at intervals.

It has been observed that the fungus causing the sugar-cane disease develops readily on the young leaves of the bamboo, the same may prove to be true of other members of the *Gramineae*, hence a careful search should be made for such possible nurse-plants, as the spores would be carried for a considerable distance by the wind.

Finally all diseased canes should be burnt, and not allowed to remain to rot, during which condition they are simply producing fresh material for the inoculation of other plants.

Previous to the receipt of the material reported on above several consignments of diseased sugar-cane had been received at Kew from Mr. Hart from Trinidad, caused by the same species of fungus; but as the material was either dry or preserved in spirit, no cultures or inoculations could be made.

G. Massee.

April 4th, 1893.

CULTIVATION ABROAD.

West Indian Lime-Juice.

The area under lime-tree cultivation in the Island of Montserrat is now about 1,200 acres, three-fourths of which bear fruit. In Dominica also a good deal of lime-juice is made, although not to the same extent as in Montserrat. It is expected, however, that if the roads that have been projected in Dominica should be carried out, the cultivation of lime-trees will be greatly extended, as the industry is believed to pay handsomely. The average yield of juice from an orchard in full bearing is about 500 gallons per acre. The average shipments of lime juice from Montserrat for the last five years have been 800 puncheons of raw lime-juice of 120 gallons each, 200 54-gallon casks of concentrated juice, and 2,500 lbs. of essential oil of limes, in addition to green and picked limes. *Chemist and Druggist.*

Lemon Growing in Santa Paula

We extract the following paragraphs relating to Lemon-growing at Santa Paula from the letter of a private correspondent, as we think that they will be read with interest. Our informant, writing under date of January 21, says:—"We have been busy for the last three weeks picking Lemons, washing, wrapping in paper, and storing them away in the curing-house, we have been through the orchard three times, each time with a different sized ring. Three men work on a row of trees taking one at a time, one man picks all round the bottom and centre, another does the middle on a step-ladder, and the third picks the top of the tree with a ladder about 15 feet high fastened on a frame with wheels. All the Lemons have to be cut green. We have a ring $2\frac{1}{2}$ or $2\frac{1}{8}$ inch in diameter as the case may be in one hand and a pair of clippers in the other, and none but those which will not pass through the ring are to be cut; bags are slung over our shoulders wherein to place the Lemons, and as soon as these are full we carefully empty them into boxes scattered over the orchard. I am the box-foreman, and have to see to the proper distribution of the boxes, also that they are not too full, otherwise they would get bruised and rot, for the Lemon is so delicate that if handled more severely than an egg, the skin is liable to get abraded, the essential oil evaporates, and the Lemon will not cure. The chief drawback to the fruit is that the most important picking is in the winter and early spring, and the market is not, of course, open until the summer; in the meantime the Lemons must be preserved. The management of their curing in this country is at present very crude. The Lemons here are hauled up to the packing-house, then sorted into several grades, those smutty or dirty in any way first being washed in tubs of tepid water; they are then roughly wrapped in tissue paper, placed in shallow wooden trays, and stacked one above the other in the curing house. They are carefully examined every few weeks, and all showing a tendency to decay are thrown away. The Lemons are picked monthly throughout the year, but the present is the most important crop. The April-May bloom yields the true or normal Lemon, the February, March, June, and July the abnormal or bastard; the first-named cures the best. More than 1,000 dollars (according to present exchange £206 5s.) is made a year off this 11-acre orchard of 20 year old trees, mostly Eurekas and Lisbons which are considered the two best varieties here; 8 dollars (£1 13s.) per box of 300 Lemons is sometimes paid here in the mid-summer.

"The best stock for budding on, is considered by most orchardists to be the "Florida sour stock," or wild Orange, as it makes a strong growth, and is less liable to "gum," and other diseases. The great enemies of the trees here are the black and barnacle scales, but these can be kept down by the caustic soda spray.

"The Lemons in this state are not, in any opinion, nearly so good as those raised in Sicily, but a good deal to do with that is the "crudeness" of the soil, want of judgment in the selection of the stocks, and location of the orchard. The Lemon to be grown to perfection must be planted on a sunny slope, that looking towards the south is best, at an elevation of from 500 to 1,000 feet within 5 or 6 miles of the sea, in a situation free from wind and frost, on a well-drained sandy loamy soil, and last, but not least, plenty of water, for "water is king" in California.

"From what I have read and heard, the "Mesas" or table-lands of San Diego county embody to a near extent all these requirements; this country is in the extreme south of California, and the land must be nearly synonymous with the slopes of Mount Etna, where the finest Lemons in the world are raised. Most of the orchards here are protected by wind-breaks, as we frequently have high winds; three or four rows of Blue Gums (Eucalyptus), and one of Pepper Trees make the best

protection, Cypresses are also good. I maintain that a Lemon-orchard is the best investment there is in California, it is a perpetual source of income. I have learned a great deal about the fruit since I came here, and am still learning.

"We shall not commence picking the Oranges until May, as the fruit ripens here so much later than that of Florida. There are several Washington Marvel (an early variety) already ripe enough for eating. I have only had to sit up six nights at present to watch the state of the thermometer; it only went down to freezing point twice out of the six times and even then not lasting long enough to necessitate lighting the pots of oils in the orchard." *H. W. C. in Gardeners' Chronicle.*

FERNS: SYNOPTICAL LIST.—XX.

Synoptical List, with description, of the Ferns and Fern-Allies of Jamaica by G. S. Jenman, Superintendent Botanical Gardens, Demerara, (continued from Bulletin No. 44.)

Tribe VIII. *Asplenieæ.*

Sori linear or oblong, rarely arcuate or subreniform, single or double, situated on the backs of the veins, close and parallel, or less commonly diverging, lying at a varying angle with the midrib, in some instances nearly parallel, in others nearly at a right angle therewith, between these extremes directed to the margin with varying obliquity, more or less falling short of both midrib and margin, or near to or distant from one or other; involucres superior, persistent, the same shape as the sori, attached along one edge, free along the other, flat or vaulted, sometimes double and back to back, or the reverse with the free edges connivent; veins free or united.

In spite of the great variety, and, in some cases, of extreme dissimilarity of habit in the members, this is a particularly well marked Tribe in the essential characters of the form and arrangement of the sori and involucres, though in the subgenus *Athyrium* there is an evident leading and approach in these organs to the sub-genus *Nephrodium* of the next Tribe. Of West Indian species the Tribe comprises only the genus *Asplenium.*

Genus XX. *Asplenium*, Linn.—Characters as given above for the tribe. Locally this genus has its headquarters in the middle and higher mountain regions, (not reaching, however, the highest altitudes) decreasing gradually both in number of types and individuals in descending from the central line to sea-level. Some species delight in the hot, sunburnt surface of weathered walls, the face or crevices of open rocks, or of more or less unshaded banks, while, on the other hand, as many affect the deep shade of forests where on steep escarpments, among the disintegrated rock of valleys, ravines and banks of streams and rivulets, with loose hold, or on decaying logs, or aloft on the branches of trees, they appear to be largely sustained by the copious moisture in the atmosphere.

a. Veins free.

b. Sori uniformly single on the veins.

c. Fronds simple, entire.

1. *A. serratum*, Linn.

cc. Fronds pinnate-tripartite.

2. *A. pumilum*, Swartz.

ccc. Fronds simply pinnate; pinnæ entire, serrate or inciso-serrate. (See also *A. auritum* and *A. rhizophorum.*)

d. Rachises very slender, wiry, blackish, scariose-edged; fronds 1 in. or less wide.

3. *A. Trichomanes*, Linn.
4. *A. parvulum*, Mart. & Gal.
5. *A. ebeneum*, Ait.
6. *A. monanthemum*, Linn.
7. *A. formosum*, Willd.

dd. Fronds herbaceous, gray-green, including rachises, base truncate, stipites from two-thirds to fully as long as the frond.

e. Fronds from ½–1½in. br.

8. *A. dentatum*, Linn.
9. *A. jamaicense*, Jenm.

ee. Fronds over 1½in. w.

10. *A. abscissum*, Willd.
11. *A. cultrifolium*. Linn.
12. *A. obtusifolium*, Linn.
13. *A. salicifolium*, Linn.
14. *A. anisophyllum*, Kunze.
15. *A. auriculatum*, Sw.
16. *A. hastatum*, Klotzsch.

eee. Rachis winged with green membrane.

17. *A. pteropus*, Kaulf.
18. *A. alatum*, H.B.K.

eeee. Fronds twice or thrice as long as the stipites; pinnæ numerous, chartaceo-herbaceous.

19. *A. latum*, Sw.
20. *A. lunulatum*, Sw.
21. *A. harpeodes*, Kunze.

eeeee. Texture coriaceous and stiff.

22. *A. falcatum*, Lam.
23. *A. dimidiatum*, Sw.

24. *A. Serra,* Langs & Fisch.
25. *A. bissectum,* Sw.

cccc. Fronds bi-tripinate, rarely simply pinnate. (See *A. lunulatum,* var. *strictum*).

d. Texture firm, chartaceous, sori radiating, surface more or less striated.
26. *A. præmorsum,* Sw.
27. *A. cuneatum,* Lam.

dd. Fronds varying from simply pinnate to decompound.
28. *A. auritum,* Sw.
29. *A. fragrans,* Sw.
30. *A. scandicinum,* Kaulf.

ddd. Fronds decompound, herbaceous, a single veinlet and sorus to each final segment.
31. *A. myriophyllum,* Spreng.
32. *A. montiverdense,* Hook.
33. *A. rhizophyllum,* Kunze.
34. *A. cicutarium,* Sw.

dddd. Rachis prolonged into a naked whip-like radicant tail.
35. *A. rutaceum,* Mett.
36. *A. rhizophorum,* Linn.

bb. Sori linear, few or several double on the same veins.

c. Fronds simple, entire.
37. *A. plantagineum,* Linn.

cc. Fronds pinnate, pinnæ entire.
38. *A. juglandifolium,* Lam.
39 *A. flavescens,* Mett.
40. *A. grandifolium,* Sw.
41. *A. celtidifolium,* Mett.

ccc. Fronds pinnate, pinnæ uniformly lobed.
42. *A. Shepherdii,* Spreng.

cccc. Fronds bipinnatifid.
43. *A. costale,* Sw.

ccccc. Fronds varying from bi to tripinnatifid.
44. *A. striatum,* Linn.

cccccc. Fronds bipinnate.
45. *A. Klotzschii,* Mett.

ccccccc. Fronds tripinnatifid.
46. *A. radicans,* Schk.

cccccccc. Fronds pinnate, pinnæ entire, lobed, or with a partially or quite free lobe on the upper side of the base.
47. *A. duale,* Jenm.
48. *A. arboreum,* Willd.

ccccccccc. Fronds bipinnate.
49. *A. semihastatum,* Kunze.
50. *A. monticolum,* Jenm.

cccccccccc. Fronds bi-tripinnate.
51. *A. Fadyeni,* Hook.

ccccccccccc. Fronds tripinnate.
52. *A. Franconis,* Mett.

bbb. Sori shortly oblong; few or several double on the same veins; involucres vaulted.

c. Fronds bipinnatifid.
53. *A. conchatum,* Moore.

cc. Fronds tripinnatifid.
54. *A. hians,* Kunze.
55. *A. altissimum,* Jenm.

ccc. Fronds multifid.
56. *A. bruneo-viride,* Jenm.
57. *A. Wilsoni,* Baker.

aa. Veins uniting and forming a network next the margin, linear and parallel within.
58. *A. marginatum,* Linn.

1. *A. serratum,* Linn.—Rootstock erect, forming a fibrous mass; fronds several or many, shuttlecock-like, 1–3 or 4ft. l. 3–6in. w., simple, lanceolate-oblong or oblanceolate, acuminate acute or cuspidate, gradually or somewhat abruptly reduced below to the very, short margined, triquetrous stipes, subcoriaceous, glossy above and bright green, naked; crenate or crenate-serrate, and usually somewhat repand: midrib prominently raised, green, the base purple or blackish, keeled beneath; veins free, close, parallel, spreading at a wide angle from the midrib where they are slightly curved and the majority once-forked, sori linear, 1–2in. l. about 1 li. apart, straight, extending from near the midrib ½ or ⅔ to the margin; involucres flat, narrow, pale, the edge even,—Plum. Fil. t. 124—Hook. Fil. Exot. t. 70; Eat. Fer. N. Am. pl. 3.

Frequent on the branches of trees and on exposed rocks, chiefly the former, in moist woods and along the banks of rivers among the lower hills; principally a lowland species. but reaching sparingly to 2,000 or 2,500 ft. alt. Young plants are very deeply serrated, the feature being gradually modified by age. This is the Western representative of the larger and equally common *A. nidus,* Linn, of the Eastern and Southern Hemisphere.

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BULLETIN

OF THE

BOTANICAL DEPARTMENT,

JAMAICA.

CONTENTS:

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JAMAICA:
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1893.

COCCIDÆ, OR SCALE INSECTS—III.

By T. D. A. Cockerell, Professor of Entomology at the New Mexico Agricultural College.

The first part of the present series of articles (see Bulletin, No 36) dealt with the general characteristics of the Coccidæ, and the method for checking or preventing their ravages; the second part (see Bulletin, No. 40) cantained an account of the West Indian genera; and it now remains to discuss the species in detail.

In the *Journal of the Institute of Jamaica* for April, 1893 (publ. May), I gave a list of the known West Indian Coccidæ, 75 in number. The number of species recorded from each Island is as follows:—

Jamaica	61	Montserrat	4	Bahamas	1
Antigua	16	Dominica	1	Bermuda	1
Barbados	5	St. Kitts	1	Nevis	1
Cuba	4	Turks I.	1		
		Caicos I.	1		

From the other Islands no species are recorded; except Trinidad, which is zoologically a part of South America rather than of the West Indies. I have given a list of the scale insects of Trinidad in the *Agricultural Record* of that island for Dec., 1892 (publ. 1893).

To the above figures some slight additions might now be made. *Mytilaspis citricola* (see Insect Life, vol. iv, p. 143) is a fifth species from Montserrat; and the same scale is also on record from Bermuda, making a second species for that island. A few days ago I received three species from the Botanic Gardens, Grenada. In Trinidad, several additional species have been collected by the members of the Field Naturalists' Club, and sent to me by Mr. Urich; these will be enumerated at some future time in the Journal of the Club.

The following six species have been recorded as found in British Guiana, but not yet in any of the West Indian Islands: *Prosopophora dendrobii*, Douglas (on *Dendrobium*); *Tachardia lacca*, Kerr (on *Erythroxylon coca*); *Aspidiotus destructor*, Signoret (on *Anona reticulata*); *A. longispinus*, Morgan (on *Cupania sapida*); *Diaspis cymbidii*, Bouchè (on mango); *Diaspis aurantii*, Signoret.

(1) *Icerya rosæ*, R. & H. (The Rose Icerya).

Diagnosis.—The only species of *Icerya* which forms no ovisac. Half-grown individuals, bright scarlet in colour, are more frequently found than the adults. The empty skins of the larvæ are white and conspicuous, owing to the abundant mealy secretion. The newly hatched larvæ, as is usual in the genus, have six very long hairs coming from the end of the abdomen.

Food-plants.—Originally found on rose, it has now been ascertained to live on various plants of different natural orders. In Jamaica it was found by Dr. Strachan on *Amherstia nobilis* (which I believe it seriously injured,) and later on rose. Mrs. Swainson found it in abundance under the bark of lignumvitæ, and I have taken it on *Prosopis juliflora* and a cactoid *Euphorbia*. It was also found under the bark of a tree not identified at the Parade Gardens. For the convenience of those who may wish to obtain specimens, it may be mentioned that *Icerya rosæ* is to be found on *Prosopis* in East Street, Kingston, just by the signboard of the Jamaica Waggonette Coy.

Distribution.—At present it is only known from Jamaica and Key West, Florida.

Enemies.—A minute Chalcidid parasite has been bred from the rose *Icerya* in Jamaica; it has been named *Cerchysius iceryæ* by Mr. L. O. Howard.

Destructiveness.—Although related to the very destructive *Icerya purchasi*, the present species does not seem likely to seriously injure any cultivated crop. In gardens, when it infests choice plants like *Amherstia*, it becomes an important pest, but with the usual remedies for scale insects there should be no difficulty in suppressing it.

(2) *Icerya montserratensis*, R. & H. (The Montserrat Icerya).

Diagnosis.—The adult females form conspicuous ovisacs with longitudinal fluting, and are further remarkable for long tufts of waxy matter springing from the body. The young larvæ, and empty skins, are much like those of *I. rosæ*.

Food-plants.—This species, like the last, feeds on several plants; but no plant has yet been found common to both. It has been noticed on *Chrysophyllum*, *Clusia alba*, and more than one kind of palm.

Distribution.—First found in Montserrat, afterwards in Trinidad. Quite lately I have received young specimens on a palm from the Botanic Gardens at Grenada. It is probable that Barbados should be added as a locality, for some leaves, apparently *Chrysophyllum*, which I examined from there showed empty larval skins, apparently of this species.

Destructiveness.—In Trinidad it was found seriously injurious to *Clusia*, and it will probably prove a troublesome pest on some kinds of fruit trees and palms. Care should be taken that it is not imported into Jamaica.

(3) *Dactylopius virgatus*, Ckll. (The Striped Mealy-Bug).

Diagnosis.—This "mealy-bug" is about 4½ millim. (less than a quarter of an inch) long. It is distinguished from other West Indian species by the presence of two thick tails or caudal filaments, and the absence of any white processes springing from the sides. The back has usually a pair of interrupted dark stripes. The male is dark olive grey, with the wings shining iridescent red-purple.

Food-plants.—It lives in great numbers on various cultivated plants, forming immense colonies easily visible from several yards away. I have seen it on *Prosopis juliflora*, *Acalypha*, sweet sop, *Tribulus cistoides*, cotton, violet, *Colocasia esculenta*, coco-nut palm, &c.

Distribution.—At present only known from Jamaica; anyone wishing to obtain specimens can hardly fail to find some if he will examine the trees and shrubs along East Street, Kingston.

Enemies.—The little fly which I described as *Diplosis coccidarum* was observed in Dr. Grabham's garden apparently depositing its eggs in a colony of *Dactylopius virgatus* on a *Colocasia*. I have no doubt that it breeds among the mealy bugs and destroys them.

Destructiveness.—This is one of the very worst Coccidæ we have, as it infests so many different plants, doing much injury to them. In Kingston, it cannot possibly be con- trolled unless by some united action; for although it would not be difficult to destroy it in one place by insecticides, efforts of this kind would be futile while it was swarming in the land adjoining. A tree hanging over the road in East St. was at one time almost covered by them, and had reached such a stage that it seemed only fit to be cut down and burned.

On *Colocasia* this mealy bug is very annoying, but it seems usually to infest only one or two leaves on a plant, at least at first. These leaves can easily be cut off and destroyed. On sour sop and allied plants it could only be reached by spraying. On coconut palm it does no great ham, so far as I know; I found it on this tree only at the Marine Gardens in Kingston, where the specimens were immature.

(4) *Dactylopius longifilis*, Comst. (The Long-tailed Mealy-bug.)

Diagnosis.—Similar to the last, but the "tails" are much more slender, and there are many short white filaments along the sides. There is also no banding on the back. It is a pretty species, very easily recognised.

Food-plants.—I have found it on various plants, including *Ficus*, *Adiantum*, Jamaica plum, guava, mango, star-apple, and palm. It is rather singular that although this and the last each infest many plants, they seem as a rule to infest different kinds.

Distribution.—In the West Indies only known from Jamaica. It was first found on hothouse plants in the United States.

Destructiveness.—It is a troublesome garden pest on ferns and small plants in pots; it also attacks the fruit of the mango in such a way as to make it presumably unsaleable.

(5) *Dactylopius brevipes* Ckll. (The Pine-apple Mealy-bug.)

Diagnosis.—A small pink species with filaments along the sides, like the last, but without any distinct "tails."

Food-plants.—Found inside the natural cavities in the fruit of the pine-apple.

Distribution.—Only known from Jamaica.

Destructiveness.—It does no appreciable damage, but may be looked for as a curiosity on the dinner table.

(6) *Dactylopius citri*, Bdv. (The Citrus Mealy-bug.)

Diagnosis.—Much like the last, but pale brownish or brownish-yellow. It is a small species with the lateral filaments but without tails.

Food-plants.—In Jamaica it has been found on coffee and *Croton*. In Europe, Signoret relates that he found it in great numbers on citron trees at Mentone. In Florida, it has been found on orange and coffee; and it has been found on orange trees from the Sandwich Islands.

Distribution.—In the West Indies, only known from Jamaica. Widely distributed elsewhere, being doubtless spread by human means.

Destructiveness.—Not noticed as particularly injurious in Jamaica; but in Florida it is a well-known orange pest. It is liable to be troublesome on the orange and coffee in our island.

Enemies.—In the United States it is known to have several parasites, which might be introduced nto Jamaica if the insect became seriously destructive.

Synonym.—Comstock has given a good description of this species under the name *Dactylopius destructor*.

(7) *Dactylopius simplex*, Ckll. (The Pancratium Mealy-bug.)

Diagnosis.—A very small brown species, with neither lateral filaments nor tails. It lives in scattered patches of white secretion.

Food-plants.—Found on the upper side of the leaves of *Pancratium*.

Distribution.—Only known from specimens discovered by Dr. Strachan in his garden in Kingston, Jamaica.

Destructiveness.—It is likely to prove moderately harmful to liliaceous plants in gardens.

(8) *Dactylopius calceolariæ*, Mask. (The Sugar-cane Mealy-bug.)

Diagnosis.—This has characters similar to the last, but is larger and pink in colour. It lives in cottony masses.

Food-plants.—The name associates it with *Calceolaria*, but in the Fiji Island and in Jamaica it infests the sugar-cane, living within the sheathing bases of the leaves.

Distribution.—First found in New Zealand, afterwards in Fiji, and more recently in Jamaica. It has probably been introduced into Jamaica with sugar-canes.

Destructiveness.—A comparatively unimportant pest of the sugar-cane.

(9) *Dactylopius segregatus*, Ckll. (The Grass Mealy-bug.)

Diagnosis.—Resembles *D. virgatus*, but is smaller. For a detailed statement of its peculiarities, see *Journ. Inst. of Jamaica*, 1893, p. 254.

Food-plants.—Found on grass.

Distribution.—Only known from Kingston, Jamaica.

Destructiveness.—Of no particular economic importance.

(10) *Dactylopius filamentosus*, Ckll. (The Caicos Island Mealy-bug.)

Diagnosis.—Found in clusters, many together, on the stems of the food-plant. The clusters are about three-eighths of an inch in diameter, and consist of about 10 individuals each. The insects themselves are dark grey, with two very short white terminal filaments.

Food-plant.—Not identified, but seems closely allied to Vaccinium.

Distribution.—Only known from the specimens found by Dr. Strachan at Cockburn's Harbour, South Caicos Island.

Destructiveness.—Apparently of no economic importance.

This completes the list of known West Indian Mealy-bugs. The following table will assist in their separation from one another.

(*A.*) Antennæ of adult females, 7-jointed.....*D. filamentosus.*
(*B*) Antennæ of adult female, 8-jointed.
(*a.*) With white caudal and lateral appendages.....*D. longifilis.*
(*b.*) With white caudal appendages, but no lateral.
(1.) Length of adult over 3 millim.....*D. virgatus.*
(2.) Length of adult less than 3 millim.....*D. segregatus.*
(c.) With white lateral appendages, but no caudal.
(1.) Colour brownish.....*D. citri.*
)2.) Colour pink.....*D. brevipes.*
(*d.*) With no appendages, but enveloped in white secretion.
(1.) Colour brownish.....*D. simplex.*
(2.) Colour pink.....*D. calceolariæ.*

(*To be continued.*)

EXPERIMENTS IN THE CULTIVATION OF VEGETABLES.—XI.

POTATOES—CASTLETON GARDENS.

Names of Potatoes grown at Castleton Gardens.	Date of Planting.	First appearance above ground.	Days from Planting	Date when tops were dead. Potatoes ready for digging.	Days from Planting	Number of sets planted.	Number of sets lifted.	Number of Saleable Potatoes per set.	Weight of Saleable Potatoes per set.	Gross weight of Potatoes per set.	Total weight of Potatoes lifted.	Max. temp. during time Potatoes were in ground.	Min. temp.	Rainfall.	Number of days rain fell.
									ozs.	ozs.	lbs ozs.	°	°	lbs.	
Sutton's Magnum Bonum ...	23.3	3.4	11	26.6	95	22	20	3.0	6.0	10.0	12 8	76.2	65.1	13.58	55
Sutton's Red-Skin Flourball ..	23.3	3.4	11	20.6	89	24	20	1.8	4.8	8 0	10 0	75.2	64.4	11.96	50
Sutton's Reading Hero ...	23 3	2.4	10	26.6	95	27	20	1.5	2.2	4 0	5 0	76.2	65.1	13.58	55
Sutton's Triumph ...	23.3	31.3	9	26.6	89	20	21	2.3	3.4	6.4	8 8	75.2	64.4	11 96	50
Sutton's Nonsuch ...	23.3	3.4	11	16.6	85	25	20	1.2	1.6	3.0	3 12	74.7	64.7	11.96	50
Sutton's Perfection ...	23.3	3.4	11	20.6	89	24	8	1.8	2.0	4.0	2 0	75.2	64.4	11.96	50
Sutton's Windsor Castle ...	23.3	2.4	10	26.6	95	24	17	1.9	3.2	5.4	5 12	76.2	65.1	13.58	55
Sutton's Seedling ...	23.3	31.3	9	26.6	95	24	23	2.0	4.3	2.0	3 0	76.2	65.1	13.58	55
Sutton's Fiftyfold ...	23.3	31.3	9	16.6	85	21	13	1.0	1.2	1.3	3 8	74.7	64.7	11.96	50
Sutton's Matchless ...	24.3	31.3	8	12.6	81	20	14	1.2	1 1	2.2	2 0	75.1	65.8	10.49	47
Sutton's Lady Truscott ...	24.3	3.4	10	12.6	81	28	17	1.4	2 5	4.7	5 0	75.1	65.8	10.49	47
Sutton's Ashleaf ...	24.3	3.4	10	16.6	85	24	15	1.2	1.3	3.4	3 4	74.7	64.7	11.96	50

E. J. F. C.

SHIPMENT OF COFFEE IN PARCHMENT.

The advantages to be derived from exporting coffee in parchment when there is any difficulty about milling, have been frequently been noticed in the Bulletin ; see Nos. 8, 12, 14, 31, 44.

The following article is taken from the *Kew Bulletin.*

COFFEE HUSKING IN LONDON.

The processes necessary for cleaning and curing coffee in tropical and sub-tropical countries entail a considerable outlay in buildings and machinery, and in many instances the produce is either shipped in an unsatisfactory condition or the industry is abandoned as beyond the means of small capitalists. The great difference that existed between "plantation" and "native coffee" in Ceylon years ago, and which now exists between "Blue Mountain" and "settlers'" coffee in Jamaica are believed to be closely connected with a proper system of curing the produce. Those with adequate means turn out good coffee, while the small cultivator with rude appliances can only turn out an indifferent quality. The prices obtained in the latter case are so low that large sums of money are annually lost owing to indifferent curing. This subject has for some years occupied attention in Jamaica, and it has been suggested that one means of improving the quality of the coffee raised by small growers would be to ship the produce to London after the pulp is removed and ensure that the subsequent processes are carried out on a large scale by efficient machinery in this country. The plan here suggested has already been successfully put into practice, and the results up to that time were given in the *Kew Bulletin* 1888, pp. 129-132. In a letter from Messrs. Lewis and Peat, dated 17th April 1888 (*ibid.* p. 132), they speak very hopefully of this plan of curing coffee :—"We beg to inform you that the system of importing "coffee in the parchment is largely on the increase, and some most satisfactory results have been "obtained. We have recently sold large parcels from America which were 'milled' here, and against "70*s.* per cwt. obtained last year for the same coffee cleaned on the plantation we obtained 86*s.* per "cwt, although prices all round were lower. Experience shows that the husk or parchment protects "the bean from atmospheric influences which affect the colour, and in every instance where trials have "been made the result has been in favour of cleaning here. The process is quite simple, and the cost "is 2*s.* 6*d.* per cwt., including everything. The coffee must be pulped and the cherry got rid of on "the plantation, but the most important matter is the drying. It is absolutely necessary that the "parchment should be perfectly dried and kept from moisture afterwards; insufficient drying is most "damaging to after results, and must have the greatest care."

The latest information respecting "husking" coffee in London is contained in the following correspondence addressed to Kew. The subject is of considerable importance to proprietors of coffee estates in the West Indies, and it is desirable to place such facts as bear upon it within their reach in a readily accessible form.

MR. MARK B. F. MAJOR to ROYAL GARDENS, KEW.

Red Lion and Three Cranes Wharf
Upper Thames Street, London, E.C.,
December 12, 1892.

DEAR SIR,

When speaking to Mr. Haldane, of Messrs. Shand, Haldane, & Co., some little time ago, on the subject of coffee husking in London, he said he thought you would probably like to see a copy of the circular letter we drew up early in the year on the subject, and he kindly said I could mention his name. Knowing the great interest you take in all matters tending to promote the spread of accurate knowledge among growers, connected with the preparation of their produce, I have much pleasure in acting on his suggestion.

It was pointed out to my father, the late Mr. C. M. Major, about 1884, by a firm of coffee brokers in Mincing Lane, that as the business was already being carried on in Holland, it was a matter for important consideration whether it could not be established equally well over here, as otherwise there was a danger that coffee might be largely diverted from the London market when planters began to realise the convenience and benefit of the new method. As a result he approached Her Majesty's Customs, and was able to induce them to allow the husking of coffee to be carried on in bond, without undue restrictions, and he started the business in 1885, which has since become a considerable one.

The enclosed circular explains the most important points to be considered by planters, both as regards the preparation and advantages gained by shipping in the parchment. Should the subject prove sufficiently interesting to you, we should be pleased to show you over the husking warehouse, and explain the details of the process to you, and in that case you would no doubt arrange a day to call.

Believe me, &c.,

MARK. B. F. MAJOR.

D. MORRIS, Esq., F.L.S.,
Assistant Director, Royal Gardens, Kew.

[Enclosure.]

COFFEE HUSKING IN LONDON.

Red Lion and Three Cranes Wharf,
Upper Thames Street, London, E.C.,
March 1892.

Having been the first to erect machinery for husking coffee in London, and being frequently asked for a few particulars as to the treatment of the parchment, we venture to submit the following remarks to those of your friends who are interested in the question. At the outset we would mention that the operation is chiefly applicable to coffee treated by what is called in some countries the "West India

Preparation," *i.e.*, to "washed" coffees, which are known by the trade here as "coloury." As these descriptions are most sought after by buyers, and command far higher prices than the qualities known as "unwashed," it is obvious that planters in their own interests should endeavour to market their crops in the former condition, the difference in price in a normal market being fully 20*s.* to 25*s.* per cwt. in its favour.

To obtain the best results, it is necessary that each operation, commencing with the gathering of the crop, should be performed with great care and discrimination. Only cherries of uniform ripeness should be plucked, as otherwise the pulping and most of the subsequent operations will be made difficult to perform, and the cleaned coffee will lack that uniformity of appearance and colour which is so highly prized by the buyers. The cherry coffee should be passed through the pulper (the machine for removing the pulp from the berries) as soon as possible after it is gathered, as the pulp is more easily removed before it has had sufficient time to dry and shrivel; care must be taken to see that the cherry pulp is thoroughly peeled from the berries, and as several of the latter will escape the action of the pulpers, sieves of a size which allow only the free parchment coffee to pass through must be used, so that the cherries remaining in the sieves may be returned to the pulping machine. After pulping, the parchment coffee has to undergo a process of fermentation, and subsequently of washing in suitable tanks, when the adhering saccharine matter is got rid of; during this latter operation, it is of great important that the parchment should be constantly stirred about, as by this means the light, black, and imperfect beans rise to the surface of the water, as well as sticks, leaves, and such like impurities, which should be skimmed off and treated separately. At no subsequent stage can this important object be attained in anything like so cheap and effective a manner, as the inferior beans can only be afterwards separated by hand-picking, a tedious and costly operation.

After washing, the parchment coffee has to be thoroughly dried, an operation requiring perhaps more knowledge of the article than any other, as on the way it is carried out depends to a very great extent the subsequent market value of the crop. If not sufficiently dried, the parchment becomes more or less musty in transit and the colour deteriorates thus seriously affecting its selling value, and from the fact that the outer layer of coffee in the bags dries on the voyage to a greater extent than the bulk in the centre, it is impossible for us when we dry it here before husking to obtain an even result. In addition to this, freight and charges have to be paid on extra weight, which is an obsolute loss : we may mention that many parcels we have received in a damp state have lost over 20 per cent. after drying, exclusive of the loss in weight naturally caused by the removal of the parchment. It will thus be understood that it is imperative the parchment should be properly dried, especially as extra charges are incurred for drying here. On the other hand, care must be taken not to over-dry the coffee, as otherwise the colour will be impaired to some extent, which will reduce the market value , it is therefore apparent that the greatest care and experience is required to ascertain when the parchment is in really prime condition. After drying, coffee intended for husking in London has only to be shipped without further loss of time.

The advantages to be derived by planters in forwarding their coffee in parchment are several. The parchment covering acts as a great protection to the bean, while in transit, from all the deleterious influences to which it is necessarily subjected while in the close hold of steamers, on quays, &c., and above all it preserves the colour. This is probably one of the greatest advantages of any, as the finer the colour of the coffee, the higher is the price paid by the buyers, and it has been abundantly proved that coffee husked here fetches prices higher by several shillings a hundred weight than the same coffee when cleaned abroad. Planters are also enabled to market their crop, probably several weeks earlier, than if they have to wait to husk it themselves. A material saving of labour is effected in districts where it is scarce, or where the crop is a heavy one, at a time when it is extremely important all hands should be concentrated on harvesting, and when this is complete, on the more careful cultivation of the plantation, thus increasing its powers of production, and at the same time getting the husking of the coffee done as cheaply as it could be effected on the estate. The outlay on machinery and other incidental expenses would be saved, and capital that would be locked up is set free; further, the dangers of a breakdown are avoided, a very serious matter on estates, where every important piece of machinery has to be obtained some thousands of miles away. Receiving as we do many thousand bags of parchment coffee each year, we have necessarily obtained considerable experience in the manipulation, and are enabled to work each parcel in the way best calculated to meet the requirements of the trade in all its different variations.

The total cost of receiving from import ship, landing, husking, sizing, and all the usual operations is 2s. 6d. per cwt., which we believe is at least as cheap as it can ordinarily be performed by planters, if not cheaper. The charge for drying is extra, and depends entirely on the condition of the parcel, but from what we have already stated, it is a charge which, in their own interests, planters should never incur here. The loss in weight from husking varies largely according to the nature of the parchment, and ranges from about 15 per cent. up to, in a few exceptional cases, about 22 per cent. The average loss is from about 18 per cent. to 20 per cent. The whole of the various operations are carried out in our bonded warehouses, under the immediate supervision of the officers of the Crown, which affords an important guarantee to importers that the correct weight is returned to them; no customs duty is charged by the Crown authorities on the husk.

We have occasionally received parcels of coffee, dried in the cherry, to husk, but we cannot recommend this mode of shipment, though it is possible that in a few individual cases planters might find it desirable to adopt it. In the first place, it adds unduly to the charge for freight, the coffee never turns out of such fine colour as it does if prepared as already detailed, and, of course, the loss in weight after removal of the cherry and parchment covering is much heavier, besides it is much more difficult to work, and necessitates a charge of at least 3*s.* 9*d.* per cwt. The foregoing remarks apply solely to coffee of the Arabian sort. As regards Liberian coffee, we have no hesitation in advising, that unless absolutely

compelled, shipments should never be made in cherry, as this species, even under favourable circumstances, is most difficult to work.

That the business has developed so largely since we commenced operations in 1884, appears to us conclusive proof that many planters are fully alive to the benefits to be derived by the adoption of this method for marketing their crops, and we therefore trust these remarks may be of special interest to those who are at present unaware of the facilities to be now obtained in London, and who have not suitable machinery on their estates for cleaning the coffee themselves.

MAJOR & FIELD.

CHUTNEY.

Large quantities of Chutney are imported into America from India, although it could readily be supplied from Jamaica, affording employment to a number of people, and utilising much material which now goes to waste.

The following recipe has been kindly forwarded by a correspondent :—

3lbs. Common Mangoes (turned but not ripe.)
3 " Tamarinds.
2 " Raisins (weighed after stoning).
8 " Brown Sugar.
½ " Chillies.
2 " Green Ginger.
½ " Garlic *or* 1½lb. Onions.
¼oz. Mace.
1 " Mustard Seed.
¼ " Cloves.
¼ " Pimento.
½lb. Table Salt.

Soak the Tamarinds in two quarts of the best Vinegar, stir them about with a wooden spoon to get the pulp off, take out the seeds and the leathery part in which they are enclosed. Cut the raisins small. Peel the Ginger and grate it. Pound the Chillies, Garlic, and Mustard Seed in a mortar, using a little of the Vinegar to moisten. Mix all together thoroughly, it is then ready for use.

LIST OF THE FLOWERING PLANTS OF JAMAICA.

A List of the Flowering Plants, which are either natives of Jamaica or have become naturalised, is now ready, and a copy will be supplied free to residents in Jamaica who may apply for one to the Director of Public Gardens and Plantations, Gordon Town P.O. Other copies will be supplied post free at the rate of 6d. each.

The List contains the scientific names only, arranged systematically in Natural Orders. The following is taken from the Preface :—

"To those engaged in the study of the Jamaica Flora, it is useful to have a simple list of the plants arranged in systematic order.

"The basis of this list is Grisebach's 'Flora of the British West Indian Islands' published in 1864. Since that time the monumental work of Bentham and Hooker, the 'Genera plantarum,' (A.D. 1862-1883) has been completed, which renders necessary a revision of the names used by Grisebach. Reference has been made to many other works, amongst which may be mentioned the later volumes of DeCandolle's 'Prodromus' and 'Monographiæ Phanerogamarum.' But with a very small botanical library at hand it has not been possible to consult all the works necessary. The list might have been increased by additional names, if opportunity had been afforded for consulting the Herbaria of the British Museum and the Royal Gardens, Kew.

"To facilitate reference to Grisebach's Flora, still the standard work, the page on which the plant is described is placed after the name, and where the name has been altered, Grisebach's name is indicated in brackets.

"The plants that are not considered indigenous, but have in one way or another been introduced, and have become naturalised, are marked by an asterisk before the name."

FERNS: SYNOPTICAL LIST.—XXI.

Synoptical List, with descriptions. of the Ferns and Fern-Allies of Jamaica, by G. S. Jenman, Superintendent, Botanical Gardens, Demerara, (continued from Bulletin No 45.)

2. *Asplenium pumilum*, Swartz.—Rootstock small, fibrous, erect; stipites tufted, slender, 2–4in. l. glabrescent or ciliate, dark at the base; fronds usually tripartite, subdeltoid, 1–3in. l., nearly as w., the central division often distant from the two lateral and unusually larger, each subentire or broadly lobed, or the central pinnatifid, tripartite, or fully pinnate, blunt or acute-pointed, the lobes rounded, entire or incised and dentate, softly herbaceous, glabrescent or pubescent, light green ; a central vein in each division or lobe, with very oblique branches once or twice forked ; sori copious, linear, straight, 1–6li. l. not reaching the margin ; involucres narrow. silvery, ciliate, or not, even-edged.—Pl. Fil. t. 66, A.

Frequent on half-exposed banks and rocks from 2,000–4,000 ft. alt, gathered plentifully on the Yallahs river at the latter elevation. In the smallest state the fronds are simply trilobed and not over ½ in. diameter, the divisions blunt and entire ; in the larger they are tripartite and in the largest uniformly pinnatiform, the lobes acute or acuminate, inciso-lobate and serrulate-margined. This is a singularly distinct type, with no near local ally

3. *A. Trichomanes*, Linn.—Rootstock small, fasciculate, densely clothed with fine black scales; stipites 1 - 4 in. l. tufted, slender, wiry, scariose-margined, blackish, finally naked, rachises similar; fronds stiff, 4 - 8 or 10 in. l. 6 - 8 li. w. pinnate, rather narrowed toward the base, dark green, glabrous or glabrescent; pinnæ contiguous above, more or less apart and often distant below, the former ovate-oblong, the latter ovate-orbicular, elastical, 3 - 4 li. l. 2 li. w. sessile or subsessile, equilateral, the base cuneate and centrally attached, outer part broadly rounded, the margin serrulate; veins pinnate, the inferior branch on the superior side forked; sori oblique, barely ½ li. l., near the midvein; involucres small, scale-like.—Hook. Brit. Fer. t. 29. Eat. Fer. N. Am. Pl. 36.

Var. *A. castaneum*, Cham. and Schl.—Fronds 1 - 1½ ft. l., stipes 1 - 3 in l. rachises strong and stiff; pinnæ ¼ in. l. 2 li. w. oblong, lower sub-deltoid.

Abundant from 4,000 to over 6,000 ft. alt., on open banks and rocks, in coffee fields, caves and waysides; best distinguished from the two following by the more ovate distinctly serrulate nearly centrally attached and consequently equilateral and cuneate based pinnæ. It is interesting as being the quite typical common British spleenwort; generally distributed through the temperate and elevated tropical region of the globe. The variety is a much larger stronger plant, of which there is a sheet in the Kew Herbarium marked from Jamaica, the locality not recorded.

4. *A. parvulum*, Mart. and Gal.—Rootstocks small, fasciculate, densely clothed with fine hair-like scales; stipites tufted, 1 - 3 in. l. wiry, dark chestnut or ebenous, scariose-edged, glossy, naked eventually; fronds pinnate, stiffish, firm, a variable shade of green, naked or glabrescent, 3 - 8 in. l. ½ - ¾ in. w. tapering both ways; pinnæ spreading or deflexed, sessile, even-edged or subserrulate, contiguous or somewhat apart, oblong or ovate-oblong, subdimidiate and laterally attached, truncate, and slightly auricled on the superior base, the inferior base shortly cut away or not, 2 - 5 li. l. 1½ - 2 li. b. rounded at the outer end, the lower reduced ones subdistant and cordate-deltoid; rachis like stipes; veins pinnate, oblique, simple and forked; sori copious, ¼ - ½ li. l. forming a row on each side the midveins, nearer the margin; involucres small, scale-like, the edge even.—Eat. Fer. N. Am. Pl. 36. fig 5 - 6.

Frequent on open banks, stony moorsides and in coffee fields at 4,000–5.000 ft. alt. : gathered at Old England, below the Government Cinchona Plantation, and by Purdie, on the Manchester hills. The sori, confluent at maturity, are very short, and directed to the margin, to which they are nearer, with slight obliquity, The texture is not so elastical as in the preceding, with which, in Jamaica, till late years it was confounded, and the colour is yellowish green.

5. *A. ebeneum*, Ait.—Rootstock small, clothed with minute dark scales, and the roots with a lighter tomentum; stipites wiry, 1–3in. long, polished, dark chesnut or ebeneous, scariose-edged, finally glabrous; rachises similar; fronds 6–8in. l. ½ to ¾in. w. pinnate, gradually reduced below, tapering to a shortly elongate, serrate or lobate obtuse segment at the apex, dark green, stiffish, glabrous; pinnæ spreading apart, elastical, opaque when dry, oblong, subdimidiate, rounded and somewhat dentate at the end, the base truncate, laterally attached, auricled on the upper side, 1–1½li. l. 4–5 li. br, the inferior reduced distant ones auricled on both sides but not cordate; veins pinnate, inner superior forked; sori on both sides of the midveins, to which they are nearer, obliquely directed to the margin, ½li. l.; involucres pale.—Eat. Fer. N. Am. Pl. 4.

Frequent on rocks, rocky banks and moorsides and in caves at 4,000–6,000ft· alt.; resembling most *parvulum*, but with more open elastical, dark green pinnæ, rather longer sori, directed at a shorter angle and nearer the midveins than margin. This, *parvulum* and *Trichomanes* grow in the same situations, intermixed; *monanthemum* preferring a different soil (shale debris) and a measure of shade.

6. *A. monanthemum*, Linn.—Rootstock short, fibrous, erect or oblique, the apex clothed with dark minute fine scales; stipites naked, 3–6in. l., densely tufted, wiry, dark chesnut brown or blackish more or less flexuose, scariose-margined; rachis similar; fronds pinnate, ½–1ft. l. ¾–1in. w., somewhat reduced below, the apex tapering to a serrate point, stiffish, chartaceous, glabrous, slate-green; pinnæ numerous, horizontal close, ½in. l. 1½–2li. w., oblong or linear-oblong, the end rounded, subdimidiate and laterally attached, the upper base truncate and slightly expanded and auricled, the under margin straight and even, upper and outer crenate-serrate, lower reduced ones distant and cuneate-flabellate; veins pinnate, the inner branch forked; sori 1–2 or 3 to a pinna, usually confined to the inferior side of the midvein in the outer part beyond where the margin is cut away, running parallel with the edge, 1–1½ li. l,. involucres pale-tinged.—Plum. Fil. t. 65.

Common on loose shaly ground, in forest and on half shaded banks at 5,000-6,000ft. alt., abundant in the region of the Govt. Cinchona Plantation. A larger plant than any of the three preceding, to which it is closely allied, with more numerous, closer pinnæ, and specially distinguished by the few sori, generally only one or two, being confined to the inferior side of the leaflets. The naked stipites are occasionally viviparous, producing fronds as large as the original. These buds are peculiar as springing from the smooth indurated surface, with no nidus for their origin.

7. *A. formosum*, Willd.—Rootstock short, fibrous, erect, finely scaly; stipites cæspitose, numerous, 1-2 in. l. slender, scariose-margined, dark brown, at first slightly scaly at the base; rachis conform; fronds pinnate, ½-1 ft. l. ¾-1¼ in. w. narrowed toward the base, light green, thin and elastical, naked, plumose; pinnæ ½ in. l. 2 li. w., close, horizontal, linear-oblong; blunt or rounded, the upper base truncate and rather expanded, the under cut away to ⅓ or ½ the inferior margin, upper and outer margins inciso-serrate, reduced lower segments more distant, inciso-flabelliform; veins pinnate, the interior branches forked; sori ½ li. l. usually 2-6, confined to the outer ½ or ⅔ of the pinnæ, when few uniformly on the inferior side of the midvein; involucres silvery, broadish.—Plum. Fil. t. 66, B. Hook. Fil. Ex. t. 16.

Common among the lower hills on wet rocks along the sides of rivers within wash of the water; with similar slender wire-like rachises to the four preceding, but thinner, light green, deeply inciso-serrate pinnæ. The plumose habit makes it a very pretty little plant in growth.

No. 47. SEPTEMBER, 1893.

BULLETIN

OF THE

BOTANICAL DEPARTMENT,

JAMAICA.

CONTENTS:

PRICE—Twopence.

A Copy will be supplied free to any Resident in Jamaica, who will send Name and Address to the Director of Public Gardens and Plantations, Gordon Town P.O.]

JAMAICA:
GOVERNMENT PRINTING OFFICE, 79 DUKE STREET, KINGSTON.

1893.

DRAGON'S BLOOD TREE OF THE WEST INDIES :—II.

In the *Bulletin* for July there is a note on the Dragon's Blood of the West Indies, which was written at the suggestion of the authorities at Kew with a view to direct attention to this native drug. Specimens will be thankfully received by the Director of Public Gardens and Plantations, Gordon Town P O.

The following articles on the same subject appeared in the *Pharmaceutical Journal*, the first on the 15th July taken from the *Gardeners' Chronicle*, the second on the 5th August written by Prof. Flückiger, one of the authors of the *Pharmacographia*.

The Gardener's Chronicle on Dragon's Blood.

In the year 1569, Monardes published his *Historia Medicinal, etc.*, and of this the famous Belgian botanist Clusius published a Latin version, with notes, in 1574. The original editions are not before us as we write, but it is desirable to note the dates at which they were published. In the French edition of Monardes, the *Histoire des Simples Medicamens apportés de l'Amerique* (1619), lib. v. cap. xxiv, we find it stated, as it probably is in the first edition to which we have referred, that the Bishop of Carthage had recently brought home the fruit of the tree, whence exudes the tear (larme) which is commonly called Dragon's Blood.

Now, this fruit, our author goes on to say is every way admirable, for as soon as the rind is removed, quite suddenly a little Dragon appears, elaborated with such natural artifice that it appears as if sculptured in marble by some skilled workman. It has a rather long neck, the throat open, the backbone beset with spines, the tail long, and the feet well armed with nails. "Carthage," in Peru, is said to be the source whence the dragon's blood is derived, and its properties are described as highly astringent, and the drug is used in those cases where a medicament of that nature is required. Clusius, in a note, proceeds to describe what we now know as *Dracæna Dra o*, of which a plant was raised from seed at Brussels. He describes the fruit, but he is careful to add that there was no dragon in it.

Gerard, in his *Herbal* (1597.) p. 1339, under the head of *Draco arbor*, the Dragon Tree, unblushing copyist that he is, gives the same figures, and a good description of the *Dracæna Draco*. The external appearance of the fruit is well described and then it is further stated that there "is to be seene as Monardus and divers, others report the forme of a dragon having a long necke or gaping throat; the ridge or backe armed with sharpe prickles like the porpentine; it hath also a long taile, and fower feet, very easie to be discerned; the figure of it we have set foorth unto you according to the greatnes thereof, because our words and meaning may be the better understood." Gerard then, as Clusius had done before him, assigned the fruit with the dragon in it to what we now know as *Dracæna Draco*, although, as we have seen, Clusius is careful to say that he could not find any dragon in it. The Dracæna also offers a difficulty inasmuch as it is a native of Teneriffe and Madeira. But Gerard is equal to the emergency, for he goes on to say of his Dragon Tree that "This tree groweth in an Iland which the Portingales call Madera, and in one of the Canarie Islands called Insula Porcus Sancti, and as it seemeth it was first brought out of Affrike, although some are of a contrarie opinion and say, that it was first brought from Carthagena in Nova Orbe by the bishop of the same province."

In any case the sixteenth century botanists attributed the "dragon's blood" to the vegetable kingdom, but their far-off predecessors were less metaphorical in their notions. Pliny, for instance, in his *Natural History*, book xxxiii., cap. 40, says dragon's blood (which was used as a "vehicle" or as a pigment by artists) is a thick matter issuing from the dragon when crushed beneath the weight of the dying elephant. Elsewhere Pliny (book xxxv., cap. 32) speaks of India sending to Rome the slime of her rivers, and "the corrupt blood of her dragons," and this fact serves him as an illustration of a tendency which is apparent now as then. "Everything, in fact, was superior at a time when the resources of art was so much fewer than they now are. Yes, so it is, and the reason is . . . that it is the material, and not the efforts of genius, that is now the object of research." (Bohn's edition vol. vi., p. 246.)

The question to be solved is, what was the fruit mentioned by Monardes, and which contained so striking a verisimilitude to a dragon? A conventional dragon it must have been like the effigy at Temple Bar, perhaps, for no one quite knows what a dragon was! What is known nowadays as dragon's blood is a resinous exudation used for varnish, and derived in some cases from a palm, *Calamus Draco*, in others from a Dracæna. Now the Palm has a scrambling stem thickly beset with spines and its fruits are covered with hard scales turned down, and dragon-like as dragons are supposed to go, but the Calamus comes from Sumatra and Borneo, and not from Carthagena. In spite of its name it is rather difficult to see any resemblance to a dragon in a Dracæna. Perhaps the bayonet-like leaves may have suggested the idea.

Dragon's Blood. By Professor Flückiger, in the Pharmaceutical Journal.

In an article in the *Pharmaceutical Journal* of July 15th, p. 47, Monardes is quoted as the first author who mentioned American dragon's blood. In his 'Primera y segunda y tercera partes de la Historia medicinal de las cosas que se traen de nuestras Indias Occidentales que sirven en Medicina,' Sevilla, 1574, page 78, the figure "El dragon" shows three pods of a tree from which the drug was collected in the time of Monardes, in the country of Carthagena. One of the pods is open, and exhibits the outlines of an animal of the fabulous kind of a dragon, just as described in the said paper in the words of Gerard's 'Herbal.'

The question to be solved is, says the author of the paper inserted in the *Pharmaceutical Journal* (from *Gardener's Chronicle*), what was the fruit mentioned by Monardes, which contained so striking a verisimilitude to a dragon?

The figures in Monardes are so extremely crude that they cannot afford any idea of the plant to which they belong. Still, they may be allowed to represent the pods of some species of the leguminous order.

Dragon's blood was certainly never an important article of commerce in Europe and that from Carthagena probably made its appearance in the market but very irregularly, and has completely disappeared long ago. It was, however, to be met with at that time; thus we find it plainly described by one of the most competent pharmacologists of the middle of our century. Theodore W. C. Martius (see Hanbury's 'Science Papers.' pp. 7 and 25), Professor of Materia Medica in the Bavarian University of Erlangen (1863), enumerates three varieties of dragon's blood in his 'Grundriss der pharmakognosie,' Erlangen, 1842, pp. 366 to 369, viz., that from Calamus, that from Draeæna (see, *Pharmacographie*, 2nd edition, pp. 672 to 676), and thirdly, that from Carthagena, the source of which according to Martius is *Pterocarpus Draco*, L. This tree having been named by Linnè. The knowledge of its product must have induced Linnè to bestow on it the specific name of Draco. *Pterocarpus Draco*, indeed, is pointed out as the mother plant of the drug under notice as early as A.D. 1749 in the first edition of 'Caroli Linnæ Materia Medica,' Liber 1, De Plantis, p. 184, No. 522. It is true that Java and India orientalis were erroneously stated by Linnè to be the native countries of the tree.

The description of the resin, as given by Martius, is so accurate that we may feel quite sure he had it before him. Whether he had actually the opportunity of ascertaining its botanical origin must remain unsettled. But Lindley already in his "Flora Medica," 1838, p. 257, mentioned *Pterocarpus Draco* as yielding the red juice from the wounded stems; he also quoted a statement of Jacquin's to the effect that large quantities of that dragon's blood had once been exported from Carthagena to Spain. When Jacquin paid a visit to Carthagena, between 1754 and 1759, he found the commerce in dragon's blood had almost ceased. In his "Enumeratio systematica plantarum quas in insulis Caribæis vicinaque Americæ continente novas detexit, etc." Lugduni Bat., 1760, t. 183, N.I.von Jacquin figured the tree under the name of *Pterocarpus officinalis* whereas in Hayne's Darstellung and Beschreibung der in der Arzneikunde gebraushlishen Gewächte, 't. IX., pl. 9, the name of *Pterocarpus Draco*, Hayne, was applied to the tree which is now known as *Pterocarpus suberosus*, DC., it is a native of Guiana.

Guibourt was also acquainted with the Dragon's blood from the West Indian Islands, which he (Histoire naturelle des Drogues simples, II., 1869, 139 and III., 346) attributed to Linnè's *Pterocapus Draco*, he says the resin was rarely to be met with.

It would appear therefore that we may unhesitatingly regard that tree as the source of the Dragon's blood discovered near Carthagena by the Spanish invaders. Its corky indehiscent pod of nearly orbicular outline tolerably answers to the figures of Monardes, and the solitary, kidney-shaped seed, if duly shrivelled, may remind in the eyes of a fantastic observer, of what he supposes to be a dragon.

In India, *Pterocarpus Marsupium*, Roxb., affords the exudation called kino, which is but little used now. It would be desirable to investigate the chemical composition of the Dragon's blood of the *Pterocarpus Draco*, and to examine whether it does or does not agree with the kino of the nearly allied species *P. Marsupium* of Malabar. On applying to Jamaica the material for such an investigation would probably be obtainable, It would be desirable to know whether two trees so closely allied, like the two species of *Pterocarpus* just mentioned, could yield products so widely different as are kino on the one side and true Dragon's blood on the other. In the careful monograph of the dragon's blood by Lojander, 'Beiträge zur Kenntris der Drachenblutes,' Strassburg 1887, the author only mentioned briefly the drug of *Pterocarpus Draco*, which he had not at his command.

We may anticipate that it rather belongs to the numerous class of kinos, the exudations of several species of eucalyptus as well as of *Pterocarpus Marsupium* and other trees. Whether they are chemically identical or not remains to be studied.

REMEDIES AGAINST INSECTS IN GRAIN, PEAS, &c,

An application has been received for information as to a remedy for weevils infesting red pea, (*Phaseolus nanus*). The weevil was submitted to Mr. Tyler Townsend, Curator at the Jamaica Institutes and was determined as *Bruchus tetricus*, Gyll.

In the *Kew Bulletin* for July, 1890, there are two methods described as being successfully employed in India in granaries for preventing the ravages of a weevil.

One of these methods is by the employment of carbon disulphide, the other of naphthaline powder.

As the former of these substances, however, is poisonous, and inflammable, its vapour igniting at 301° F. when mixed with air,—it is scarcely so convenient for use as naphthaline powder. This latter substance is cheap, and a very small quantity placed at the bottom of the bin or receptacle in which peas or corn is stored will keep out insects; it can be obtained from druggists.

The following is the plan recommended for applying the powder, if weevils are found in the stored grain.

"It is best to place the naphthaline powder at the bottom of the bin or bulk of grain. To accomplish this, take a bamboo, about 1½ inches in diameter, and long enough to reach from the top to the bottom of the bulk of grain. Punch the joints out of the bamboo, so as to be able to pass a stick through from one end of the bamboo to the other. Have the stick made to fit the cavity in the bamboo. Pass the bamboo with the stick in it, down through the bulk of grain from the top to the bottom. Withdraw the stick, and drop into the top of the bamboo about half a teaspoon of naphthaline powder. The bamboo can then be drawn out, as the naphthaline is safe at the bottom of the bulk of grain. If the bulks are large this should be done once to every 10 feet square of the bulk. Repeat the application every 15 or 20 days as the powder evaporates.

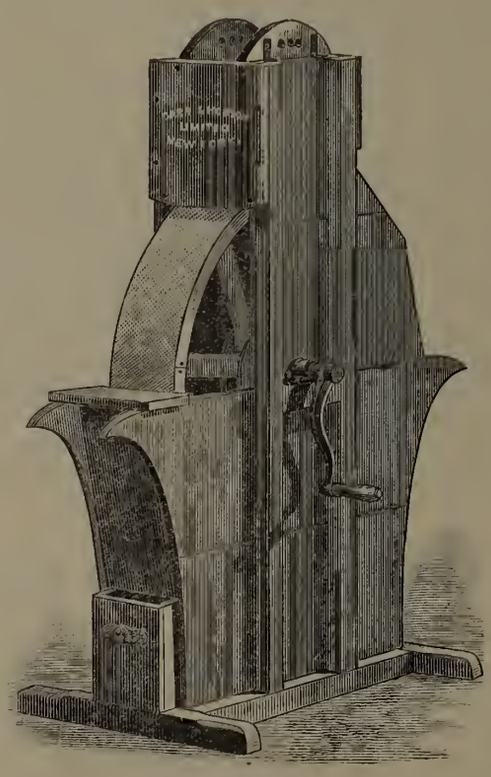
"The weevils that can leave the grain will do so, and those that cannot leave are killed by the odour of the naphthaline. I do not believe that naphthaline thus used can cause any injury whatever to grain. For seed purposes the germinating powers appear not to be affected in the least. For marketable grain the colour is not affected, and the odour will leave in a short time if fresh naphthaline is not applied to it. The quantity of powder used is infinitely small in proportion to the quantity of grain, and the powder is entirely destroyed by evaporation, so that for food purposes the effect is *nil*."

QUININE IN AMERICA.

Judging from a recent report of the Quinine market, it seems that the consumption of this all-important medicine, though still realizing low prices is on the increase. Brunswick-manufactured Quinine was fetching last month only a trifle over 8d. per oz. It was stated by a New York house that the imports of Quinine (as sulphate and in the bark) into the United States in 1892 amounted at least to 4,500,000 ozs. or half the estimated output of all the factories in the world. As it is said to be a well-known fact that stocks in the States are higher than usual, it is argued that the consumption of Quinine in America must be on the increase; also that generally all over the world the consumption is ahead of the production, and that the deficiency is supplied by the surplus stocks of former years. If this is true it is good news for Cinchona planters.—*Gardeners' Chronicle.*

CASSAVA GRATER.

Enquiries have been made about machines for grating Cassava, and Messrs. Gillespie Bros. & Co. of New York, have kindly forwarded an electro of a machine called a "Yucca Grater," which they recommend for the purpose.



The box at the top over the wheel comes out and the Cassava is placed underneath this. A stone is put into the box to weigh it down, if necessary. A man turns the handle and the machine grates, the meal falling into a box at the bottom. The wheel is covered with perforated tin, as it will not corrode and has been found the best for the purpose.

The prices of the machines, f. o. b. New York, are as follows;—subject to 25 per cent. discount:—

No. 2	2	feet diameter	6	inch	face for hand	or power.....	$22.00
No. 2½	2½	"	6	"	"	"	25.50
No. 3	3	"	6	"	"	"	30.00
No. 3½	3½	"	6	"	"	"	35.00
No. 4	4	"	6	"	"	"	42.00
No. 5	5	"	12	"	"	"	58.00

There is no market in New York for the products of Cassava, as the heavy duty makes them too dear in comparison to Corn, Oatmeal, and such things.

NUTMEGS.

Last year Mr. Sutton Scoltock (Manchioneal) reported finding a Nutmeg on one of his male trees. In July of this year, he kindly forwarded some flowers from this tree, and another Nutmeg which, he says, is the third or fourth borne by this tree. The flowers are male, and it is certainly a noteworthy circumstance to find that the tree bears also female flowers.

The Nutmeg is very much smaller than the usual size. The seed was examined and found to contain a perfect embryo.

Mr. Scoltock writes :—"Nutmegs seem to be unusually prolific in this district. I have just sold the yield of three trees for three months at 2s. 6d. per lb. for both mace and nutmegs, and realised £3 4s. 10d."

DIRECTIONS FOR GROWING POT-PLANTS.

FUCHSIAS, PELARGONIUMS, GLOXINIAS, AND TUBEROUS ROOTED BEGONIAS.

FUCHSIAS.—These may be raised from seeds if new varieties are desired, but the usual method is to propagate by cuttings which strike readily during the cooler months of the year, if made of free-growing shoots not disposed to flower. The cuttings should be placed an inch apart in light, sandy soil, either in pots or beds, shaded from strong sun, and the soil kept moist. When rooted they should be moved singly into 3 inch pots, and if kept well watered and attended to they will make rapid growth. When the 3 inch pots are moderately filled with roots the plants should be shifted into 8 to 10 inch pots, the leading shoots should be pinched off, and the plants watered freely and allowed plenty of light and air, but shaded from the burning mid-day sun, and if so treated they will flower freely Fuchsias will grow in any good garden soil, but thrive best in a mixture of loam, well rotted manure and a fair sprinkling of sand, and when the pots are filled with roots liquid manure may be used with advantage.

The plants are usually kept dry during the winter months, pruned closely back in the spring, shaken out of the old soil, repotted with fresh, and again started into growth.

PELARGONIUMS.—Cuttings made from shoots neither too hard nor too soft and sappy, are the best, and will root at any time of the year, but the cooler months of the year are the best for propagating all plants of this class. The cuttings should be inserted in beds, or small pots filled with loam and sand. The soil should be kept just moist, as if too much water is given the cuttings are very liable to damp off. When well rooted they should be moved into 3 inch pots, well drained, as they cannot stand stagnant moisture, and in potting the soil should be pressed firmly in the pots. The point of each plant should be nipped off, and three or four shoots will be formed, and when large enough to handle, these should be tied down to the rim of the pot, and when the shoots have made 3 or 4 joints they should also be pinched to induce them to make further shoots. At this stage the plants may be moved into 6 inch pots.

Pelargoniums should be kept rather dry than otherwise, and it is important that the soil should be rammed firm in the pots, or the plants will make coarse growths little disposed to flower.

Good fibrous loam with a fairly liberal supply of rotten manure or dry cow dung, and sufficient coarse sand to keep the whole open, will be found a good mixture for potting.

When about to flower a little liquid manure may be given occasionally. When the flowering season is over, the plants may be stood out of doors for a month or so, then cut back, and when they start into growth they should be repotted, shaking most of the old soil off the roots, the latter should be trimmed a little, and the plants placed in pots a size smaller than those they came out of; train the shoots when they get long enough to be tied down, and later move into pots a size larger.

GLOXINIAS.—The tubers of these are usually imported, but plants are easily raised from seeds, and may also be propogated by cuttings of the stems and leaves. The seed should be sown thinly in a mixture composed of equal proportions of finely sifted loam and leaf-mould, to which should be added some sand, in a well-drained pot or seed pan, which should be covered with a pane of glass till the seed germinates. The soil should be kept just moist. When the seedlings are large enough to handle they should be pricked off into other pots or pans of similar soil, about an inch apart and when they have grown sufficiently they should be placed singly in small pots, and as they increase in size they should be moved into larger pots till they finally occupy 6 or 8 inch pots. For potting use good sandy loam and leaf-mould in the proportion of three parts of the former to one of the latter.

After flowering keep the soil damp so long as there is any vitality in the leaves, gradually withholding water as they decay, and when they have died away the tubers may be stored in a dry place till the next spring, when they should be again started into growth.

BEGONIAS —TUBEROUS ROOTED.—Sow the seed in a pot or pan of well-drained, light sandy soil, which should be well watered just before. The seed should be scattered thinly over the surface and gently pressed down, but not covered with soil or it will not germinate.

A pane of glass should be placed on the pot or pan which will prevent excessive evaporation, and keep the atmosphere surrounding the seed in a state conducive to germination; this is an excellent plan to follow in sowing all minute and delicate seeds, but the glass should be removed as soon as the plants apppear, or they get drawn by it and become weak and straggly.

As soon as the little Begonias are large enough to be manipulated, they should be pricked off into boxes of light leaf-mould soil in which they may remain till large enough to be placed singly in 3 inch pots, and they may be moved finally into 6 inch pots, using a mixture of loam, leaf-mould and well rotted manure, with sand. Plenty of water should be given during the growing season, but as growth decays water must be withheld, and finally the tubers may be shaken out of the soil and stored in sand, or dry cocoa-nut fibre till next season.

INSECTS.—All pot plants are liable to the attacks of insect pests:—thrips, green-fly, mealy-bug, scale, &c., For the two former tobacco water (made by soaking tobacco in water) may be used by dipping the plants in the solution, or soft soap at the rate of ½ to 1 oz. to the gallon of water, and thoroughly mixed with it

may be used in the same way, or for sponging the leaves of plants. For mealy-bug, and scale insects kerosine is probably the best remedy, used in the proportion of a small wineglassful of kerosine oil to four gallons of water for syringing or spraying the plants affected, but the solution must be kept thoroughly mixed, by constant agitation, whilst being used These remedies are best used on a dull evening, and the plants should be well syringed with clear water the following morning. A most excellent remedy for destroying insects pests, called "nicotine soap" is supplied by English nurserymen, and dealers in garden requisites. It is sold in jars at 1s 6d. and 3s each, and printed directions for using the preparation accompany each jar.

For further information than that given in these notes the following may be consulted:—Nicholson's "Dictionary of Gardening," and the "Gardeners' Assistant."

W. Harris.

FERNS: SYNOPTICAL LIST.—XXII.

Synoptical List, with descriptions. of the Ferns and Fern-Allies of Jamaica, by G. S. Jenman, Superintendent, Botanical Gardens, Demerara, (continued from Bulletin No 46.)

8. *Asplenium dentatum*, Linn.— Rootstock very small, upright ; stipites tufted, 2-4 in, l. slender, green-gray, naked or with few minute scales at the base ; rachis conform ; fronds naked, gray-green, herbaceous, 2-4 in. l. ½-¾ in. w., pinnate, fertile erect and larger, barren prostrate ; pinnæ 6 12 to a side, opposite or alternate, apart or subdistant, the lower most remote and not or little reduced, ⅓-½ in. l. less usually in breadth, ovate-rhomboid the outer part rounded and dentate, the inner cuneate, or obliquely-cuneate, and plain-edged, the inferior ones slightly stipitate, terminal segment blunt, lobate and incise-dentate ; veins forked, pinnate—flabellate ; sori copious, very oblique, 2-3 li. l. not quite reaching the margins ; involucres pale, narrow.—Plum. t. 101, c. (exaggerated) ; Hook. & Grev. Icon. Fil. t. 72 ; Eat. Fer. N. Am. pl. 80.

Common throughout the island on walls and wet and dry rocks, first gathered by Sloane, well marked by its small size, few pinnæ and distinct barren and fertile fronds, the former being much smaller and very short stipites. There are two forms, the second longer, more tapering, with closer, smaller, less dentate or quite even and more numerous segments.

9. *A. jamaicense*, Jenm.—Rootstock upright, fibrous, slightly scaly and tomentose ; stipites grey—green above the base ; tufted, 3-6 in. l. ; rachis similar ; fronds pinnate, herbaceous, grey-green glabrous, fertile central, erect, 4-7 in. l. 1¼-2 in. w., barren external. spreading, much smaller, pinnæ apart, the terminal roundly lobed, 6-10 to a side, spreading, rhomboidal-oblong, broadly rounded, subdentate, shortly pedicillate, the upper base expanded and somewhat auricled, the under cut away ¼ ½ the inferior margin ; veins pinnate, forked, the inferior flabellate ; sori 1½-3 li. l. oblique, not reaching the margin ; involucres pale or silvery, flat, narrow.—Jour. Bot. Sept. 1886.

Infrequent or occasionally common from 500 - 6,000 ft. alt. throughout much of the Island, growing on rocks ; gathered by Hart at the top of the John Crow Peak (about 6,000 ft. alt.), by Sherring in St. Ann (2.000 ft. under and above) and myself in various lower situations in the eastern parishes. Intermediate between the last, of which it has the habit, and the European *A. marinum*, Linn,* sometimes there is a distinctly separated segment on the upper and occasionally under side of the inferior pinnæ, with pinnate veins and double series of sori, as in the undivided pinnæ. The rachis is rather flattened in the upper part and often somewhat flexuose. It has been gathered also in Guatemala.

10. *A abscissum*, Willd.—Rootstock small, fibrous, erect or oblique ; stipites tufted, 3 - 5 in. l. grey-green, naked ; rachis conform slightly margined and sub-flexuose above ; fronds pinnate, 3 - 6 in. l. 2 - 3½ in w., lanceolate or deltoid—lanceolate, thin naked, grey-green, the base truncate ; pinnæ few, spreading 1–2in. l. ½in. w., the lower, which are not reduced, acute or acuminate, the upper obtuse or rounded, passing gradually into the roundly-lobed, acuminate terminal division, which is 1–2in. l., obliquely-truncate and the under side shortly cut-away, serrate or bi-serrate on both margins, veins pinnate, branches forked, oblique ; sori on the superior branch. 1½–3li. l., falling about equally short of both margin and midrib ; involucres narrow, pale.—Plum. Fil. t. 74 *A firmum*. Kze. Hook. Sp. Fil. t. 174 ; Eat. Fer. N. Am. Pl. 80.

Common among the lower hills of the eastern parishes on rocks and boulders near rivers and in damp woods ; very near *cultrifolium*, of which it might be regarded as a variety, shorter, with fewer pinnæ and of thinner texture. It spreads by means of viviparous buds produced on the wide-extending, more or less exposed, roots, as in *A auritum*.

11. *Asplenium cultrifolium*, Linn.—Stipites tufted, erect from a small slightly scaly upright rootstock, 4–10 in. l, grey-green, naked channelled ; rachis similar ; fronds pinnate grey-green, chartaceous, naked, 6–10 in. l., 3 5 in w. broadest as a rule at the base, with an acuminate lobed terminal segment, 1–2½ in. l. ; pinnæ 6–12 to a side, spreading apart or subdistant ; acuminate, upper base usually truncate, under shortly cut away; or the lower ones cuneate, serrate or biserrate on both margins, the teeth appressed an evanescent in the outer part, veins pinnate, forked, oblique, sori on the outer branch, 2–4 li. l. more distant from margins than midrib, involucres narrow, pale.

Common on rocks near rivers and in damp woods and ravines among the lower hills up to 1,000 ft. alt., reappearing on the banks of streams at 4,000–5,000 ft. alt, differing from the preceding by its larger size and more numerous pinnæ. The superior base is in some cases slightly expanded, but not at all auricled and the sori sometimes appear as if double there, but are not really so, being on separate but closely contiguous veinlets. A small state, apparently of either this or the preceding, only 2–3 in. high

**A. marinum*, Linn. has been over a century mistakenly ascribed to Jamaica owing to Linnæus quoting tab. 33, fig. 1 of Sloane's History as a type in founding the species. On page 56 of Sloane's folio herbarium in the British Museum is the specimen from which his figure was taken, and this is a small state of *A. auritum*, Swartz.

including the stipites, with 2–3 small rounded pinnæ to the side, quite soriferous, was gathered at Old England, below the Cinchona Plantation. The name was founded on Plumier's Fil. t. 59, which is represented as much larger, with only 5–6 pinnæ to a side, the lower with a deltoid auricle on the superior base, and having a cylindrical, prostrate, creeping rootstock,—clearly a different species to that to which the name is now applied. Moore regarded it, probably correctly, as a *Diplazium*.

12. *A. obtusifolium*, Linn.—Rootstock strong, repent, scurfy, the end finely scaly, stipites approximate, erect, 4–8 in. l. grey-green or darker, flattish or channelled, naked, rachis conform; fronds pinnate, acuminate or obtuse, base truncate, herbaceous, very thin and pellucid or thicker, dark green naked, ½–1 ft. l. 3–6 in. w.; pinnæ spreading, usually open or their own width apart, 1½–3 in. l, ½–¾ in. w. acuminate, blunt or broadly rounded, the base cuneate or truncate, expanded and auricled or not on the upperside, the under obliquely cut away, sessile or slightly stipitate, the margin entire, serrulate or inciso-serrate; veins pinnate, branches open, very oblique, simple or once or twice forked; sori linear, straight or curved, ¼–¾ in. l.; involucres narrow flat.—Plum. Fil. t. 67. Hook and Grev. Icon. t. 239.

On rocks near streams rivulets and water falls in moist woods and forests. There are two forms, one, of which Plumier's figure well represents, with thin, broadly rounded, plain-margined pinnæ, and the other thicker of substance, acute or acuminate, but very variable, and more or less toothed or deeply incised. I have not seen Jamaica specimens, but Heward recorded it as common in the woods near Old England Plantation, Manchester, collected by him in 1823-6.

13. *A. salicifolium*, Linn.—Stipites tufted from a short, fibrous, finely scaly-crowned rootstock, few slender grey-green, naked, 6–10 in. l.; rachis similar, slightly margined above; fronds pinnate, ½–1½ ft., l. 4–8 in. w. light green naked, herbaceous; pinnæ spreading, 4–10 to a side and a similar terminal one, apart or distant, the lowest as large or little reduced, 3–5 in. l. ½–1 in. w. equilateral, base cuneate, the lower stipitate, tapering and mostly attenuated outwards, margins even or slightly repand, not toothed; veins pinnate, oblique, once or twice forked, short of the edge, sori linear on the anterior veins, ¼–½ in. l. usually equally short of both mid-vein and margin; involucres pale, narrow, flat.

On trees, logs and rocks of woods and shady places; more or less drooping and pendant in habit, the substance being very pliant. This is ascribed to Jamaica by Swartz, no subsequent collector apparently having found it. The cuneate base, equal on both sides, not at all expanded or auricled, of the pinnæ readily distinguishes it.

14. *A. anisophyllum*, Kze.—Stipites ½–1 ft. l. scaly at first at the base; fronds pinnate, more or less pendent, glabrous, chartaceous, cloudy-green, 1½–2 ft. l. 5–8 in. w. the rachis naked and grey-green; pinnæ 3–5 in. l. ¾–1 in. w. alternate, spreading, acuminate, distantly toothed, base deeper or not on the upper side, the lower distant ones not, or very little, reduced and shortly petiolate, upper ones apart, sessile, with a similar terminal one; veins oblique once or twice forked, terminating in the marginal teeth; sori 2–3 li. l.; sunk, confined to the base of the anterior veinlets, but not reaching the midrib; involucres ample, finally revealing the tumid sori.—Hook Sp. Fil. vol. 3 t. 166.

Readily distinguished from its neighbours by the short tumid sunken sori, the beds of which are conspicuous on the upper sides of the fronds. The description is taken from Cuban specimens gathered by Linden; I have seen no local ones. The species has a very wide range in both the Eastern and Western Hemispheres.

15. *A auriculatum*, Linn.—Rootstock fibrous, erect or oblique, tomentose, and with minute reticulated brown scales; stipites tufted, ½–1 ft. l. channelled, grey-green, naked; rachis similar; fronds pinnate, 6–12 in. l. 4–8 in. w. light green, naked, herbaceous; pinnæ spreading, petiolate, more or less apart, 2–4 in. l. ½–1 in. w. acuminate, bi-serrulate, teeth evanescent outwards, inferior base shortly cut away, superior expanded into a rounded or subdeltoid auricle, lowest pair not reduced, terminal lobate and inciso-serrulate, veins pinnate, once or twice forked, flabellate in the auricle, sori very oblique, ¼–½ in. l. much short of the margins, involucres narrow, flat, even-edged.—Plum, Fil. t. 60. Hook Sp. Fil. vol. 3 t. 171.

Frequent in woods and forests below 2,000 ft. alt. on trees and rocks; with the habit of growth of *salicifolium*, from which the auricle at the base of the pinnæ clearly distinguishes it. This latter varies in shape with the degree of development, usually it is rounded, but when large it more or less deltoid.

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Notes on Pulvinaria and Lecanium by Prof. Cockerell. [Author]
Baker (J. G.) A Synopsis of the Genera and Species of Museæ. [Kew.]
Bailey (F.M.) A Companion for the Queensland Student of Plant Life. Brisbane. 1893. [Author.]

SEEDS.

From Messrs Milner and Smith, Sydney, N.S.W.

Eucalyptus trianthos.
" botryoides.
" citriodora.
" corynocalyx.
" crebra.
" leptophleba.
" melliodora.
" microcorys.
" paniculata.
" pilularis.
" rostrata.
" siderophloia.
" sp.
Eremophila maculata
Acacia decurrens
" pycnantha
Boronia megastigima
Casuarina equisetifolia
Frenela Maclayana
" robusta
Syncarpia laurifolia
Hymenosporum flavum
Telopea speciosissima
Tristania conferta
" laurina

From Botanic Gardens, Dunedin New Zealand.

Hoheria Sinclairii
Hoheria populnea, var. angustifolia
Scheffliera digitata
Olearia avicennæfolia
Cyathodes acerosa
Clianthus puniceus
Panax longissimum
Phormium tenax
Parsonsia albiflora
Pseudopanax crassifolium

From Botanic Gardens, Cape Town

Aberia Caffra
Agapanthus umbellatus
" " albus
Albuca minor
Aloe marginata
Antholyza æthiopica minor
Babiana sulphurea
Gladiolus cunonia
" alatus
" angustus.
" grandis.
" gracilis
Gladiolus hirsutus.
" tristis·
Geissorhiza humilis.
" Bellendeni.
" Kermesina.
" secunda.
Greyia Sutherlandi.
Ferraria undulata.
Freesia refracta alba.
Homeria collina
" spicata.
Lachenalia pendula.
Moræa sp.
" tricuspis.
Massonia pustulata.
Sparaxis grandiflora alba.
" bulbifera.
Synnotia bicolor.
Trichonema aurea.

From Botanic Gardens Saharanpur, India.

Amaryllis spp.
Phœnix humile.
Rubus trivialis.
Ehretia serrata.
Beaumontia grandiflora.
Ipomæa rubra-cœrulea.
Dillenia indica.
Butea frondosa.
Sterculia alata.
Hiptage Madablota.
Peach.

From Botanic Gardens, Seebpore, India.

Bambusa siamensis.

From Botanic Gardens Bangalore, India.

Soymida febrifuga.
Abroma augusta

From Botanic Garden, Rockhampton, Queensland.

Livistona australis.
Antidesma Dallachianum.
Erythrina vespertilio.
Eucalyptus maculata, var. citriodora
Sesbania grandiflora.

From Govt. Botanist, Melbourne.

Banksia collina.
Banksia ornata.

From Agri-Horti-Socy's Gardens, Madras.

Cordia Rathii

From J. R. Reece Jamaica.

"Nut Eddoe," Musk Melon.

No. 48. October, 1893.

BULLETIN

OF THE

BOTANICAL DEPARTMENT,

JAMAICA.

CONTENTS:

PRICE—Twopence.

A Copy will be supplied free to any Resident in Jamaica, who will send Name and Address to the Director of Public Gardens and Plantations, Gordon Town P.O.]

JAMAICA:
GOVERNMENT PRINTING OFFICE, 79 DUKE STREET, KINGSTON.

1893.

EXPERIMENTS IN THE CULTIVATION OF VEGETABLES.—XII.

POTATOES—CASTLETON GARDENS.

Name of Potatoes	Date of Planting in April, 1893.	First appearance above ground.	Days from Planting	Date when tops were dead and Potatoes ready for digging.	Days from Planting	Number of sets planted.	Number of sets lifted.	Number of Saleable Potatoes per set.	Weight of Saleable Potatoes per set.	Gross weight of Potatoes per set.	Total weight of Potatoes lifted.	Max. temp. during time Potatoes were in growing.	Min. temp.	Rainfall.	Number of days rain fell.
										ozs.	lbs.	°	°	in.	
Sutton's Satisfaction ...	12.4	22.4	10	8.7	87	24	14			2.8	2.8	73.0	63.5	42.64	49
Sutton's White Kidney —	12.4	22.4	10	4.7	83	24	19			2.5	3.0	74.5	62.4	39.88	47
Sutton's Nonsuch ...	12 4	22.4	10	9.7	88	24	12			5.3	4.0	72.2	63.5	42.64	50
Sutton's Supreme ...	12.4	20.4	8	9.7	88	20	15			3.2	3.0	72.2	63.5	42.64	50
Sutton's Windsor Castle ...	12.4	20.4	8	8.7	87	20	15			4.2	4.0	73.0	63.5	42.64	49
Sutton's Triumph ...	12 4	19.4	7	8.7	87	21	19	None.	None.	1.6	2.0	73.0	63.5	42.64	49
Sutton's Reading Hero ...	12.4	20.4	8	10.7	89	24	19			1.6	2.0	72.3	63.4	43.69	51
Sutton's Abundance ...	12.4	21.4	9	9.7	88	21	15			2.6	2.8	72.2	63.5	42.64	50
Sutton's Magnum Bonum ...	12.4	22.4	10	8.7	87	22	18			3.7	4.4	73.0	63.5	42.64	49
Sutton's Perfection ...	12.4	21.4	9	9.7	88	19	10			4.4	2.12	72.2	63.5	42.64	50
Sutton's Seedling ...	12.4	20.4	8	4.7	83	20	18			4.2	4.12	74.5	62.4	39.88	47
Sutton's Reading Russet ...	12.4	20.4	8	10.7	89	19	17			3.7	4.0	72.3	63.4	43.69	51

HAVANA TOBACCO SEED.

During the last 3 or 4 years large quantities of Tobacco Seed raised by the best growers in the Temple Hall District have been distributed free by the Department of Public Gardens and Plantations. This seed is yielded by plants grown originally from seed from Havana ; but of late Tobacco Merchants have been unable to get seed from Cuba.

It was important that an effort should be made to obtain the best seed from a reliable source, for the seed from plants grown year after year on the same spot tends to deteriorate, and the high quality of Jamaica cigars could not in consequence be maintained.

The cultivation of this important article of trade is extending, and efforts are being made by the Department to substitute seed of Havana Tobacco for the use of settlers instead of that of their own native plants and to induce them to follow Cuban methods of cultivation and manufacture.

At the suggestion of the Director, a Despatch requesting seed was sent by His Excellency the Governor to the British Consul-General at Havana, and a parcel is daily expected containing 25lbs. of Vuelta-Abajo Tobacco seed, which the Consul-General states to be quite fresh and of the very best quality.

It is rather late to sow this year, but those who wish for seed should apply to the Director of Public Gardens and Plantations, Gordon Town P. O., stating how much land they have prepared for planting.

Bulletin, No. 13, for May, 1889, contains a short treatise on the cultivation and curing of Tobacco by the late Mr. J. C. Espin, a practical grower and cigar-maker. This Bulletin will be sent free to those who apply for it.

SISAL HEMP IN THE BAHAMAS.

A correspondent writes concerning Sisal Hemp in the Bahamas as follows :—

"Our fibre industry continues to advance rapidly. A new Company with very large capital has commenced operations on Little Abaco, and employs 300 men. J. S. Johnson has turned his business into a Limited Company with £80,000, capital. They have about 3,000 acres already planted. Chamberlain has 2,000 and commences cleaning next year. Monroe has about 2,500 and has just put up a Todd machine, and is only waiting to finish his railway to bring the leaves to it to commence steady cleaning. Albee Smith has 2 machines in the Colony now, but the only one I have heard from (at Rum Cay) is a failure, as the second grip (gutta percha over chain) gave out after very little work. Menendez in this Island is cleaning steadily now, using Van Buren's machine, until he can find a better. I think we shall have a large export in 1895 and a very fair one in 1894."

COCOA-DRYING IN CEYLON : A CORRECTION.

Dr. Trimen, Director of the R. Botanic Gardens, Ceylon, writes as follows :—

"In the reprint of my description of a drying-house for Cacao in your "Bulletin" (No. 41) for March last, I notice a serious error, "R 120" for R 1,200. I do not know who is responsible for this as the note has been through so many hands, but it would be well to call attention to it. It means £80 instead of £8 in sterling money.

"Also the last paragraph (in inverted commas, like the other two) is none of mine but added by some other hand, and, as far as Ceylon is concerned, not correct."

These paragraphs were taken from the *Agricultural Record* of Trinidad for 1890, to which Dr. Trimen referred in his first letter. The mistake in the *Record* is not a mere misprint, for Sir Wm. Robinson in a later paragraph refers to the cost as being only £12. But there is a misprint in the Bulletin in quoting the last paragraph as from Dr. Trimen ; it is really part of Sir Wm, Robinson's lecture.

NOTES FROM THE MUSEUM, INSTITUTE OF JAMAICA.—I.

By C. H. TYLER TOWNSEND, Curator of the Museum.

No. 38.—A Grub Injuring Strawberry Plants.

On April 6, 1893, Mr. W. Harris, Superintendent of the Cinchona Plantations at Gordon Town, sent to the Museum specimens of a grub, with the report that they were doing serious damage to strawberry plants. Mr. Harris wrote that the grubs burrow in the soil, and eat up into the hearts of the plants, causing them to become sickly and finally to wither up. Mr. Cockerell, in reply, stated that he suspected them to be larvæ of a species of Praepodes. They were placed in soil to breed, but without result. On July 5, I wrote to Mr. Harris for further specimens, which were obtained July 10, together with specimens of beetles which Mr. Fawcett thought might be the adults of the grubs. His opinion, I believe, is correct. One of the smaller grubs is a scarab or chafer larva, and may not be particularly concerned in the injury, although it is root-feeding in its habits. It may be known at once by the fact of its having six well-developed legs. The other grubs all belong to a very different group, the Rhyncophora, or weevils, as indicated by the fact that they are absolutely footless. The beetles are *Praepodes amabilis* Waterh., a large weevil from 21 to 26 mm. long, black, with three pale bluish green stripes down the wing covers, the whole frequently thickly covered with a rosy or pink-golden or grey metallic efflorescence of minute scales. In fact the green stripes are simply scales of this color. This weevil is with little doubt the adult of the strawberry grubs above-mentioned as being footless. It will however, be attempted to breed some of the latter, so as to prove or disprove this. The grubs sent are from 13 to 25 mm. long. They are wholly whitish, except the head, which is pale yellowish brown, and the mouth parts, which are blackish brown. They greatly resemble at a casual glance the "white grubs," or chafer larvæ, but are at once distinguishable by being footless.

Mr. Harris writes, under date of July 10, that applications of fresh lime and kainit have seemed to be partially successful, pointing out that the fresh lime should be dug in and well mixed with the soil. As Mr. Harris suggests, however, the grubs may make their appearance sometimes when it is not possible to put the lime in the ground, as when young crops are coming on, in which case it would be necessary to use some other remedy. It is quite possible that kerosene emulsion could be used with success in this instance. It would need to be of such a strength that it would not injure the growing plants by soaking into the ground about their roots; and yet be sufficiently strong to kill the grubs. Actual experiments in the field are necessary to determine these points. A full paper on the subject of this grub will be published in a future number of the Journal of the Institute.

July 13th, 1893.

[The attempt to breed these grubs at the Museum ended in failure, owing to the absence of growing plants with which to mature them. Strawberry plants and larvae will be obtained from Cinchona the coming season, when it is hoped that the beetles will be successfully reared.—C. H. T. T., Nov. 2, 1893.]

No. 43.—An Enemy of Casuarina.

In Mr. Cockerell's lecture on Agricultural Pests, it is stated that the Casuarina tree furnishes an example of a plant introduced without its enemies, no insects having been found up to that time to depredate upon it in Jamaica. We have now, however, to record an insect enemy of this tree, in the shape of a twig girdler, a beetle which gnaws away the bark and wood to a certain depth in the shape of a ring around the smaller branches, causing the terminal portion to die and finally to break and fall to the ground with heavy winds. This beetle is *Oncideres pustulata*, a native species, which doubtless attacks other trees as well, and has taken to the Casuarina since its introduction into Jamaica from Australia. It was identified by Dr. Riley in Washington from specimens received through Mr. Fawcett, from Mrs. Ruth Charley, of Little London.

Girdling beetles practise this peculiar habit of girdling branches, so that the terminal section, in which they deposit their eggs afterwards, may become dead. This later falls to the ground, and the beetle transforms therein, finally emerging from the dead stick.

The remedy, therefore, consists in gathering and burning all the dead or girdled sticks, whether on the tree or on the ground, The larvæ can in this way be very easily destroyed. The perfect beetles seem to be quite common, and should be killed when found on the trees.

August 7th, 1893.

[This girdling beetle has since been recorded to attack the gungoo pea (*Cajanus indicus*). See Notes from the Museum Nos. 52 and 54 for an account of this, which had been observed here in 1882. The beetle is an addition to the Jamaican list of named species.—C. H. T. T., Nov. 2, 1893.]

No. 47.—A Potato Weevil.

In June last, Mr. H. McDermot, of Grand Cayman, sent to the Museum specimens of a small weevil, both adults and larvæ, with the report that they were injuring potatoes in that island.

This weevil is the *Cylas formicarius*. The adult is about 6 mm. long, of a dark greenish or bluish black, with the head, thorax and legs orange-coloured, the beak being blackish. The head and thorax are narrowed and elongate, giving the insect an elegant appearance. The small maggot-like grubs of this weevil are wholly of a whitish colour, and are the stage which does the injury to the tubers.

Mr. MacDermot writes that this weevil has within the last four or five years become generally distributed and extremely troublesome to the cultivation of the Potato. It attacks potatoes of all kinds, but especially the large white variety, and has apparently been introduced from Cuba or Pedro (St. Elizabeth) where it abounds. Infested potatoes present the appearance outwardly of being sound and good, but on being split open disclose the worms boring in every direction. Immediately next the borings the tissues of the tuber are black and discoloured, while the remaining portions are said to be tasteless, and are often refused even by pigs.

It appears that the tubers attain a certain size before they are attacked, and are therefore sometimes dug early, before they are large enough to be good eating, so as to escape the worms. Sandy soil and deep planting are said to be preventives to a certain extent of the destructiveness of the worms.

Aug. 29th, 1893.

[*Cylas formicarius* is also native to Jamaica, but is an addition to the lists of identified species. —C. H. T. T., Nov. 2, 1893.]

No. 48.—A Jamaican Bean Weevil.

In July, Mr. Fawcett sent to the Museum a box of "red peas," *Phaseolus nanus*, which were infested with a weevil. They were received from Mr. W. Grant, of Cave Valley, in St. Ann's, and are what are commonly known in America as "string beans." These beans contained small holes, in which a large number of the weevils had bred, quite the same as those made by the pea and bean weevils in more northern countries. Specimens sent to Dr. Riley in Washington were determined as *Bruchus tetricus* Gyll. The more destructive weevils of this genus in America are *B. pisi* and *B. obtectus*, which attack peas and beans respectively in that country. There are many other species of this family Bruchidæ, of which the great majority breed in seeds of leguminous plants. The eggs of the pea and bean weevils are deposited in or on the young pods usually, and the newly-hatched grub, as recently described by Dr. Riley, contrary to the rule among weevil larvæ, is furnished with legs. These it soon loses, however, having passed the post-embryonal stage, and becomes a maggot-like larva enclosed in the bean or pea. *Bruchus tetricus*, above mentioned, is new to the Jamaican lists. A species, supposed to be *B. rufimanus*, was found by Mr. Cockerell in white beans *(Lablal vulgaris* var. *bonavist)* in the Museum of the Institute. He, however, doubted whether they were a Jamaican product. The only other Bruchus recorded from Jamaica is *B. spinosus*, a rather large spinous species whose habits are not known.

As a remedy for these weevils in dry beans or peas in bulk, bi-sulphide of carbon is most effectual as it kills every stage of the insect, from egg to adult beetle. A very small quantity—one or two tablespoonfuls—should be poured into a barrel, or other tight receptacle containing the beans, the barrel being then closed and left for a few hours. It should afterward be opened and the bi-sulphide allowed to thoroughly evaporate, the building being thrown open, if it is done within doors, and no light or fire should be introduced in the meantime, as the vapours are highly inflammable.

August 31st, 1893.

No. 49.—The Cynthia Silk Worm Experiment.

The Cynthia silk worm, *Attacus cynthia*, is a native of China, India along the Himalaya Mountains, and Assam. It has been naturalized in the the United States and in France, and is cultivated somewhat in parts of Africa and in Austrialia. The larvae are quite easily reared in the open air in northern countries.

The native food-plant of this silk worm is the Ailanthus tree, but it is said that it will also thrive on the castor oil plant, lilac, cherry, barberry, laburnum, and others.

Last January some cocoons of this species were sent to the Museum by Mr. D. Morris, of Kew, through Mr. Fawcett. They were obtained by Mr. Morris from Mons. A. Wailly, the well known silk worm authority. M. Wailly imported them from the United States, where they had been raised. Eggs obtained from moths which issued from these cocoons were distributed by Mr. Cockerell in March, to seven persons in different parts of the Island. Cocoons were previously sent to four others. The castor oil plant was suggested as the most suitable food for the worms.

The experiment unfortunately ended disastrously in each case. Only one correspondent secured the cocoons from the eggs, and they were valueless. In all other cases the larvae died from one cause or another. It was complained that the worms would not eat the castor oil leaves. In some cases, lettuce was eaten in preference.

Apparently the climate and the food plant are not well adapted to the species in Jamaica. Yet it would seem that it might be made to thrive with proper food and care in the more mountainous districts. It would seem that the other very closely allied species, *Attacus ricini*, whose native food is the castor oil plant, would be much better adapted to our Island.

Mr. Cockerell records breeding an American parasite, *Spilochalcis mariae*, from the Cynthia cocoons. These parasites had survived the passage of the cocoons from America to England, and thence to Jamaica, where they issued.

September 5th, 1893.

No. 53.—The Pimento Borer.

In October, 1892, some pimento sticks were sent to the Museum by Mr. A. E. Husband, of Manchester. They were infested with longicorn larvae, and were placed by Mr. Cockerell in a jar to breed. The following July, the sticks having remained in the jar undisturbed during the interim, it wa

found that several specimens of a small and elongate light coloured longicorn beetle had issued from them. These beetles on being sent to Dr Riley, in Washington, were pronounced to be *Cyrtomerus pilicornis* Fab. The species is new to the Jamaican lists.

As the pimento or allspice *(Pimenta vulgaris)* is considerably cultivated in Jamaica, this borer may prove a serious pest. The sticks sent to the Museum show rather wide, more or less sinuate or irregular, shallow channels in the hard wood immediately beneath the thin bark. The channels are very solidly packed in places with a fine and hard frass. Their general direction is lengthwise of the branch, but they sometimes wind around it, or rarely turn backward at an acute angle. At intervals, in the sticks are seen small deep holes penetrating obliquely downward or upward into the hard wood towards the heart of the branch. These are narrower than the outer superficial feeding tunnels, but are still flattened, and doubtless are the cells where the borers undergo the pupal change to the adult state. The bark being removed shows the tunnels to extensively cover the outer surface of the sticks, indicating that these borers are active ones and capable of doing much injury.

The only remedy for such borers in living trees is to search for infested branches, detect the tunnels before they become extensive, and kill the grubs by using a probe of wire or other material. Probing is simple in this case because the borers work just beneath the bark until ready to pupate.

September 22nd, 1893.

No. 57.—Erinose Growths due to Mites.

Phytoptus, a genus of mites, produces a peculiar fungus-like growth on various plants, the growth varying in its form and structure according to the species of *Phytoptus* producing it, and to a certain extent depending upon the plant infested. In as much as these mites are very small and usually well concealed, the growths wich they cause were for a long time classed by mycologists as fungi under the generic term *Erineum*.

As recorded in the August number of the Journal of the Institute, Mr. Campbell sent from Castleton Gardens last July a leaf of *Calophyllum calaba*, which was covered on its under surface with numerous small and compact brownish growths, formed of fine and short closely packed setae, presenting much the structure of the pile of velvet. This was sent to Mr. Ellis, and by him determined as the form originally called *Erineum calabae* by Kunze, who described it from the island of Porto Rico. Mr. Fawcett has recently written me that specimens from Castleton Gardens were also forwarded to Kew, and pronounced to be an erinose growth due to an insect.

When troublesome, the phytoptid mites may be destroyed with sulphur or Kerosene emulsion. Recent experiments with the latter seem to prove its efficiency for the pear *Phytoptus* in the U.S. The orange *Phytoptus* producing the rust is destroyed in Florida by using sulphur mixed with lime in the process of slacking, and applied in a watery solution. A soft soap and sulphur wash is used in England for the Currant *Phytoptus*.

October 9th, 1893.

No. 60.—Grubs Injuring Roots of Orange Trees.

There have been found in a jar in the Museum several grubs of a beetle, which, according to the label, were found eating roots of an orange tree, and sent by Mr. Fawcett on the 28th of May, 1887. They are rhynchophorous or weevil grubs, and quite similar in appearance to those found by Mr. Fawcett and Mr. Harris, from April to July of the present year, injuring roots of strawberry plants at Cinchona, and which are mentioned in Notes from the Museum No. 38. Like them, they doubtless belong to the genus *Praepodes*.

This observation should not be lost sight of. Grubs attacking the roots of trees and plants are more easily overlooked than those which work above ground, since their depredations are concealed and usually not suspected until the ruin of the tree is imminent. In the U.S. the grubs of certain scarabaeid and prionid (longicorn) beetles attack the roots of plants and trees, the former being usually confined to certain crops and grass, and the latter to trees. The grubs of these prionid beetles are often of great size, some of the beetles being very large. It is noteworthy, however, that in the tropics, at least in Jamaica, the grubs of certain large weevils seem to take the place in part of those above mentioned in the U.S. The cocoanut or palm weevil, which bores the root of the cocoa palm in the West Indies, is the gigantic grub of *Rhynchophorus palmarum*. Then we have these larvæ of *Praepodes* injuring the roots of the strawberry, orange, and without doubt other plants. It is very probable, as Mr. Cockerell has suggested, that the grub reported to injure the roots of cacao in Jamaica is the larva of *Praepodes*. Then we have a coffee borer, which may or may not turn out to be the same thing. These weevil larvæ, as pointed out in the notes above referred to, are at once distinguished from all other larvæ of beetles by being footless.

There are some large prionid beetles native in Jamaica, whose grubs doubtless injure the roots of trees, and quite possibly those of the orange. The Curator will be glad to receive any specimens of root-borers, with notes upon them.

October 14th, 1893.

CURING LEMONS AND LIMES.

The export of Lemons would probably prove to be most remunerative, if they were properly cured and packed.

The following information is taken from the *Handbook of Orange Culture*, by the Rev. T. W. Moore.

"Comparatively little attention has been given in Florida to the cultivation of the lemon and the lime; and yet these are among the most valuable of the citrus family, whether we consider their monetary value or their healthfulness. This neglect has arisen from several causes.

"The lemon is a more vigorous grower than the orange, and when planted on strong or fresh land the fruit grows to a much larger size and with a thicker skin than in Europe. The rind, also, when

the fruit is permitted to yellow upon the tree, is bitter, which destroys the commercial value of the lemon. Other ill results are noticed when the fruit is permitted to ripen on the tree. Such fruit is comparatively light, the juice sparse, and charged with a small per cent of citric acid. All this is the result of a want of knowledge of proper treatment of the fruit. My lemons have brought in New York more money per box than my oranges, and have in these markets ranked as first quality. I would mention, also, that as a general rule the lemon tree is more productive than the orange. This fruit which ranked so high was gathered from seedlings planted from seed of the Sicily and Messina fruit of commerce. If the fruit on these trees is allowed to ripen on the tree, they average three-fourths of a pound in weight, but of inferior quality, juice little and rind thick.

"My method of preparing for market is to gather the fruit when about one-third larger than we find the Sicily lemon when it reaches our American market. In curing, the fruit will shrink this extra third. The fruit is gathered in latticed boxes holding about fifty lemons each and only two layers deep. The fruit should be cut with short stems, and so handled as not to be bruised. The boxes are at once put into a close room, one on top of another, but forming a hollow square. If the room is large, cover the pile of boxes with a cloth that will confine the sulphurous gas with which the fruit is to be treated. Place in the centre of the square, and sufficiently remote from the boxes not to heat the fruit, an oven of live coals. Throw on the burning coals an ounce of flowers of sulphur, and fasten down the cloths. If the room is small and tight, the cloth is not necessary. Allow the fruit to remain in a dark room for a week, then expose to sunlight—the direct rays of the sun a part of the day is best—until the skin is yellow. The fruit is then ready for market, or to be stored for future use, for when thus treated it can be kept for an indefinite time. This sulphurous gas is of great benefit in the curing of both lemon and orange. First, it aids in properly curing the fruit by toughening the skin and drying up the watery particles ; second, it is fatal to all parasites of the orange, whether vegetable or animal. I am satisfied that a very large per cent of the speedy decay of the orange so fatal to shippers is occasioned by the germ of fungi left over from the former year in the packing houses, and old boxes in which rotten fruit was conveyed. These germs lie dormant, waiting for a moist atmosphere favorable to their development ; they then develop and multiply with wondrous rapidity, showing their work in the form of mould on any moist surface, but especially on fruit. Some years ago I put into a basket that had held some decayed lemoms, on the sides of which basket at the time of gathering I noticed a little mould, some very fine Tangerine oranges. In two days' time half the fruit was entirely worthless. The fruit that was left on the tree, or that had been otherwise handled, was entirely sound. This gave me a hint. It was a very wet season ; most of our shippers were losing heavily. Commission merchants were constantly reporting, "Fruit arrived in bad order," "Did not pay expenses." I knew that sulphurous fumes were fatal to fungoids. I commenced to gather and ship in the midst of the damp season. I fumigated every box of fruit, and though mould had appeared on the fruit as it hung on the trees, I heard no report of decayed fruit, but on the contrary had the report of "Arrived in good condition," and "Good price."

"I have not much experience in handling the lime, but I am convinced that this fruit, most valuable because of its healthfulness and its richness in citric acid, can be cured as easily as the lemon, and preserved quite as long, if subjected to the treatment recommended for the lemon. This fruit needs only to be known in our Northern market to be valued even more highly than the lemon. When once brought into notice it will prove truly profitable to the grower. The yield is speedy and abundant.

"The Florida lemon, marketed during the latter part of August and all of September and October, meets with little competition from foreign fruit."

The *Californian Fruitgrower* says that the import of lemons into America is steadily increasing the value rising from 2,501,426 dollars in the year 1885 to 4,831,334 dollars in 1892.

BUDDING ORANGES.

The following letter on the subject of budding oranges from Mr.D. Morris, Assistant Director of Kew Gardens, is of great interest and value.

In Bulletin No. 42 for April, I stated that "the climatic conditions are so much against the operation of budding that, in my opinion, it will not be found worth while ever to adopt it in the Island."

I am not prepared yet to modify my opinion until very many more experiments have been carried out at Hope Gardens. The Superintendent will leave no method untried to ensure success, but it is evident that the climatic conditions for the whole year must be considered in comparing Lucknow and Jamaica, and not those obtaining only in March.

In *Gardening for India*, Firminger says "In the Upper Provinces the budding is performed with great facility at two seasons of the year: first, when the plants are about to start for their Spring growth, and again when for their Midsummer growth, as at those times the bark separates most freely from the wood. But, for some reason I am unable to explain, I have not found such to be the case in the vicinity of Calcutta; and budding can so seldom be performed there with success, that it is rarely or never attempted, inarching being uniformly adopted instead."

Now compare what he says about the difference in the climate betwoen Bengal and these Upper Provinces.

"In Bengal what is called the 'Cold season' lasts, at the longest, not more than three months, commencing in November and ending by February. The temperature at night, during that period at times, will fall as low as the freezing-point,—but this is of rare occurrence. Towards the close of February commences the hot season, which lasts till about the middle of June, when the periodical rains usually set in. From March to May is the hottest poriod of the whole year. March and April are the driest months. Some time in June the rain season begins, and lasts usually till about the 20th of October. The greatest humidity prevails in August and September. During these months, towards evening, the atmosphere is filled with vapour almost to saturation.....

"The climate of the Upper Provinces varies considerably from that of Bengal, insomuch that many plants which thrive under the one, will not thrive nor hardly exist in the other..... The Cold season, in Upper India, commences at the beginning of October, and cannot be said to be completely over till about the close of April.

"In December and January sharp frosts at night are not unfrequent, sufficiently severe to destroy many of the tender kinds of shrubs, unless protected. The European annuals, though often in the early morning rigid with a white coating of hoar-frost upon them, and in an hour or so after exposed to the burning rays of the sun full upon them, seem, with one or two exception, to take little harm otherwise than that their growth is all but entirely arrested while the season is at the coldest. By the 10th February the frosts are over.

"During March, after their temporary rest, trees and shrubs in a well-irrigated garden push forth with a vigour perfectly astonishing, far beyond anything of the kind ever witnessed in Bengal. The young shoots, however, thus rapidly produced, are very apt to be scorched up and killed in a few hours' time by the fierce hot gales that prevail soon after.

"In May the heat becomes intense, the same at night as during the day. At this period the garden must be unremittingly watered. Many plants in a border left unwatered even for a fortnight would of a certainty perish, and most would be sure of dying, if left unwatered during the whole of the dry season. This excessive heat continues with little intermission, unless during the heavy falls of rain that occur more or less in July and August, till September, when it begins gradually to abate."

It is quite evident that we have at Lucknow conditions of vegetation, arising from different causes, but similar in their effects to those in Florida and other places where budding is practised, namely a rapid springing into growth after a season of rest, instead of a continuous growth throughout the whole year.

W. F.

Royal Gardens, Kew, 8th September, 1893.

My dear Fawcett,

As bearing upon our recent correspondence with regard to the budding of oranges, I may mention that on Saturday last we had a pleasant visit from Mr. Matthew Ridley, Superintendent of the Government Horticultural Gardens at Lucknow. He was formerly at Kew and has had wide experience in fruit-growing in the plains of India. His Reports, as probably you are aware, are always interesting, and contain valuable information of a useful character.

2. Mr. Ridley's experience with regard to oranges is a somewhat singular one. Nearly all the orange trees grown and distributed by him are budded trees. The plan of budding oranges has been regularly practised in the Lucknow Gardens for many years. It is carried out by native labour, and although there are naturally some failures, the supply of budded trees is always kept up to the demand.

3. It may interest you to learn that stock plants are raised from seeds of sour orange and lime. These are raised in large numbers in open beds, as plants are raised in Jamaica, and they are grown on until they are about 18 inches to 2 feet in height. In the spring of the year on the advent of dry weather, the work of budding is commenced. During the month of March, and with bright, hot weather, just as is experienced at that season in the West Indies, suitable buds are taken from the best kinds of orange trees in the Garden, and these, after being prepared, are budded on to the sour seedlings as they grow in the beds. The seedlings are taken one by one, and a clean cut made in the upper part of the stem with a budding knife. The bark on each side of the cut is lifted, exactly as in budding roses, and the bud put in. A little binding with bast or banana fibre completes the operation. There is no need of wax, clay, or any preparation to cover the budded area.

4. Mr. Ridley mentioned, first of all, that the slit in the bark of the stock is not T-shaped, as shewn, for instance, by Dr. Nicholls in his book (English ed.) opposite p. 82. It is simply a cut down the stem, with no cross cut. Further, that the shield of bark attached to the bud is cut squarely across top and bottom. It is not trimmed into a narrowed point either above or below. It is claimed that the bud is easier to manage when so left. When the bud is being inserted the stem of the stock is bent forward so as to open the slit, and so facilitate the admission of the bud. These latter are not matters of any great moment. They are rather details of procedure which have been adopted at Lucknow and passed on from one man to another.

5. It is not necessary to describe the budding process in any greater detail. Budding is a very simple process, and it is well described in any work on gardening. As regards climate, I should say that the hot weather in the plains of India must be much hotter than anything in Jamaica. There is apparently little difference, as far as I could gather from Mr. Ridley, between the conditions of vegetation during, say the month of March in Lucknow and in Jamaica. Hence it would appear that upon theoretical grounds there is nothing to prevent budding being followed as fully in one place as in the other. There is so much to be gained by an adoption of the budding process wherever it can be carried out, that this must be my excuse for inflicting so long a letter upon you in support of it. I hope you will be able to say something more about it in your *Bulletin*, and so draw increased attention to the subject in the interest of orange-growers in Jamaica. I attach a Memorandum on "budding oranges," giving instances where it is practised elsewhere.

I am, Yours very sincerely,

D. Morris.

Budding Oranges.

Extracts from "Fruit Culture in the Several Countries," being United States Consular Report, No. 41½, June. 1884.

Italy: *Marsala*.—"The trees are produced from seeds of bitter orange and budded afterwards." p. 597.

Sicily.—"The seed of the bitter orange is planted. When the young plants are a year old, they are transplanted.....when well rooted and growing, the best varieties of orange and lemon are budded on to the stocks." p. 599.

Venetia.—"For propagating plants.....seed is sown in spring.....such plants require to be grafted later..... but oftener by the insertion of a bud or some thrifty shoot from one of the lower branches." p. 618.

Spain : Western Andalusia—"The general mode of propagation is by cuttings.....In Valencia however, grafting or budding is resorted to." p. 670.

Malaga.—Orange "trees are seedlings from sour orange seeds transplanted at one year old and grafted the next year." p. 687.

Asia Minor : Mitylene.—"the orange and lemon trees here are budded or grafted." p. 751.

South Australia.—"We graft or bud." p. 812.

Morocco.—"They (orange trees) are propagated from seeds, inarching, grafting, budding, and by cuttings." p. 815.

Florida.—"The best example.....of an orange grove.....is the fine grove of Mr. E. H. Hart at Federal point. This grove is of the choicest 'budded' varieties." (Report on Tropical and Semi-Tropical Fruits in the United States, 1887. p. 60.)

FERNS : SYNOPTICAL LIST.—XXIII.

Synoptical List, with descriptions of the Ferns and Fern-Allies of Jamaica, by G. S. Jenman, Superintendent Botanical Gardens, Demerara, (continued from Bulletin No. 47.)

16. *Asplenium hastatum,* Klotzch.—Rootstock small, fibrous, finely scaly, erect or oblique, stipites tufted, 4–7in. l. channelled, naked above the finely scaly base ; fronds pinnate, 8–12in. l. 2–3½in. w. naked, dark green, chartaceous, truncate at the base, the apex terminated by a linear distantly inciso-lobate segment 1–2in. l. pinnæ horizontal, ½in. less or more, apart but not distant, shortly stipitate, tapering, acuminate-bluntish, shortly cut away on the underside of the base, upper expanded auricled and subcordate, margins bilobate-dentate, the teeth irregular, rounded and deep, about 1 li. w., veins pinnate, forked, flabellate in the basal auricle ; sori on the outer branch, oblique, 1½–2½ li. l. distant from the margin.—Hook. Sp. Fil vol. 3. t. 172.

Infrequent on rocks and trees of Portland from 2,000–4,000ft. alt. Quite intermediate in its general characters between *auriculatum* and *pteropus,* but stiffer and more upright of fronds than either ; and with much shorter fronds and fewer, though somewhat conform, pinnæ than in the latter

17. *A. pteropus,* Kaulf.—Rootstock short, erect, finely scaly ; stipites cæspitose, 2–4in. l. margined, naked, except the minute scales at the base, gray-green ; rachis similar, narrowly-winged throughout ; fronds pinnate, 1–2ft. l. 2–3in. w. light green, herbaceous, naked, a little reduced toward the base, passing abruptly or not at the apex into a linear attenuated lobate segment 1–2in. l. and 4–5 li. w., shortly cut away on the inferior side at the base, the upper side expanded, acute or acuminate at the point, the margins evenly serrated with oblique blunt teeth ½ li. w. which are evanescent in the acuminate or attenuated outer part ; veins pinnate, simple, except the interior one at the superior base, which is 2–3 times forked : sori copious, oblique, 1–1½ li. l. 8–12 on either side, near the midvein and distant from the margins ; involucres thin, pale, the open edge curved.—Hook, Sp. Fil vol. 3. t. 177.

Very common from 2,000–4,000 ft. alt. on rocks and trees on the banks of streams and other wet situations in moist forests. A much more slender plant, smaller in all its parts, with the rachis less winged with membrane than *alatum,* which in habit and in situations of growth it resembles. The pinnæ, which are 30 or more to a side, resemble most those of *harpeodes* and *lunulatum,* the fronds however, being more weakly and differing much in other features from either.

18. *A. alatum,* H. B. K.—Rootstock erect, with strong, wiry, descending roots ; stipites cæspitose, 4–7in. l. compressed broadly or narrowly winged, naked ; fronds pinnate, lanceolate-oblong, 1–1¼ft. l. 2–5in. w. thin, glabrous, dark green, little if at all reduced at the base, no terminal segment, the conspicuously winged rachis, extending an inch beyond and rooting at the apex ; pinnæ numerous, horizontal, apart or subdistant, 1¼–2½in. l. ¼–½in. w. subsessile, base equal-sided, cuneate-rounded, point bluntish, margins bidentate, teeth appressed ; veins pinnate, forked ; sori oblique, 2–4 li. l. near the midrib but much short of the margin ; involucres narrow, finally concealed.—Hook and Grev. Icon. Fil. t. 137.

Abundant on wet rocks and banks by rivers and in the beds of streams in wet forests at 4,000–5,000ft. alt. ; distinguished by its broadly winged rachis, projecting beyond the pinnæ at the top of the frond, and by the numerous equilateral, blunt pinnæ. The habit is rather weakly, the fronds curving gracefully outwards, the end eventually rooting in the ground.

19. *A. lætum,* Swartz.—Rootstock oblique, shortly repent, dark, fibrillose ; stipites tufted, few or many, 2–6in. l. light or dark, channelled, naked ; rachis similar, but rather compressed and margined above ; fronds pinnate, lanceolate-oblong, base usually truncate, chartaceous, cloudy-green naked, 6–10 in. l. 1½–2½in. w. ; pinnæ numerous, spreading, usually close, subdimidiate, the inferior slightly stipitate the superior slightly adnate-decurrent, passing gradually into the acuminate lobate-serrate apex, 1–1½in. l. 3–5 li. w. rounded, blunt or acute, the inferior side cut away at the base in a curved or straight line, from which point the outer part is up-curved, superior base truncate, deep, but not auricled, upper and outer margins serrulate or duplicate-serrulate, the teeth blunt and ½li. w. ; veins pinnate, very oblique, simple and forked ; sori 1½–3 li. l. slender medial ; involucres pale, narrow.—Hook. Sp. Fil. vol. 3. t. 173.

Common on wet rocks in forests and on the banks of shaded streams from low levels up to 4,000ft. alt. ; easily recognized by the subdimidiate pinnæ, which are deep on the upper side, quite cut away within on the under, beyond which, below the midvein, is very narrow. There are two local forms ; that at the lower elevation has fewer fronds, rarely more than 1–2 full grown, with blunter pinnæ, rather thicker texture and more of the veins forked ; while in the other, which is larger, the fronds are numerous and the rachises stiffer and dark brown.

No. 49. November, 1893.

BULLETIN

OF THE

BOTANICAL DEPARTMENT,

JAMAICA.

CONTENTS:

PRICE—Twopence.

A Copy will be supplied free to any Resident in Jamaica, who will send Name and Address to the Director of Public Gardens and Plantations, Gordon Town P.O.]

JAMAICA:
GOVERNMENT PRINTING OFFICE, 79 DUKE STREET, KINGSTON.

1893.

NOTES ON BANANAS.

To the Director of Public Gardens and Plantations.

Sir,

I send you the following rough notes for Banana Cultivation which I have gained from actual experience.

1st. Limit the cultivation to an area that you can give direct personal supervision to, say each root to be examined once per month.

2nd. Calculate your means and always have sufficient ready money in hand to do the work as soon as required. I have seen three weeks delay in the performance of necessary cultivation ruin a crop for a whole season.

3rd. Keep the land properly drained. Allow no surface water to become stagnant or heated by the sun's rays, neglect of this precaution in bad weather means sudden death to Bananas. I have seen a whole row destroyed in three days.

4th. Do not plant too close unless one or two crops are all the planter wishes to reap, say 14 ft. square for level lands that can be ploughed and 10 ft. square for hill sides. Let the rows be straight to enable the planter to detect trespass and theft easily.

5th. Leave suckers that will fruit in succession at intervals longer or shorter in accordance with the fertility, or poverty of the soil. In rich soils the intervals may be as short as 2 or 3 months, in poor lands 4 to 6 months. Two stalks should not be permitted to shoot at once if it is possible to avoid it. If several suckers of the same size are left in one root it takes longer for them to mature, and even if the land is good, the bulk of the fruit will not be ready in the spring when good prices are the rule, but late in the season when the demand is less, and prices unremunerative. The cultivator, if he is an observant man, will soon discover the capabilities of his land, and be in a position to control the yield of fruit.

6th. To ensure ratooning, the land must be kept thoroughly broken up and pulverized, by forking or ploughing and harrowing. Care should be taken that the plough is always followed by a harrow. It is injurious to leave the land in heavy clods unfit for plant growth.

7th. Bananas always throw suckers outwards, so that ratoons grow away from the original plant. The rotted trees in the centre form a barren circle after a few years. This circle can be sweetened, and made available by application of *unslacked* lime.

8th. Green grass or Cow peas, forked or ploughed in, keeps the soil loose and supplies nitrogenous food to the plants, encouraging early maturity.

9th. Too many of our small proprietors waste a great deal of their time in efforts to obtain a trifle more per bunch for their bananas, by carrying it themselves to the shipping port, instead of selling it on the spot, and devoting their energies to planting and cultivation. They often expend time worth four shillings, to obtain one shilling on the sale.

10th. Sufficient care is not observed in carriage of fruit. Bananas which take twelve months to produce are often destroyed in five minutes from this cause. Rejections are greatly complained of, but in very many instances they are caused either by damage in carrying, or by immaturity of the fruit delivered. There are sometimes faults on both sides.

I promised you a few figures *in re* Banana Cultivation, and as my financial year has ended and my books have been closed, I append the particulars showing the results attained.

Stalks per acre, 339.

		£	s.	d.
Gross sales per acre	...	£27	1	3
Cost of cultivation and delivery per acre	...	6	18	6
Net profit ...	...	£20	2	9

		s.	d.
Selling price per stalk	...	1	7½
Cost per stalk cultivation and delivery	...	0	4¾
Net profit per stalk	...	1	2¾

Cultivation per acre.

Each acre was weeded, ploughed, and harrowed seven times during the year; forked around the roots once in the year; suckered regularly whenever the suckers shewed.

I may remark that forty acres of my cultivation have been bearing since 1886 and are still in cultivation.

My crop in 1887-88 when I took charge of the property, averaged ten six-hands to one nine-hand. The crop for 1892-93 averaged fifteen whole bunches to one six-hand. This has been done without the aid of manure, and shows the result obtained by improved methods of cultivation.

I hope these figures will be of use to you, They are taken from my books and can be relied on.

My figures include cost of keeping up herd of cattle, cleaning and fencing pastures, watchmen, headmen, salaries, general supplies and all minor improvements.

Yours, &c.,

Henry Cork.

NOTES ON POTATO CULTIVATION.

As the cultivation of the so-called Irish Potato is not carried on to any great extent in Jamaica, and the methods usually adopted by experienced growers elsewhere are not clearly understood by small planters, a few words on the subject may be useful. There is no reason why this highly important

article of food should not be largely, and profitably grown in the hills of Jamaica. At the higher elevations this crop is liable to considerable variation in yield and quality of produce, but as a rule, the potatoes grown near Cinchona, for instance, are excellent. The method of cultivation usually followed by the settlers here is to open shallow trenches with the hoe, drop the seeds (sets) in the trenches and roughly cover with soil. When the tops are a few inches high they are moulded once, and no further cultivation is considered necessary. No manure is employed, unless the patch of ground happens to be near the owner's yard, when such as he can scrape together is sometimes used. Perhaps there is no crop that shows better the effects of good cultivation than the potato. An instance illustrating this occurs to me whilst writing. On a property in the north of Ireland I remember to have seen potatoes of the same variety grown at the same season of the year in the vegetable garden, and in the open field. In the garden the ground had been thoroughly trenched but only lightly manured; the potatoes as they grew were carefully moulded with fine soil; the ground between the rows was occasionally forked over and broken up fine, taking care not to injure the young roots and tubers, and the whole was kept rigidly clean. A very large crop of clean skinned potatoes was the result, and these when cooked were dry and floury. The field corp was cultivated mainly by means of the plow, manure being freely used, but the yield was not nearly so large as in the garden, and there was a very much larger per centage of small, and diseased tubers, and in point of quality the potatoes were not to be compared with those from the garden.

Of course the farmer with his five, up to fifty acres or more, cannot bestow the same care and attention usually given to the small garden plot, but as growers in Jamaica only plant small areas of this crop, they should endeavour to follow the garden method of cultivation as nearly as possible. Mr. Shirley Hibberd, an eminent authority, says:—

"The potato, though peculiar and capricious in constitution, is nevertheless a very accommodating plant. Hence it may be grown with some degree of success, depending, of course, on the nature of the season, on any kind of soil that will produce a mere blade of grass. I have many times lifted crops of 15 tons to 20 tons per acre from low-lying undrained clay land, where in such seasons as 1860 or 1879 the sets would rot in the soil without starting, or at the very best would produce a crop that would not pay for lifting. Perfect drainage seems to be the first requisite to success. From the moment the plant becomes waterlogged it has received its death-blow; but given depth of soil and full exposure to daylight, with free escape of every drop of moisture the plant does not require, and a fair crop commensurate with the conditions may be looked for in a season fairly favourable to vegetation. There is probably no plant in cultivation that can equal the potato in scraping money out of sheer sand, or shale or starving chalk and limestone."

I have had on several occasions endeavoured to convince small growers, who merely place the sets in the ground and obtain fairly good results, that if they would at any rate loosen the soil, and apply a little manure their crops would increase in value probably ten-fold, but have always been met with the excuse that it would not pay to do so. This excuse is a very poor one, when we consider the low rates of wages paid to field labourers, that suitable land can be rented at a few shillings per acre per year, and that all their marketable potatoes can readily be disposed of at 1½d or 2d per lb. Compare these conditions with those under which the growers in market gardens near London labour. A writer in the "Gardeners' Chronicle" in 1878 remarked:—

"When a grower of potatoes for market can undertake to rent for a short season of six months land for the purpose of growing potatoes for market at a charge of £13 per acre, it might well be asked, how are the profits to be obtained, and what kinds of crops are to be looked for? For this price the land is taken, well manured, and fairly well cultivated, the planter having the choice either of casting out drills with the plough or dibbling the sets in. In the present case the former plan is adopted: the seed is laid in rapidly by women and boys, and plough moulders follow behind and cover in as fast as the sets are laid. A wooden roller presses down the apex of the ridges thus formed, and presently harrows will be run over the ground and this will leave it in excellent condition for hoeing when the crop is well through the ground. The average quantity of seed per acre is about 30 bushels of small and 35 bushels of large. The present average price of seed of Victorias is 5s. per bushel, which, exclusive of labour, adds to the expenses about £8, and if £6 be added for labour and general cost per acre, for lifting and other charges, it will make a total of £27 per acre, to be deducted from the value of the crop before there is any profit to go into the hands of the cultivator. Potatoes are a risky crop, late frost may injure them, drought may check them, excessive moisture may provoke an undue amount of haulm growth and a severe attack of the inevitable disease. A good crop would be 8 tons per acre on ordinary fields, and from that may be deducted ½ a ton of chats worth about 15s. for pigs' food, and 1½ tons of seed size, leaving 6 tons of ware for market. "This estimate will only be fulfilled if there be no disease, but if, as is too often the case, one third be diseased, the largest tubers as a rule being the worst, then at most there will be but 4 tons of ware tubers for the market, and only 1 ton of seed. The price of potatoes in the market is affected by the state of the crop, which because of the immense extent of ground planted, is certain to be an abundant one if there be no disease, and the price will then range from £4 to £5 per ton. With a clean crop of Victorias held over until the market had settled down to its winter price at £5 per ton, the amount realized per acre for 7½ tons would be £37 10s. and adding 15s. for the ½ ton of chats, £38 5s. A diseased year would give 5 tons at about £9 per ton, which would give a total of £45 15s., a better paying crop, though less in bulk; but as the disease is so irregular in its effects it may be that this particular grower would not have more than one half a crop clean for sale, a common result when the disease is very prevalent, and therefore it would not be safe to look in any case for a product that should realize more than £40 per acre under any circumstances. If from this be deducted the £27 per acre for expenses, and at least £3 for cartage to market, it will be found that £10 per acre is no great profit to look for out of such a venture, as all the amount deducted must be paid in hard cash before the crop can be marketed.

"In spite of all the contingent losses to which the cultivation of the potato for market is liable, it is evident that it is in market districts still one of the most widely grown, and best paying crops."

The potato crop of Great Britain is estimated to be of the annual value of £16,000,000, and in addition to this, potatoes to the value of several millions sterling are yearly imported.

Potatoes will grow in almost any kind of soil with good cultivation, but a good friable loam, rather light than otherwise, and free from stagnant water is the best. Good potatoes are produced in light sandy soil, but a liberal supply of manure is necessary to ensure a heavy crop.

Manure.—The quantity, and kind of manure to be employed must depend on the nature of the soil: to a light, sandy soil a liberal supply of thoroughly decomposed manure should be given, but if the soil is of a heavy, damp nature, half rotten long manure is best. In hot dry soils, cow dung, when it can be obtained, is preferable, as it retains more moisture than stable manure, but it should be well mixed with litter. Pigs' dung is too powerful in an unmixed state, but when mixed with about twice its own bulk of earth it forms an excellent manure. Generally speaking, however, for the hills of Jamaica farm-yard manure, that is the excrements, both solid and liquid, of the various animals kept about a place, mixed with litter and refuse and allowed to decompose, is probably the best.

"Seed" or sets.—There is some difference in opinion as to whether the tubers should be planted whole or cut, but from experiment made in the Gardens of the Royal Horticultural Society at Chiswick, London, it was found on the mean of two plantations that the produce from cut sets exceeded that from whole tubers by nearly one ton per acre. Good sized tubers are considered best for sets. The eyes in a potato are true buds, and it stands to reason that good sound tubers with strong eyes or buds will produce much more healthy and vigorous plants than small tubers with comparatively weak eyes. This also, has been proved by actual experiment.

When good sized tubers are used for sets they may be cut in halves, passing the knife through from the bunch of eyes at the top, and generally the halves may be divided again. One good eye to each set is all that is really necessary, but it is safer to cut the set so that it may two eyes,as sometimes an eye so blind, or so weak as to be unable to push.

The sets should not be planted for a few days after being cut, but kept in a dry place, and some wood ashes or such like material mixed with them to absorb the juice exuding from the fresh cuts, and thus prevent decay setting in.

Planting.—Potatoes are planted here from December on to the following March, but January and February are considered the best months for putting in this crop.

Modes of Planting.—For garden cultivation, or small patches of ground, drawing drills with the hoe, if the soil is well pulverized, or digging trenches are probably the best methods. I have no doubt that drawing the earth into hills, as is done for sweet potatoes, and planting one set in each hill would be an excellent plan. By this means each plant could be moulded with fine soil when needed, and the hills being above the level of the ground would ensure good drainage, and it should always be borne in mind that two of the main things necessary to ensure success in the cultivation of the potato are good drainage, and a good body of pulverized soil. In heavy wet ground a good plan is to throw the soil up in ridges. These are really raised beds about 4½ feet wide, with trenches 18 inches wide between them; the soil taken from the trenches is thoroughly broken up, and used for covering the sets, and for moulding the plants later on. The trenches act as so many drains during heavy rains and keep the ridges comparatively dry.

Some growers spread the manure on the ridges, or in the drills or trenches just previous to planting and lay the sets on it, but this is not considered a good plan, as later on the young tubers come into direct contact with the manure which causes them to scab, and as manure is provided to afford nourishment to the fibrous roots, not the tubers, it is a mistake to run the risk of spoiling the appearance of a crop by adopting this method. For field cultivation I should recommend opening trenches or drills from end to end of the ground, spread the manure evenly in the bottoms of the trenches, or on the tops of the ridges if that system of cultivation is adopted, and cover it to the depth of a couple of inches with fine soil, then lay the sets and cover up. If only a garden, or small piece of gronnd is to be planted, it will be better if it is evenly manured and well dug over sometime previous to planting, and when the season comes round the trenches can be opened and the sets planted without any further manuring.

Dibbling in the sets is a system followed in England to a considerable extent, but unless the soil has been well cultivated previously it is not a system to be recommended here. The sets are likely to be placed at unequal depths, and the chances are that the eyes will be turned down in the holes instead of being placed uppermost, and in performing the work the ground gets trodden unnecessarily, the consequence being that if dry weather follows the soil cakes and the buds are unable to push through it, whereas if rain follows immediately after planting, it collects in the holes and as likely as not causes the sets to rot.

Distance apart.—The distance at which the sets should be placed apart varies with the nature of the soil and vigour of the kind grown; in rich soils a greater distance should be allowed than in poor soils. In general, the distances should be 2½ to 3 feet between the rows, and 12 to 15 inches between tho sets in each row, but, as a rule, the greater the distances the better the yield.

Depth.—The depth to which the sets should be covered also varies somewhat, but 4 to 5 inchos in heavy, and 5 to 6 inches in light soils are about the proper depths.

Subsequent Culture.—This consists in keeping the ground free from weods, earthing up the plants as they advance in growth, and keeping the soil stirred and fine as the more it is pulverized the better, but taking care not to injure the young roots, or tubers.

Lifting.—When the tops aro observed to wither from natural decay the crop may be lifted, and this should not be delayed too long, as if so, in this climate the new tubers are apt to vegetate. Choose fino, but if possiblo cloudy woathor, as potatoes should be exposed to light, and especially bright sun-

shine, as little as possible. Exposure to the sun causes tho tubers to turn green, and it is well known that the green parts of a potato contain a more or less poisonous principle. After lifting, the potatoes should be stored in a dry airy room or shed, but light should be excluded as much as possible. Potatoes are too often seen exposed to the light, and when such are cooked they are yellow in appearance and have a decidedly bitterish flavour, whereas if kept in the dark till required for cooking they would be white and floury.

Varieties.—There are hundreds, probably thousands of varieties of the potato, but those most suitable for Jamaica cannot yet bo named with any degree of certainty,

Experiments are now being carried out at the Public Gardens, with a number of varieties, with a view to ascertain not only a few of the most suitable kinds, but also the best months of the year for planting. The following are highly thought of, and largely cultivated in England :—Early Ashleaf, Myatts' Prolific, Early Pearl, Victoria, Triumph, Snowflake, Magnum Bonum, Schoolmaster, Flourball, Beauty of Hebron, Regent, Red-skin-Flourball.

Of course with such an immense number of varieties to choose from, in different districts different kinds are grown, and in the same district one grower will prefer one kind of potato to another for his general crop. The kinds usually grown in market gardens near London are Ashleaf Kidney, Myatts' Ashleaf, Lapstone Kidney, Regents and Victorias.

Diseases and Insects.—Potatoes are attacked by various diseases and insects, but the most formidable of all is tho well known potato blight or disease which causes such devastation amongst this crop. Much has been written about, and many remedies suggested for checking this dreaded disease but so far without much success. The disease is a fungus which makes its first appearance on the foliage, and then descends to the tubers. When the plants are attacked, the leaves curl up aud become black, and in a few days the whole haulm is in a state of putrefaction.

The spores of the fungus float in the air, and are brought into contact with the plants by various sgencies, wind, birds, insects, &c.

It is well known that wet weather greatly accelerates the progress of the disease, as then the atmosphere is humid, and in a state conducive to the rapid germination of the spores, which are carried along by the driving rain, and find a congenial resting place on the leaves of the potato plant.

I attribute the presence of the disease, and consequent failure of the potato crop at Cinchona this year to the wet seasons which we have had. The plants looked the picture of health, when, after a few showers of rain, the disease was noticed. The affected parts were at once carefully removed, and the ridges watered with a solution of sulphate of iron which is said to check the disease, but all to no purpose; the disease spread. and what was a few days before a flourishing patch of potatoes was converted into a mass of decaying vegetable matter. When once potatoes are decidedly diseased cure would appear to be hopeless.

Land for potatoes should, where possible be selected in an open situation, and well drained instead of in low-lying, confined spots. In the former the plants will be stronger and better able to resist the disease should it make its appearance, than when grown in close situations tending to produce a rank growth of tops which fall an easy prey to the disease.

I am indebted for some of the foregoing information to an excellent little book entitled "The Potato in Farm and Garden" by R. Fremlin. W. Harris.

NOTES FROM THE MUSEUM, INSTITUTE OF JAMAICA.—II.

By C. H. TYLER TOWNSEND, Curator of the Museum.

No 62. The Tobacco or Cigarette Beetle.

A complaint has come to hand, through the Director of Public Gardens, from a prominent cigar manufactory in Kingston, of the ravages of an insect severely damaging stock tobacco and cigars in its warehouses. Specimens were obtained, both adults and numerous larvæ, which proved to be, as was expeced, the common cigarette beetle, *Lasioderma serricorne.* The small larvæ look like miniature "white grubs." The adults are small pale brown beetles a little larger than a pin's head.

This is a well known cosmopolitan pest to cured and made up tobacco. It bores through leaf-tobacco, cigars and particularly cigarettes. It infests not only tobaccos, but also all sorts of drugs and spices, Cayenne pepper and other pungent substances. It has caused severe damage in tobacco establishments in Kentucky, Baltimore and North Carolina, and is doubtless the pest which does such a vast amount of damage to cigars in Brazil and the West Indies, where it has apparently never been identified before.

The damage results from the adults and larvæ eating their very small channels through the leaf tobacco, thus ruining it for wrappers; while the eggs or very young larvæ contained in the fillers or binders, in the process of being made into cigars, afterwards grow and eat their way out through the wrappers, thus destroying the draught of the cigar. In the same manner, from infested cigarette tobacco, after being made up, the beetles eat their way out through the paper, thus rendering the cigarettes worthless. These beetles easily spread from one establishment to another. They are night flyers, and gain access to warehouses by flying in the windows or other openings at night only. Or they may be brought in stock tobacco from another establishment. They are sometimes very plentiful one year, and then disappear for several seasons. They damage cigarettes more extensively than cigars in the United States.

The best remedy to be employed in an infested manufactory, as advised by Professor Riley, is to thoroughly steam all the tobacco in stock, and keep it in tightly closed boxes when not in use. Thorough steaming will destroy all stages including the eggs. All possibly infested cigars and cigarettes should be isolated in a close room apart from the stock, after the latter has been thoroughly steamed, so as to prevent tho stock from becoming re-infested. Windows and all openings should be kept closed at night. This steaming may affect the peculiar aroma of the tobacco intended

for cigars, and which so much care has been taken to artificially produce in the processes of curing and manipulating. But as soon as the pest has once been thoroughly eradicated from the buildings, it will probably be sufficient thereafter to carefully examine all later stock brought in, to see that the beetle is not introduced again in any of its stages. If such is found infested, it must be at once subjected to the steaming process. Either the steaming done in the preparation of cigarette tobacco is not thorough enough, or else the tobacco is left exposed for a longer or shorter time after steaming, and becomes re-infested before it is made up. In addition to the above, other precautions must be taken. All cigars and cigarettes made up during the day, should be packed away, or closely covered with flannel cloth. Refuse or dirt heaps should not be allowed to remain on the floors over night, and the walls and floors should be kept clean. A careful observance of the above recommendations will secure immunity from the pest.

Oct. 20th, 1893.

FERNS: SYNOPTICAL LIST.—XXIV.

Synoptical List, with descriptions of the Ferns and Fern-Allies of Jamaica, by G. S. Jenman, Superintendent Botanical Gardens, Demerara, (continued from Bulletin No. 48.)

20. *Asplenium lunulatum*, Swartz.—Stipites numerous, stiffly erect from an upright fibrous rootstock, cæspitose, 2 - 5 in. l. light or dark brown, green margined; rachis similar, not winged; fronds erect, pinnate, ½ - 1¼ ft. l. 1½ - 2 in. w. thin, naked, dark glossy green; pinnæ very numerous, horizontal, the lower pairs distant and little or not reduced and deflexed, upper approximate, passing, gradually into the lobate-serrate acuminate apex, oblong ¾ - 1 in. l. 3 - 4 li. w. blunt and rounded, inferior base cut away with a curve, the upper truncate, deep, and in the lower ones rather auricled, evenly serrulate, teeth blunt, the inner double and outer single; veins pinnate, inner ones forked; sori very oblique, 1½ - 2½ li. l. straight, near the mid-vein; involucres narrow, pale, thin.—*A. erectum*, Bory.

Var. *A. strictum*, Brack.—Fronds as large, pale green; pinnæ uniformly pinnate, the segments narrow, blunt, often rather falcate, 2½ li. l. ¾ li. w. with a space their own width between, a vein, simple or forked, and a single sorus to each, the interior auricle generally uncut, cuneate flabellate and deeply toothed.—*A. rhizophyllum*, Hook. and Grev. t. 193. *A. dubium*, Brack, *A. erectum*, var. *subbipinnatum*, Hook. *A. erectum*, var. *pinnati-partitum*, Mett.

Var. *parvulum*, Jenm.—Delicate, fronds 2-3 in l. ¾ in. br. stipites ½-1½ in. l. pinnæ 3-8 li. l. 2 li. w. sori ½ li. l.

Common in situations on the banks of spring sand streams and on rocks under shade from 3,000 to 5,000 ft. alt. The fronds are much longer than in *lætum* and the pinnæ less cut away, while the stiffly erect habit and uniformly round-ended pinnæ mark it from *pteropus* and *harpeodes*. The var. *A. strictum* at first sight might justly be regarded as perfectly distinct, but I have gathered fronds in the upper parts of the forest streams of the Port Royal mountains, where both are common, exhibiting every stage of the passage from one extreme to the other. The second variety was gathered on rocks in the interior of Portland.

21. *A. harpeodes*, Kunze.—Rootstock stout, short, decumbent, densely clothed with fine attenuated, dark scales ¼-½ in. l.; stipites cæspitose, 2-4 in. l. stiff, subterete, polished dark, brown or blackish, naked; rachis similar, channelled, fragile, fronds pinnate, prostrate—spreading, very thin, dark glossy green, naked, 1-2½ ft. l. 2-4 in. w. reduced at the base; pinnæ very numerous, horizontal, or decurved, the lower distant and flabellate, those above with usually half or quite their own width between, 1½-3 in. l. 4-6 li. w. shortly cut away in a curve on the inferior base, the upper base expanded, truncate and deep, tapering thence outwards to the acute or acuminate or sometimes elongated and attenuated point; both margins evenly and deeply serrated with blunt or rounded teeth ½-¾ li. w.; veins pinnate, the interior flabellate, outer simple; sori copious oblique, 1-2½ li. l. near the distinct mid-veins, distant from the margin; involucres narrow, pale, straight, at length concealed.—Hook. Sp. Fil. vol. 3, t. 178.

Frequent in forests at the highest elevations on the ridges and peaks above 6,000 ft. alt.; resembling *bissectum* in habit of growth, but differing in texture, character of serratures and direction of the venation and sori. The nature of the rootstock readily distinguishes it from *pteropus* and *lunulatum*. In the larger fronds some of the pinnæ become elongate-attenuate, extending to 3 - 4 in. in length, the outer part being barren, while the rest of the pinnæ remain normal.

22. *A. falcatum*, Lam.—Rootstock shortly elongated, clothed with small dark reticulated scales; stipites tufted, ½ - 1¼ ft. l. strong, grayish or dark, channelled, puberulous; rachis similar; fronds pinnate, ¾ - 1½ ft. l. ¼ - ¾ ft. w. the base truncate, the upper part passing gradually into the linear-lanceolate, inciso-serrate, acuminate point, dark green and glossy, paler beneath, glabrous, stiff and coriaceous; pinnæ several or many to a side, spreading obliquely or sub-horizontally, sub-distant, 3 - 6 in. l. ½ - ¾ in. w. acuminate or attenuate, the base stipitate. and obliquely cuneate, the lower ones, which are the larger, expanded or auricled on the superior base, serrato-entire, or deeply and obliquely incised and serrate with groups of sharp teeth which gradually become single in the attenuated outer part, veins obscure, oblique, 2 - 3 times forked, midrib channelled above; sori linear, ¼ - 1 in. l. at an acute angle with the midrib, from which it extends to near the margin; involucres firm, narrow entire. *A. erosum*, Linn. (ex parte) Hook. Sp. Fil. vol. 3, t. 198. *A. erosum*, Mett.

Common on steep stony forest ground and on shady banks and cliffs from the lower hills up to 4,000 ft. alt.; very stiff and firm of substance, of a dark cloudy green colour, variable in size of fronds, pinnæ, degree of serration or incision, and length of the sori. The largest form, in which the pinnæ are long and attenuated, the margins deeply incised and eroded, and the sori from ½ - 1 in. l. is found in lowland woods; the mountain form being much smaller, darker, the pinnæ serrato-entire and not attenuated. The sori in both form a single series, never duplicated; nor is it ever diplazioid. I have

adopted in preference Lamarck's name of the E. Indian, Malayan and Australian plant, with which ours is absolutely identical, and to which it was referred by Swartz, in preference to the older Linnæan name, *A. erosum*, which was partly founded on this and partly on *A. auritum*, Sw.

23. *A. dimidiatum*, Swartz.—Rootstock strong, erect or oblique, often fascicled, very densely clothed with attenuated, serrated, reticulated dark scales; stipites tufted, several, erect, 4-8 in, l. dark coloured; rachis similar, channelled, fibrillose with scattered dark reticulated scales, or nearly naked; fronds pinnate, coriaceous, stiff, light or dark green, lanceolate-oblong, ½-1¼ ft. l. 3-6 in. w., base truncate, apex terminated in a deeply inciso-lobate elongated acuminated point; pinnæ spreading, glabrous, subdistant, 6-12 to a side, 2-3 in. l. ¾-1 in. w. base stipitate and obliquely cuneate, the inferior side much cut away in a straight line, the upper and outer deeply and irregularly incised lobed and serrated, terminating generally in two major somewhat divergent linear-lanceolate acuminate dentate or incised points, the upper of which is usually considerably the larger, veins flabellate, no distinct midrib; sori straight, variable in length, copious, flabellate, ½-1 in. or more l.. involucres narrow, firm.—*A. zannifolium* Kze.

Frequent in isolated situations on rocks near the banks of shady streams from 3,000-4,000ft. alt.; marked by the exceptionally shaped deeply incised and lacerated pinnæ, all the incisions being directed to the basal axis. The habit is erect, not pendent as in the preceding and following species.

CONTRIBUTIONS TO THE DEPARTMENT.

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Key to Kansas Trees in their Winter condition. [Prof. Hitchcock.]
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PLANTS.

From Royal Gardens, Kew. (Two Wardian cases.)

Acanthophœnix crinita.
"Acanthaceous climber." Sierra Leone.
Aristolochia gigas var Sturtevantii.
Aristolochia Westlandi.
Camoensia maxima.
Cinnamomum sp.
Gardenia sp.
"Handsome Shrub." Sierra Leone.
Hyophorbe amaricaulis.
"Large fruited plant." Rio de Janeiro.
Maniltoa gemmipara.
Melhania erythroxylon.
Nephrosperma Van Houttcana.
Oncosperma tigillaria.
Cassipourea sp.
Coffea arabica. Var Mexicana.
Coffea sp. Sierra Leone.
Cordia monoica.
Dermatobotrys Saundersiæ.
Desmodium pulchellum.
Dillenia sp.
Erythroxylon Coca.
Gardenia sp.
Godwinia gigas.
Ixora incarnata.
Kigelia sp.
Leguminosæ.
Pandanus sp.

Ptychoraphis augusta, Becc.
Sarcocephalus cordatus.
Shorea Talura ,Roxb.
"Small Tree." Sierra Leone.
Streblus aspera.
Strobilanthes cuspidatus.
Strobilanthes gossypinus.
Strychnos sp.
"Tree." Sierra Leone.
Verschaffeltia splendida.
Zingiber sp.
Eupomatia Bennetti.
Passiflora racemosa.
Phalcria laurifolia.
Siderxylon dulciferum.
Tacsonia sanguinea.
Vanilla sp.
Andropogon Schœnanthus.
Barbaccnia squamata.
Bassia Parkii.
Cassia sp.

From Royal Gardens, Kew..
Raphia vinifera. Uncaria sapientum.
From Govt. Botanist, Melbourne.
Acacia dealbata.
" decurrens.
Anigozanthos Manglesi. Brachychiton Gregorü.
Casuarina Decaisneana.
Eucalyptus corynocalyx.
" diversicolor.
" punctata.
Euchlaena mexicana. Kennedya sp.
From Botanic Gardens, Bangalore.
Thunbergia laurifolia.
From Botanic Gardens, Adelaide, and S. Australia.
Acacia aulacocarpa.
A. auriculiformis.
A. cyanophylla.
A. drepanocarpa.
A. longifolia.
A. holosericea.
A. sentis.
Adansonia Gregorü. Agonis flexnosa.
Bauhinia Leichhardti.
Brachychiton diversifolium.
B parodoxa
Caesalpinia tora.
Callistemon speciosus.
C. salignus.
C. rigidus.
Cassia Brewsteri.
Casuarina humilis.
C. stricta.
Clematis glycinoides. Clerodendron tomentosum
Cochlospermum Frascrii. Cupania semiglauca.
Cyperus decompositus. Doryanthes Palmeri.
Dysoxylon Schultzei.
Eucalyptus cornuta.
E. rostrata.
E. Lehmannü.
E. gomphocephala.
E. corynocalyx.
E. resinifera.
E. calophylla.
E. grandifolia.
E. miniata.
Elæocarpus cyaneus.
E. australe.
Frenela intratropica.
F. rhomboidea.
Gardenia megasperma.
Grevillea mimosoides.
G. chrysodendron.
G. heliosperma.
G, robusta
Rhynchospora aurea.
Plant from Ceylon.
Rio de Janeiro.
Musa sapientum.
From Mr. J. R. Reece, Pedro.
Lacebark Seedlings.
From Dr. Henderson, Kingston.
Epidendrum Lindleyanum.
Lælia majalis.
From Mr. F. N. Isaacs.
Cattleya Skinneri.
Brassavola sp. (Demerara.)
From Mr. C. H. Levy, Serge Island Estate.
Ficus repens.
Oreodoxa regia.
From Mr. C. R. Isaacs, Rowington Park.
Eichornia paniculata.
From Miss Gordon, Mile Gully.
Otaheite orange.
From Mr. Thos. Christy, London.
4 cuttings Polygonum sachalinense.

SEEDS.

Hakea pandanicarpus.
H. cucullata.
H. acicularis.
Helicia australasica. Heimeyclia sepiaria.
Heptapleurum venulosum. Ipomæa alata.
Melaleuca hypericifolia.
M. genistifolia.
M. symphyocarpa.
M. Preissiana leiostachya.
Metrosideros paradoxa. Myosporum Cunninghamii
Nephelium leucocarpum.
N. tomentosum.
Notelœa longifolia. Olinia cymosa.
Personia falcata. Pithecolobium pruinosum.
Pittosporum bicolor.
P. melanospermum.
Polyalthia Holtzeana. Psoralea testariæ
Rhus rhodanthema. Spondias Solandri.
Sterculia acerifolia.
S. heterophylla.
Syncarpia laurifolia.
Tristania conferta.
Vitis acetosa.
Zanthoxylon parviflorum.
From Botanic Gardens, British Honduras.
Attalea Cohune.
From Reasoner Bros., Oneco, Florida.
Callicarpa americana, Biota orientalis.
Chionanthus virginica. Catalpa Kæmpferi.
Hibiscus grandiflorus. Ceratotheca triloba.
Hibiscus incanus. Duranta Ellisii.
Prunus Chicasa, Duranta Plumierii.
Rubus cuneifolius. Myrsine floridana.
Rubus flavus. Myrtus tomentosus.
Psidium Cattleyanum. Sabal Palmetto
From Royal Botanic Gardens, Trinidad.
Hevea braziliensis.
From H. Caracciola, Trinidad.
Thrinax radiata.
From Mrs. Heaven, Whitfield Hall.
White Cosmos.
Scabious mixed.
Crimson Linum.
Pansy.
From Hon. J. W.Fisher, Mahogany Hall.
Breadnut. (Brosimum alicastrum.)
From Messrs. Machado, Kingston.
Tobacco seed.
From Mr. Geo. Nash, Mandeville.
Cedar seeds.
From Miss Barrett, Browns Town.
Satin wood.
From Mr. F. Jackson, Kingston.
Alsike clover.

No. 50. DECEMBER, 1893.

BULLETIN

OF THE

BOTANICAL DEPARTMENT,

JAMAICA.

CONTENTS:

PRICE—Twopence.

A Copy will be supplied free to any Resident in Jamaica, who will send Name and Address to the Director of Public Gardens and Plantations, Gordon Town P.O.]

JAMAICA:
GOVERNMENT PRINTING OFFICE, 79 DUKE STREET, KINGSTON

1894.

REPORT

OF THE

DIRECTOR OF PUBLIC GARDENS AND PLANTATIONS,

JAMAICA,

FOR THE YEAR ENDED 31ST MARCH, 1893.

CONTENTS.

REPORT OF THE DIRECTOR OF PUBLIC GARDENS AND PLANTATIONS, JAMAICA, FOR THE YEAR ENDED 31st MARCH, 1893.

Hope Gardens.

Expenditure.—The work of extension of the Gardens has been prevented by several expenses. The water-pipes laid down in 1888–89 have been paid for by annual instalments of £150, but during the year 1892–93, £300 was paid, completing the amount. Mr. John Campbell was acting as clerk at Hope, and was paid from the Hope Vote a salary of £100. Two Cart mules were purchased for £52, a tilting cart for £11, and £30 was spent for Flower Pots. Another sum of £30 was spent on Water-pipes for the Rose Garden. In forming this part of the Garden, sufficient pipes and bib-cocks were put down to enable the workmen to water any part of it without having to use more than one length of 50 feet of hose. This is an economical arrangement, as galvanised iron piping costs less than 9d. per foot for all expenses, and will last probably 25 years, while rubber hose will not last more than 3 or 4, and costs more than double the price of pipes. Besides, when long lengths of hose are lifted and pulled about over plants, many of them are injured and broken down. It was also necessary to put 4 new bib-cocks in the Nursery for convenience in watering the Nursery stock.

These expenses left only about £500, and Nursery and ordinary garden work absorbed this amount.

Nursery.—The Nursery is the most important part of the garden, for in it plants are propagated, and tended until they are distributed. During the year, over 27,000 plants have been distributed from Hope, and the labour implied in this fact is not always realised. To take Roses, for instance, a bed must in the first place be prepared for them with properly mixed soil, a substantial shading is erected, and the wood is taken carefully from the stock plants for the cuttings. To ensure 1,500 young plants, at least 3,000 cuttings are made. The bed must be carefully watered every day, sometimes twice a day, for eight or ten weeks. Then each plant is potted off and 1,500 names are written on labels. Similar work goes on with all cuttings of other plants. Raising plants from seeds involves quite as much labour. Sometimes, e.g. in the case of many palms, the seeds take months before they germinate, and have to be watched and watered all that time. When they germinate, the state of the atmosphere has to be considered. If there is too much moisture in the air, the seedlings are apt to damp off and perish by hundreds. If the air is too dry, they die from want of atmospheric moisture. Means are devised to remedy the defects of surrounding air. Another glass-roofed house however is much needed for raising seedlings. Encalypti must be potted before they are an inch high. This work can be trusted only to the most careful coolie, and naturally it proceeds very slowly. Other plants are equally troublesome When the seedlings are safely potted off and are growing vigorously they have to be watched to prevent their roots growing through the pots into the ground. Cocoa plants for instance, are shifted into new pots once a fortnight, otherwise the roots would take such firm hold of the ground that on removal they would be useless.

The stock of plants has been considerably increased, reaching a total at the end of the year of more than 60,000 plants, every one of which must be handled at least once in five weeks, rotten pots replaced by new pots, &c.

Pot plants.—A new stage has been erected for growing pot plants of all kinds,—it consists of three shelves, each 60 feet long, and 15 inches wide.

The collection of Tree Ferns under the large Divi-divi trees is in magnificent form some of the plants being twenty feet across. The general collection of Crotons and other pot plants consists of about 2,000 plants, and they are all in good condition. As there was some demand for larger plants growing in clay pots, a supply of them was prepared, and 191 large plants were sold.

Rockeries.—Two large rockeries have been made at the bottom of the Divi-divi walk, the one on the Western side being planted with Adiantums, and the one on the East with Gymnogrammes. These ferns have grown exceedingly well. The following are the names of these ferns.

On west rockery

Adiantum cristatum, Linn.
A. trapeziforme, Linn.
A. fragile, Sw.
A. tenerum, Sw.
A. concinnum H.B.K.
A. macrophyllum, Sw.
A. " var bipinnatum,
A. Kaulfussii, Kunze.
A. obliquum, Willd.
A. hispidulum, Sw.

On both Rockeries, Selaginella Wildenovii, Bak.
S. serpens, Spreng.

On east rockery.

Gymnogramme calomelanos, Kaulf.
G. sulphurea, Desv.
G. trifoliata, Desv.
G. rufa, Desv.
Pteris quadriaurita, Retz.
Hemionitis palmata, Linn.

Fern House.—The rockeries in the fern house have all been remodelled, and made much higher, being now from 3 to 4 feet in height. There are now 69 species of ferns growing on these rockeries and 3 species of Selaginella and all are flourishingly luxuriantly.

The following are the names of the ferns :—

Anemia adiantifolia, Sw.
A. Phyllitidis, Sw.
Aspidium Plaschnickianum, Kunze.
A. semicordatum, Sw.
A. triangulum, Sw.
A. " var glandulosum, Hook. & Grev.
A. Moritzianum, Kunze.
A. ascendens, Hew.
A. trifoliatum, Sw.
Nephrodium macrophyllum, Baker
N. cicutarium, Baker
N. conterminum, Desv.
N. patens, Desv.
N. Grisebachii, Baker
N. effusum, Baker
N. molle, Desv.
N. usitatum, Jenm.
N. Fendleri, Hook.
N. villosum, Presl
Nephrolepis cordifolia, Presl
N. tuberosa, Hook.
N. exaltata, Schott
Polypodium hastœfolium, Sw.
P. phyllitidis, Linn.
P. crassifolium, Linn.
P. pectinatum, Linn.
Gymnogramme rufa, Desv.
G. sulphurea, Desv.
G. calomelanos, Kaulf.
Meniscium angustifolium, Willd.
Hemionitis palmata, Linn.
Acrostichum latifolium, Sw.
A. lepidotum, Willd.
A. nicotianæfolium, Sw.
Dicksonia cicutaria, Sw.
D. apiifolia, Hook.
Davallia fumarioides, Sw.
D. inæqualis, Kunze
Adiantum obliquum, Willd.
A. tenerum, Sw.
A. fragile, Sw.
A. trapeziforme, Linn.
A. concinnum, H.B.K.
A. macrophyllum, Sw.
A. cristatum, Linn.
A. hispidulum, Sw.
A. pulverulentum, Linn.
A. Kaulfussii, Kunze.
Asplenium cicutarium, Sw.
A. fragrans, Sw.
A. dimidiatum, Sw.
A. hians, Kunze.
A. grandifolium, Sw.
A. celtidifolium, Kunze.
A. Franconis, Mett.
A. arboreum, Willd.
A. diminutum,
A. dentatum, Linn.
A. rhizophorum, Linn.
Cheilanthes microphylla, Sw.
Blechnum occidentale, Linn.
Lomaria procera, Spreng.
Pteris pedata, Linn.
P. grandifolia, Linn.
P. quadriaurita, Retz.
Cyathea Serra, Willd.
C. insignis, Eat.

Planting.—Trees have been planted in the different sections of the gardens according to the geographical arrangement on which the plan of the garden has been laid down. In the Tropical African section a commencement has been made towards putting the whole place under Bahama grass, fourteen chains of land have been levelled, and beds made containing the following African plants :—

Amphiblemma cymosum Naud. (Melastomaceæ.) Sierra Leone.
Cæsalpinia pulcherrima, Sw. (Leguminosæ.) Tropics.
Hibiscus schizopetalus, Hook. f. (Malvaceæ.) East Africa.
Mussænda luteola, Delile. (Rubiaceæ.) Nile Land.
Ochna Kirkii, Oliv. (Ochnaceæ.) East Africa.
Tinnea æthiopica, Kotschy. (Labiatæ.) East Africa.
Thunbergia (Meyenia) erecta, T. Anders. (Acanthaceæ) West Africa.
Do. var. alba.
Thunbergia Vogeliana, Benth. (Acanthaceæ.) Fernando Po.

Rosary.—The commencement of a Rose Garden was made during this year. A very large extension is needed to enable the Superintendent to grow in quantity the most desirable roses for which there is a large and increasing demand. The present stock of trees is quite inadequate to supply wood for cuttings in sufficient numbers. Five large beds have been made, each half-a-chain wide with a verge of Bahama grass, *(Cynodon dactylon)* four feet wide on all sides. The gravel walks between are nine feet in width, while at the back and bottom sides the walk is 15 feet wide. The total length of walk and grass verge is 800 feet each. The walks are covered nine inches deep with gravel. The length of the beds is 383 feet. The road in front of the Rose Garden has been repaired by the addition of about six inches gravel over a length of twelve chains. About 500 feet of 1 inch galvanised iron piping has been laid down, and ten stand pipes with $\frac{3}{4}$ inch bib-cocks attached, so that the whole of the garden can now be watered without using more than one length of hose.

Rose plants to the number of 998, consisting of 93 varieties were planted out, and the formation of the Rose Garden will be continued during the following year.

Economic Section.—Many plants of economic value are planted in the portion of the garden along the waste-water gutter, where they can often have the benefit of irrigation. This section illustrates the very great importance of water at the roots. Writers on the cultivation of Cocoa follow the historian Long who states, that " it will not thrive in the dry, low parts of the Southside," it is also maintained that " the rain-fall should not be below an average of 60 inches per annum." Now the Liguanea plain, to

which Long refers, has at Hope Gardens only an annual average rain fall of 53 inches, and yet as any one may see for himself the Cocoa trees are producing abundantly.

The plants that so far have been planted in this section are the following :—

Achras Sapota, Linn. (Sapotaceæ). "Naseberry". S. America.

Anona palustris, Linn. (Anonaceæ). "Cork Wood, Alligator Apple." Trop. Amer.

Artocarpus incisa, Linn. (Urticaceæ). "Bread Fruit." Malaya and Pacific Is.

Artocarpus integrifolia, Linn. (Urticaceæ). "Jack Fruit." E. Indies, Malaya.

Averrhoa Bilimbi, Linn. (Geraniaceæ). "Blimbing." E. Indies, China.

Bocagea (Oxandra), virgata, (Rich) (Anonaceæ). "Lancewood." W. Indies.

Cananga odorata, Hook. f. and Thoms. (Anonaceæ). "Kananga." Burma, Malaya.

Carica papaya, Linn. (Passifloreæ). "Papaw." Trop. Amer.

Caryocar nuciferum, Linn. (Ternstroemiaceæ). "Sonari or Butter Nut." Guiana.

Cedrela odorata, Linn. (Meliaceæ). "West Indian Cedar." S. Amer.

Cinnamomum leylanicum, Nees. (Laurineæ). "Cinnamon." E. Indies, Malaya.

Citrus medica, Linn. (Aurantiaceæ). "Citron." Trop. Asia.

Feronia elephantum, Correa. (Aurantiaceæ). "Elephant or Wood Apple." India and Ceylon.

Garcinia Morella, Desrouss. (Guttiferæ). "Gamboge Tree." E. Indies to Siam.

Grias cauliflora, Linn. (Myrtaceæ). "Anchovy Pear." W. Indies.

Guaiacum officinale, Linn. (Zygophyllaceæ). "Lignum Vitæ." W. Indies, S. Amer.

Hevea brasiliensis, Mull. Arg. (Euphorbiaceæ). "Para Rubber." Trop. S. Amer.

Manihot Glaziovii, Muil. Arg. (Euphorbiaceæ). "Ceara Rubber." Trop. Amer.

Mimusops Elengi, Linn. (Sapotaceæ). "Elengee." India.

Olea europea, Linn. (Oleaceæ). "Olive." W. Asia.

Picræna excelsa, Lindl. (Simarubaceæ). "Jamaica Quassia." W. Indies.

Simaruba glauca, DC. (Simarubaceæ). "Bitter Dan." W. Indies and Florida.

Spondias dulcis, Forst. (Anacardiaceæ). "Otaheite Plum." Cult. in Trop.

Theobroma Cacao, Linn. var. Forastero. (Sterculiaceæ). "Cocoa." W. Trop. Amer.

" " Criollo. " "

" " Callabacillo " "

Experiments are being carried out with potatoes, onions, and fodder-plants. The budding of oranges has also been tried on a small scale by the Superintendent, and has been partially successful. Buds were placed on some young shoots of an old cut-down lime hedge and some have grown.

Roads and Fences —The roads have been maintained and kept in a fairly clean state during the year, but the nut-grass (Cyperus rotundus) is a terrible pest, and involves great expense in keeping it down. The fences have all been repaired, and this work is being constantly carried on, as they are frequently destroyed by roving cattle which infest the roads and the adjoining lands of the Water Works.

Plants received.—Among the additions to the Garden during the past year, special mention must be made of three Wardian cases from the Royal Gardens Kew, containing Palms, Ferns, Aroids, and Trees, nearly all new to the collection, and all in first rate order. A list of these is given in Appendix II.

Roses of 43 varieties were purchased from Messrs. Paul, Waltham Cross. All the plants arrived in splendid condition. The following had flowered before the end of the financial year, and the first five have proved to be most desirable additions to our list of Roses. --Empress, Furstin Bismarck, Star of Waltham, Pride of Waltham, Waltham Climber No. 1, Princess Beatrice.

The following plants were purchased in London and are growing well :--Macrozamia spiralis (2), M. corallipes (1) ; two Xanthorrhea hastata that came in the same lot, died.

Number of Plants sold.

Nutmegs	...	3,674	Shrubs—varions	...	3,516
Chocolate	...	2,809	Crotons	...	2,399
Kola	...	1,218	Palms	...	1,822
Liberian Coffee	...	125	Roses	...	1,479
Miscellaneous Fruit Trees	...	754	Climbers	...	297
Misc. Economics	...	665	Ferns	...	357
Shade trees	...	435	Misc. Ornamental Plants	...	806
			Total number of Plants sold	...	20,356

Plants distributed free and in exchange :	...		To Parade Gardens	...	127
Free grants (various)	...	4,470	To Castleton Gardens	...	200
Eucalyptus	...	1,681	Sent out in exchange	...	103
To King's House Gardens	...	112			6,693
			Total number of Plants sent out from the Garden	...	27,049

Office work.—The work of the office is heavy, and especially the correspondence, 2,041 letters being received, and 3,244 written, by the Superintendent.

Visitors.—The number of visitors who signed the book was 1,125.

Sisal Hemp Plantation.—The Sisal Hemp plants are growing fast but the weeding is expensive.

Sugar Cane Ground.—The canes have received careful attention during the year. The collection is well known, and applications are frequently received from many parts of the world for specimen canes.

The Superintendent is Mr. Wm. Cradwick.

The elevation of the garden is 600 feet above sea-level.

The annual mean temperature is 77.4 F., and the average rainfall 52.83 inches.

The amount of rain that fell during the year was 57.22 inches.

The mean temperature was 77.4°F. The Meteorological tables for the different months is given in Appendix IV.

Hill Garden.

Roads.—The principal roads through the Plantation were cleaned, and several of them that required repairs, were put in order by grading, opening drains, and filling in ruts.

Fences.—The dividing and line fences were all overhauled during the year, and are generally in good order.

Pastures,—These were all billed and cleaned during the year. Feeding for stock at this elevation is scanty and poor, and if the pastures are not regularly cleaned the grass would be exterminated by weeds and bush.

Garden.—The usual Gardening operations were carried on during the year. Trenching and manuring beds and borders, cutting grass, pruning, raising and transplanting of annuals, &c., propagation and potting of Greenhouse plants, ferns and orchids, watering and weeding.

The two slopes in the Garden have been planted with the Mexican Daisy *(Erigeron mueronatum.)* These will look well when the Daisy thoroughly takes hold of the soil and spreads, and a great deal of labour will be saved in cutting the grass on the slopes, which had to be done by cutlass, and never looked neat.

A considerable portion of the grass verge along the shrub border was renewed, the old turf having become partly filled with hay-grass and weeds, looked unsightly. The walks were re-gravelled. It is intended to lay drain pipes across the walks at intervals to carry off the surface water, which accumulates during heavy rains, and succeeds on each occasion, not only in cutting up the walks, but in washing away a good portion of the sand and fine gravel.

The two Rose beds, and the Rose border were thoroughly renovated and planted with new roses, and the beds and borders have since been several times lightly forked over, and mulched.

Experimental Garden.—Peas : Experiments in the cultivation of peas were carried on, and the results were generally satisfactory. Tabular results of these experiments were published in the Bulletin.

The finest crops were those yielded by seeds sown in March and April, the peas being fit for use in May, June and July. But seeds sown in September, November and December produced good crops of excellent peas ready for use in December, January, February and March ; those sown in January, however, producing peas fit for use in April, were not so successful. Of the varieties sown in September, November and December, the following gave the most satisfactory results :—

Name.		Height.	Name.		Height.
Duke of Albany	...	6 feet	Carter's Balmoral Castle	...	5 "
British Queen	...	8 "	" G. F. Wilson	...	5 "
Laxton's Supreme	...	5 "	Princess Royal	...	6½ "
" Alpha	...	4 "	Marvel	...	6 "
" Prolific	...	5 "	Kentish Invicta	...	5 "
Carter's Empress	...	6 "	Abundance	...	2½ "
" Telegraph	...	7 "	Early Sunrise	...	3 "

Out of the 43 kinds grown at Cinchona, the following can be recommended for general cultivation :—

Name.		Height.	Name.		Height.
Carter's Dignity	...	6 feet	Carter's Empress	...	6 "
" Balmoral Castle	...	5 "	Abundance	...	2½ "
" Telephone	...	6 "	Marvel	...	6 "
" Telegraph	...	7 "	Bishop's Long Podded	...	8½ "
" G. F. Wilson	...	5 "	Princess Royal	...	6½ "
" First Crop	...	3½ "	Kentish Invicta	...	5 "

Name.	Height.	Name.	Height.
Laxton's Alpha ...	4 "	Tall Sugar ...	8 "
" Prolific ...	5 "	Ne plus ultra ...	8 "
" Supreme ...	5 "	Early Sunrise ...	3 "
Sturdy ...	4 "	Champion of England ...	7 "
Duke of Albany ...	6 "	William the First ...	5 "
British Queen ...	8 "	Emperor of the Marrows ...	7½ "

The following can be recommended as producing good crops :—

Name.	Height.	Name.	Height.
Bishop's Long Podded ...	2½ feet	Sturdy ...	4 "
Princess Royal ...	6½ "	Carter's Telegraph ...	7 "
Kentish Invicta ...	5 "	" Balmoral Castle ...	5 "
Laxton's Alpha ...	4 "	Abundance ...	2½ "
" Prolific ...	5 "	Emperor of the Marrows ...	7½ "
Duke of Albany ...	6 "	Ne plus ultra ...	8 "

The following can be specially recommended for excellence of quality :—

Name-	Height.	Name.	Height.
* Abundance ...	2½ feet	* Duke of Albany ...	6 "
* Carter's Balmoral Castle ...	7 "	British Queen ...	8 "
* " Telegraph ...	5 "	* Princess Royal ...	6½ "
" Telephone ...	6 "	Champion of England ...	7 "
" First Crop ...	3½ "	* Laxton's Prolific ...	5 "
" Dignity ...	6 "	" Supreme ...	5 "

Strawberries.—These should, and would no doubt, succeed well here, if they could be protected from the ravages of the larvæ of a beetle (Præpodes amabilis) which makes its appearance in large numbers during the summer months. When the larvæ are hatched, they burrow in the loose earth and feed on the tender roots of plants. They are particularly fond of the cultivated strawberry, eating up into the hearts of the plants and eventually killing them.

Applications of fresh lime well dug into the soil checks them for a time, but it is not always practicable to apply lime in this state, for instance when crops are growing, and besides the quantity of lime which would be required to exterminate the caterpillars would be too much for the constitution of most garden crops. During the coming season a small reward will be offered the work-people for catching and destroying the beetles, and it is hoped by this means to lesson in some measure the evil complained of.

Onions.—Seeds were received from the Botanical Gardens, Saharanpur, Northern India, of two kinds, "red onions" and "white Patna," and they promise well. A small packet of seed of the variety known as "White Queen" was sown by the Director, and the onions give promise of being exceptionally fine. This variety has been grown by Mr. Stephens, of Radnor, for some years and he speaks highly of it. The onions seldom fail to bulb, and grow to a large size often weighing as much as 16 ounces.

Fodder Plants.—The question of suitable fodder plants for high elevations in Jamaica is an important one, and has been engaging the attention of this Department for some time. Experiments are now being carried out and will be continued with all the grasses, clovers, &c., likely to succeed at this elevation, and it is to be hoped that one or more kinds will be found of sufficient merit to warrant their introduction on a much larger scale, and that in time they will become naturalized and prove as useful in the highlands as the indispensable guinea grass now is at lower elevations.

Guinea grass ceases to grow spontaneously at elevations from about 4,500 feet upwards. At 5,000 feet it requires to be planted by hand, in sheltered spots, to be kept free from weeds, and, if possible, manured, and even then it has a stunted appearance, and can only be cut about three times in the year. A Himalayan Grass (Pennisetum triflorum) grows well here, and animals are very fond of it, but unfortunately it does not appear to produce fertile seeds freely, so that there is not much likelihood at present of its spreading, unless it is planted. When it becomes thoroughly naturalized, however, it may produce good seed, and the question of its spreading would then be only one of time.

Red top grass (Agrostis vulgaris), Kentucky blue grass (Poa pratensis), and Texas blue grass (Poa arachnifera) are growing well and are much relished by stock, and I have reason to hope for good results from them, but they have not been for a sufficient length of time under trial to enable me to state whether they will produce fertile seeds and spread naturally. Of Clovers the following are satisfactory :—Scarlet (Trifolium incarnatum), Red Medium (Trifolium pratense), Cow grass (Trifolium pratense, perenne), and Japan (Lespedeza striata). Alfalfa, or Lucerne has also done fairly well, but it requires a good deep soil. These plants are not being treated as Garden subjects : beyond clearing the bush off the land and loosening the surface of the soil no cultivation has been attempted so that they are having a fair test as to their capabilities of holding their own in a poor soil.

Potatoes.—A small lot each of twelve varieties were received from Messrs. Sutton & Sons, Reading, once a month for eight months for trial, but each lot was attacked by a fungoid disease and killed to the ground.

Fruit Trees.—A consignment of fruit trees was received at the end of the financial year from Mr.

* Also included in the list of varieties producing the best crop.

John B. Beach, Florida. The consignment consisted of Pears, Apricots, Cherries, Peccan nut, Persimons, &c. Holes four feet wide and four deep were dug and prepared with good manure for these plants. Unfortunately the plants did not arrive in good order, many of them were without names, and others had labels attached the names on which were illegible. Had a little ordinary care been exercised in despatching the plants, the consignment would have been a valuable one.

The old Peach trees in the Garden had their roots uncovered in September, and covered up again in March, and bore fairly good crops of fruit, many of which, however, were spotted, and not of good flavour.

The liquid Cinchona Febrifuge manufactured by Mr. J. J. Bowrey was tried by the Medical Department; and one D.M.O. reported that "in the treatment of Malarial Neuralgia the liquid Cinchona Febrifuge was found to be invaluable combined with Hydrobromic Acid." He states that "the combined preparation was administered in 30 drops doses of each three times a day. Similar results were not obtained by the administration of either drug separately."

The number of plants sold during the year amounted to 760; and of Tree Tomato fruits 433 dozens, weighing 746 lbs.; 114 quarts of Green Peas; and 23 lbs. Onions.

The following plants were distributed free and in exchange:—

To Royal Gardens Kew: 31 species of Jamaica Orchids, 6 blocks of Filmy Ferns, &c.

Reports on Peach Plants Distributed from the Hill Garden in April, 1892.

Mr. R. H. Haughton, Kingston—(Water Works.) I regret to say that the Superintendent at Rose Hill reports that the trees referred to are not doing well, they are withering from the top downwards They blossomed early this year but the blossoms did not arrive at maturity.

Mrs. Hotchkin, Kingston—The Peach trees have not done well, indeed I fear they are quite dead.

Mr. E. G. Orrett, Kingston—(Pelcore.) The Peach trees are growing very quickly, but lately they are troubled with a white scale insect. The tallest tree measures about 4½ feet.

Mr. P. H. Baxter, Kingston—(Lucky Valley.) The Peach trees were too far gone when I got them and although I watered and nursed them they subsequently died.

Mr. A. DeMontagnac, Kingston—One of the trees died, but the other has grown to a height of 5 feet with a few slim branches. I have not as yet transplanted it from a tub in which it was originally planted.

Mr. C. W. Chapman, Kingston—I sent my four trees to Stony Hill, and Mrs. Nuttall writes:—"One Peach tree has grown very much within the last month or two, and the others look fresh and well. A single blossom appeared on one soon after they came, but resulted in nothing. I am looking forward to the Spring."

Captain Taylor, Hagley Gap—(St. Thomas.) "Bidwell's Lake" arrived in a dying condition. I planted it and it died off, but sprung up from the roots and is now doing well. "Ceylon" has grown to a height of 18 feet and is 8 inches round the stem one foot from the ground. Bore one peach but heavy winds prevented it coming to perfection or bearing any more.

Mr. J. A Stephens, Hagley Gap—(St. Thomas.) Four out of the five plants grew well and are now large sized trees; fruited heavily. I picked off nearly all the fruit as soon as set, so as not to weaken the trees. The fruit left ripened well but the quality was poor.

Mr. Geo. Massey, Trinity Ville—(St. Thomas.) One tree reached me dead, one has since died; the two surviving have made wonderful growth, one being 12 feet high and the other 6 feet, both very branchy, rich in foliage, and as healthy as any I have seen in Europe and America.

The smaller one blossomed last May but did not set any fruit.

Messrs. Melhado, Old Harbour—(St. Catherine.) Only one out of nine grew, and it is now about 7 feet high.

Mr. M. H. Edwards, Linstead—(St. Catherine.) The Peach trees were withered when I got them—one sprouted a short time after planting but died off soon after.

Mr. R. H. Butler, Linstead—(St. Catherine.) The Peach trees are doing well, they stand 16 feet to top of branches—blossomed in March, but did not fruit.

Mr. A. A. Stewart, Walkers Wood—(St. Ann.) Of the two plants received, "Reeve's Mammoth" soon died—but the "Red Ceylon" has grown to a height of 8 or 9 feet and is in full leaf. The plant has never shown any signs of flowering though otherwise strong and healthy.

Mr. F. H. Barker, Retreat—(St. Mary.) Of the three trees I got, one died—the other two are about 10 feet high and look healthy. One has a thick single stem, the other a good many branches from the side. They shed their leaves and bore a few blossoms immediately after doing so, but bore no fruit this year.

Mr. Alexander Hopwood, Brown's Town. The plants reached me almost dried up and did not grow. I however imported from New York in March last a few Peach plants, and they have grown so astonishingly well that I am now getting out 100 more plants.

Hon. J. W. Fisher, Stewart Town—(Trelawny.) The Peach trees have grown well and are very healthy, but although pruned at the proper time as advised have shown no signs yet of bearing fruit.

Mr. J. J. Lannaman, St. Ann's Bay. Both trees grew and died a few months after—probably on account of the severe drought.

Mrs. Farquharson, (Barossa)—Mandeville. Of the Peach trees sent in April 1892, three grew. One of these bore three Peaches, which though small were of good flavour. All the trees are at present covered with a white scale and look most unhealthy.

Rev. J. Reinke, Mile Gully—(Manchester.) I regret to report that both my plants died.

Mr. Ralph Stewart, Newport—(Manchester.) "Bidwell's Early" has grown to the height of 16 feet. A few months ago it bore one fruit, but it did not come to perfection. Since then it has shown no signs of flower "Red Ceylon" and "Reeve's Mammoth" are each 9 feet in height. All the trees are flourishing.

Mrs. Isaacs, Malvern—(St. Elizabeth).—I am glad to be able to report the fair progress of my plants though the limbs do not appear to be very strong nor of full size yet. Some of the trees have borne, fruit which has been of very small size, but possessing the usual colour, bloom, and full flavour of the Peach.

Mr. W. M Douet, Sweet River– (Westmoreland).—One of the Peach trees has grown well and has flowered several times. The flowers however always drop off when full-blown. A scale insect has now attacked the tree

Mrs. Osmond, Southfield—(St. Elizabeth).- -The trees have grown to a good height, blossomed, but did not fruit. A white scale insect has covered all the trees.

Dr. E. H. Cooke, Chester Castle—(Hanover) —Only three of the Peach plants are alive, and although apparently healthy, their growth has been very slow –but I fancy the soil and location are to blame.

Mrs. Campbell, Westphalia—(St. Andrew) —The Peach trees have grown well and borne several fine fruit

Mr. W. G. Clark, Gordon Town.– Of the five plants received, four are growing—one having died apparently through being planted in too damp and shady a part. "Red Ceylon" I took up some time in January and replanted in good soil—it has now fine good sized Peaches on it.

Peach Trees have also been sent to the following :—

Mr. Henry E. Fowler, Shanbury, St. Ann's Bay
Mr. Arthur James, Bloxburgh
Honourable Neale Porter, Halfway Tree
Honourable C. S. Farquharson, Mandeville
Mr. E. Stewart, Bath
Mr. D. Archer, Cave Valley
Mr. George Douet, Four Paths
Mr. J. R. Reece, Pedro
Mr. Geo. Henderson, Pleasant Hill
Mr. J. J. Bowrey, Kingston
Mr. L. Isaacs, Mandeville
Mr. L. F. Mackinnon, Red Hills, St. Andrew
Revd. W. Griffith, Tweedside
Mr. Harry Kemble, St. Andrew
Mrs. Maclaverty, Newton
Miss Marescaux, Cherry Garden
Mr. R. M. Cocking, Port Maria
Mr. A. J. Hopwood, Port Antonio
Mr. P. A Moodie, Port Antonio
Mr. E. C. Hosack, Annotto Bay
Revd. E. Bassett Key, Balaclava
Mr. C. F. A. Warren, Kingston
Superintendent of Hope Gardens
Superintendent of King's House Gardens.

Strawberry plants have been sent to the followiug :—

Mrs. A C. Walden, Shooter's Hill
Mrs. Hamilton, Clifton Mount
Mr. Fred. H. Barker, Port Maria
Mr. Chas E. Gunter, Kingston
Mr. W. H. Hall, Kingston
Mrs. Heaven, Whitfield Hall
Mr. Alex. Hopwood, Brown's Town
Mr. Arthur James, Bloxburgh
Mrs. Jno. Farquharson, Williamsfield.

Various other plants were sent to the following :—

Miss Barrett, Brown's Town.
Mr. A. C. McMillan, Kingston
Mrs. Cundall, Halfway Tree
Mr. O. Marescaux, Cherry Garden
Mr. J. T. Palache, Mandeville
Mrs. Farquharson, Mandeville
Hope Gardens
Castleton Gardens.--Rose cuttings.

To Dr. H. A. Alford Nicholls, Dominica—14 species of orchids.
To Mr. F. R. Hart, Colombia—3 species of orchids.

Seeds Distributed.

To Head Office, the following Seeds for distribution :—

Tree Tomato or Jamaica Plum, (Cyphomandra betaeca.)
Blackberry (Rubus racemosus.)
Walnut (Aleurites moluccana.)
Cinchona succirubra and C. officinalis.
Agave americana, variegata.
Gouania domingensis.
Coix Lacryma.
Pittosporum undulatum.
Pimenta vulgaris.
Juniperus bermudiana.
Psidium Guajava-varieties.
Passiflora edulis.

To Hope Gardens :—
Datura suaveolens.
Trophis americana (Ramoon.)
Zizyphus Chloroxylon (Cogwood.)
Cyphomandra betacea (Tree Tomato.)
Symphonia globulifera (Hog Gum.)

To King's House Gardens :—
Trophis americana (Ramoon.)
To Castleton Gardens :—
Cyphomandra betacea (Tree Tomato.)
Tigridia Pavonia

Mr. A. J. Hopwood, Titchfield, Pt. Antonio—36 packets of vegetable seeds, such as Peas, Tomatoes, Cabbages, &c.

Mr. J. R. Reece, Resident Magistrate, St. Ann—34 packets of vegetable seeds such as Peas, Cabbages, Tomatoes, Beans, &c.

To Revd. A. Hedmann, Clifton, St. Andrew—1 pkt. each of 20 varieties of Pea.

To Mr. T. J. Breakspear, Morant Bay—2 pkts. of Pea seeds.

Plants received :—

From Royal Gardens, Kew—68 plants of an ornamental character : 23 Gladiolus corms : 42 bulbs of Cyrtanthus, &c. : 27 Gloxinia tubers.

From Mr. J. B. Beach, Florida—33 fruit trees such as Persimmon, Pear, Apricot and Cherry.

From Dr. G. C, Henderson, Kingston—8 Orchids—various.

From Lord George Fitzgerald—9 plants of Lilac.

From Mrs. Heaven, Whitfield Hall – 8 plants and roots

From Mrs. Maclaverty, Newton—1 plant of white Iris, and several roots of Neapolitan Violet.

From Mr. J. T. Palache, Mandeville—61 bulbs of Hippeastrum.

From Hope Gardens—15 various plants, seedlings of Grevillea robusta, Coleus cuttings

From Castleton Gardens—40 various plants.

From Messrs. Jas Veitch & Sons ; H. Cannell & Sons; and Wm. Paul & Sons, England—a small collection of bulbs, Pelargoniums, &c.. and Roses.

Mr. W. Harris is Superintendent.

Castleton Garden.

Borders.—All the borders and beds have been frequently forked, and the dead leaves and weeds buried. Some portions received a supply of fresh soil. Several overgrown plants were removed, and young plants substituted. All the pruning was done little by little by the Superintendent himself.

Lily Tank.—The Lily Tank was thoroughly cleaned out, and fresh soil mixed with stable manure added for replanting the Water Lilies. The Victoria regia grew vigorously and flowered freely for several months. It excited great admiration especially amongst visitors from temperate climates.

Palmetum.—The following palms new to the Castleton collection, were planted out, viz. :—Corypha umbraculifera, Linn. "Talipot Palm," S. India and Ceylon, (3). Licuala grandis, Wendl. New Britain, (1) Phœnix dactylifera, Linn. "Date Palm," N. Africa, (2). Duplicate plants of the following were also put out, viz. :—

Areca triandra, Roxb., India to Burma.
Diplothemium caudescens, Mart. Brazil.
Euterpe antioquensis.

Of the whole collection in the Garden, 58 species have flowered, and 47 have ripened seeds.

Rosary.—Most of the Rose plants, from continuous cutting for propagating purposes, have become worn out, and the more delicate kinds have died. A new bed 80 feet long by 15 feet wide was therefore prepared and planted with all the better kinds available. The new plants have grown fairly well.

Orchids.—The Orchids have been removed from the trees in the Arboretum and placed on the two Pandanus trees near the Fern House. Most of them were repotted, and are thriving better,

Notable Trees.—Amherstia nobilis, Mesua ferrea, and Lagerstrœmia Flos-reginæ have all flowered profusely, but did not produce seed. Napoleona imperialis yielded seed, and several plants were raised for distribution.

Ferns.—The Superintendent has collected a large number of ferns, and the stock of plants in the Fern House and on the rockeries has been considerably increased.

Lawns.—The lawns have been attended to as usual, receiving occasionally a close cutting.

Walks.—The walks, about a mile and a half long, have been constantly weeded, regravelled, continually raked, and the edges cut, presenting always a nice tidy appearance. A new walk has also been made by the bamboos along the riverside.

Seats.—Four new garden seats have been made and placed in different parts of the garden. The table by the river has been repaired.

Nursery.—Work in the Nursery is carried on as usual, special attention being given to those plants that are most in demand. About 500 Clove plants have been raised from seeds from the trees in the gardens.

Buildings.—A new potting-shed was put up, and fitted with a potting bench.

A kitchen was built by the Public Works Department.

Economic Plants.—The propagation of Manilla Hemp (*Musa textilis*) is being continued,—the suckers being put out into rows between the Cocoa.

A small quantity of Onion seed was sown, but the results were unsatisfactory.

Several varieties of Potatoes were received from Sutton & Sons, Reading, and the first lot was planted in February.

The Liberian Coffee bushes bore a good crop. There are less than 100 in the plantation and they yielded 21 bushels.

The Cocoa trees have been pruned, dead plants removed, and the ground hoed.

Cocoa pods to the number of 12,700 were purchased from settlers in the district and forwarded to be cured at the Hope Industrial School

Specimens of 3 species of Vanilla were forwarded to Kew, and the one (V. planifolia, Andr.) most suitable for cultivation for commercial purposes was pointed out. Specimens of other Garden plants as well as of native plants, were collected for the Departmental Herbarium.

Visitors.—The number of names recorded in the Visitors' Book was 962, but this does not include all who visited the Garden.

Seeds collected.—Packets of seeds to the number of 71 were collected. Most of them were palm seeds.

Plants distributed.—The number of plants forwarded to Hope is as follows: —

Roses	...	2,621	Vanilla	...	88
Palms	...	2,400	Rubber plants	...	70
Miscellaneous trees and shrubs		3,227	Mango trees	...	27
Kola	...	245	Crotons	...	43
Miscellaneous Fruit trees		370	Amherstia nobilis	...	6
Clove	...	150	Black Pepper plants	...	5
Cinnamon	...	182	Water Lilies	...	12
Ferns	...	121	Timber and Shade Trees	...	302
Liberian Coffee	...	171			
Ginger	...	75	Total		7,494

Plants sold at the Gardens are as follows :—

Roses	...	670	Vanilla	...	30
Crotons	...	670	Misc. Fruit and Economic plants	...	530
Misc. trees and shrubs	...	579	Total		3,868
Palms	...	623	The total number of plants distributed was	...	11,362
Ferns	...	352	Cacao Pods sold	...	103
Orchids	...	44	Nutmeg seeds sold	...	152
Liberian Coffee	...	137	Mace sold	...	$5\frac{3}{4}$ lbs.
Nutmeg	...	286			
Ginger	...	50			
Mace sold	...	2lbs.			

Plants received.—The following plants received from Kew Gardens may be specially mentioned.

Attalea Guichere (Palmæ) (1)
Geonoma Princeps, Hort. Bull. (Palmæ) Trop. Amer. (1)
G. pumila, Lind. and Wendl. (Palmæ) New Grenada. (1)
G. Schottiana, Mart. (Palmæ) Brazil Guiana (1)
G. Spixiana, Mart. (Palmæ) Rio Negro (Amazons) (1)
Piper Cubeba, Linn. f. "Cubebs" (Piperaceæ) Borneo, Java (3)
Platycerium æthiopicum, Hook. (Filices) Trop. Afr. (1)
Tylophora asthmatica, Web. (Asclepiadeæ) India, Ceylon. (1)
Vanilla planifolia, Andr. "Vanilla" (Orchideæ). Malaya Mexico. (3)
Zingiber Zerumbet, Rosc. (Scitamineæ). India, Ceylon, Java. (1)

Correspondence. The number of letters written during the year amounted to 601, and the number received to 367.

Mr. E. Campbell has acted as Superintendent.

The elevation above sea-level is 580 feet.

The average rainfall is 110.01 inches per annum, and the annual mean temperature is 76.2° F. The rainfall during the year was 126.47 inches, and the mean temperature was 74.2° F.

The heaviest rainfall was in November, with 32.92 inches, and November 29.32 inches. On the 29th October 19 inches of rain fell in 24 hours. The meteorological results for the different months is given in Appendix IV.

Kingston Public Garden.

Mr. John Campbell was placed in charge of the Garden in October.

The great feature of the year has been the erection of Gates on the East and West sides, and the opening of the passages by the fountains at each corner. The erection of East and West gates was recommended in the Report for 1888-89, and it is satisfactory to see that this which was part of the original design for the garden, has been carried out. The Report for 1889-91 pointed out that the facilities thus offered as a thoroughfare would have a beneficial effect in attracting many more persons to the garden. With the increase in the number of thoroughfares during the year, with the weekly performances by the excellent band of the West India Regiment, and the lighting of the garden at night by electricity, this has now in truth become the City Garden and is much appreciated by the inhabitants.

The grass lawns have suffered very much in appearance on account of the trampling over them on Band nights, and by people not keeping to the paths as they pass through. It will become necessary to adopt the plan used in some of the London Parks, and enclose the grass by a railing, otherwise one of the greatest beauties of a garden, especially of one in a town—the fresh green expanse of grass—

will be quite destroyed. Probably the wisest plan will be while enclosing the grass, to have certain portions, for instance in the vicinity of the Band Stand, gravelled over and planted with shade trees (where they are wanting) so that small play grounds may be formed for the use of children during the day.

The passage by a French writer quoted below from Robinson's *Parks and Gardens of Paris*, gives expression to what should be the popular sentiment with regard to a Public Garden.

"The squares in Paris have now been opened for a long time, and the numberless frequenters of them have conducted themselves with admirable order and decency. The people evidently understand that they are at home—that it is for their special behoof that the gardens have been constructed—they know that in pulling up a flower it is their own property they are destroying—and, moreover, they evince a respectful gratitude for the hands that have given them these pleasant places of resort. The establishment of public squares in Paris is an eminently social idea. We repeat, it tends to regenerate the human race by the development of the physical forces,—by exercise in the open air it improves the morals of the people, by allowing the workingman to change the dirty wine-shop for a pleasant walk and an agreeable resting place."

The plants transplanted from the Exhibition Grounds have done well, and more have been brought from Hope Gardens. The borders have been forked and manured, and a good deal of pruning of the bushes and other trees has been carried on The central tank has been cleaned.

The elevation is 60 feet above sea-level The average rainfall is 37.96 inches, and mean annual temperature 79° F.

The rainfall during the year was 21.88 inches, and the mean temperature 78°6 F.

Bath Gardens.

Mr. A. H. Groves, the Overseer, reports as follows:—

"The Garden is now in fair order as regards cleanliness, but the continual shedding of leaves at this season of the year makes continual sweeping and removing a necessity and our periodical strong winds assist in a great measure to make it more so.

"The large trees prevent the action of the sun from any flowers that may be planted and they should be trimmed for the benefit of all the palms.

"I am sorry to say that the old Amherstia which was blown down by the hurricane of 1880 is now dead, except a small shoot from one of the arms which I hope to succeed in rearing.

"I am glad to say since the Mangosteen has been removed, it has improved.

"The wire fence is not in bad order but wants re-straining and a few posts put in. A good lock is also required.

"A very poor show of nutmegs this season for potting; I intend to remove the body of the old tree shortly, so as to give the young tree a chance of thriving."

King's House Garden and Grounds.

The area under cultivation at King's House is about six times as large as it was four years ago. There is besides extra work on Guinea grass pieces, the Race Course and Cricket Ground.

The roads to the House, though practically public roads. are kept in order by the Department.

Water pipes and Tanks.—Two hundred feet of ¾ inch piping and ten taps have been fixed in the borders.

In the north-east border six hundred feet of 1¼ inch piping and four taps have been fixed. This is a great saving in wear and tear of hose, and in labour.

Two tanks have been constructed by the Public Works Department, one in the Plant House, and one in the Fern House,—serving to reduce the time spent in watering.

Tool Houses and Sheds.—The Public Works Department has also put up a much needed tool-house and potting shed. Another shed is badly wanted to protect the mules and carts from sun and rain Barracks are also required for boys coming up from the country for work. Without such accommodation it is found impossible to keep boys for any length of time so as to train them to be of some use in the garden and to leave eventually possessed of some knowledge beyond that of a mere labourer. Besides this it would be a distinct advantage to have all the watering done before 7 a.m. and after 4 p.m., —but if the boys are not living on the spot, such an arrangement cannot be made.

Hose and Tools.—Hose of ¾ inch has been purchased to the amount of 600 feet, and fittings put on, and a quantity of old hose has been repaired. Several forks and spades have been repaired.

Fences.—The Dildo Fence at the East Gate has been repaired, and all the fences now are in good order.

Avenue Road Walks.—The road to the House has been kept well hoed and cleaned during the year at an expense of about £35; the walks have also been kept in thorough repair.

Pastures.—The pastures have been cleaned, and some more than once, making a total of 140 acres that have been cleaned. Roots to the number of 4,750 have been dug out of the pastures and grass pieces. The Race Course and Cricket ground have been twice billed.

Avenue Trees—Some of the Palms and Ficus trees have made good growth. Others have not done so well, and some of those that were burnt in the fire last year have died. To supply vacancies 20 more Palms and Ficus have been planted. Three large Ficus trees have been transplanted from the Arboretum to the Avenue, and are doing well.

Avenue Borders —On the West Drive four more beds have been planted with Roses. The hay-grass behind the borders has been cut twice. Both plants and flowers have been stolen from the borders by passers by.

Lawns.—A great deal of labour has been expended upon the lawns and grass verges in weeding, rolling and mowing. The lawns have been top-dressed with good soil. One acre of hay-grass has been hoed off to the south-west of the Palmetum and the ground well dug and laid down with Bahama grass. The central lawn is in poor condition, as there are so many large trees on it with roots coming above ground. There is very little Bahama grass on it, and it wants digging up and relaying. Most of the shrubs on the lawn have been treated with a top-dressing, and have grown well.

Borders.—The borders have been kept in good order ; they require unremitting care and attention Numbers of the plants have been transplanted, and many young ones have been added. The strong sea-breeze dries up the plants very much, and as the soil is full of roots, it takes four men their whole time in dry weather to keep the borders properly watered. They have much improved in appearance since the water-pipes have been laid down.

Arboretum.—The hay-grass in the Arboretum has been cut once in the past year, and several young trees have been planted.

Palmetum.—Some of the largest Palms that were growing in tubs have been put out into the Palmetum.

Planting in general.—Palms *(Attalea Cohune)* have been planted, one on each side of East gate. A large Tamarind tree chose to the the front entrance of King's House has been cut down. At the north corner a number of over-grown climbers, &c., have been cleared away, and in their place have been planted a large palm, and small shrubs, and grass has been laid down. Several large Aralia plants have been removed from the borders, and placed in a row to hide outhouses from the Rose-garden, and the laundry from the Dining Room. Twenty Guango trees have been transplanted along the side of the road in No. 2 pasture, and several young trees have been planted in a row in No. 3 pasture. More climbers have been planted about the Garden Grounds, and all have been well manured.

Rose Garden.—The Rose Garden is surrounded by large trees, and until these are cut down good results cannot be expected ; but still a constant supply of roses has been kept up.

Orchid House.—The Orchids have done very well during this year; 38 kinds have flowered. They have all been removed into new baskets. The Public Works Department has put up a glass roof to keep the rain off several varieties, and made a tank to catch rain water.

Pinery.—There has been a good crop of pines. The ground has been well ploughed, manured, and hoed.

Fernery.—Three rockeries have been made in the Fern House, and the ferns planted on them are growing well. The ferns in pots have all been repotted.

Pot Plants.—The greater part of the collection of pot plants has been repotted. Some young plants have been added to take the place of those planted in the Palmetum. A large number of such plants are required for the decoration of King's House. By permission of His Excellency the Governor, several plants were exhibited at the Flower Show.

Experiments with Onions.—One ounce and a half of seed of red and white onions from Teneriffe, as supplied for Bermuda, was sown and afterwards transplanted into a bed of good rich soil. A crop of 70 lbs. in weight was the result. None of the onions were very large, but were of fair size for ordinary use.

Propagation of Ficus Benjamina. –About 200 bamboo pots were fixed on branches of the Ficus tree. About 40 plants were obtained during the year, 30 of which were sent to Hope Gardens.

Vinery.—A vinery has been formed close to the Superintendent's house, and fenced in with wire fence and dildoes. Piping of one inch diameter and 400 feet in length has been laid down, and 4 taps affixed. A large number of cuttings of the best English Vines were obtained through the kind offices of the Director of Kew Gardens from the Royal Horticultural Society's Gardens at Chiswick, and from these 34,350 young Vines were produced and planted out for distribution later.

The Vines obtained by His Excellency the Governor from England, and planted in the Arboretum have made good growth Dr Grabham has very kindly obtained from Madeira, and presented to the Department, cuttings of the best Madeira Vines, which have been planted out to supply plants for distribution during the following year.

The plan proposed in the last Annual Report for instruction in the cultivation of the Vine has been carried out and demonstrations have been frequently given by the Superintendent.

Distribution of Seeds.—Seeds of palms, &c., were collected and sent to Hope Gardens.

Mr. W. J. Thompson has acted as Superintendent during the year.

The elevation above sea-level is 400 feet.

The average rainfall is 49.20 inches per annum, and the average annual mean temperature is 78.7° F. The rain-fall during the year was 45.50 inches, and the mean temperature was 72.3° F.

The meteorological results for the different months are given in Appendix iv.

Bulletin.

Twelve Bulletins, Nos. 30 to 41, have been issued during the year, the contents of which are as follows :

No. 30, April, 1892.—Sugar-Cane Borer, Gardening in Jamaica.

No. 31, May, 1892.—Diseased Banana plants, Coco-nut disease at Montego Bay, Parchment Coffee, Nutmegs, Nutmegs in Banda, Experiments in the Cultivation of Vegetables, Manufacture of Castor Oil, Logwood, Casuarina.

No. 32, June, 1892.—Sisal Hemp, Professor Huxley on Agricultural Education, Preservation of Potatoes, Yield of Potatoes, Onions, Ferns: Synoptical List IX.

No. 33, July, 1892.—Drying Machines, Salsafy, Scorzonera, Potatoes, Botanical Gardens in Java, Ferns: Synoptical List X.

No. 34, August, 1892.—Experiments in the Cultivation of Vegetables, V., Cocoa at Hope Industrial School, Ebony, Cotton, Nutmegs, Ferns: Synoptical List XI.

No. 35, September, 1892.—Fibre Industry of Yucatan, Disease in Sisal Hemp in Turks Island, A Tree for Bee-Keepers, Ferns: Synoptical List, XII., Contributions to the Library.

No. 36, October, 1892.—Onion and Tobacco Seed for distribution, Eucalyptus, Concentrated Mangrove Juice for Tanning, Verandah Gardening, Plants in Flower or Fruit at Castleton Garden, Coccidæ or Scale Insects, Ferns: Synoptical List, XIII, Donations to the Department.

No. 37, November, 1892.—The Bogardus Eccentric Mills, Garden Egg, Limes, The Peach, Pruning of Deciduous Fruit Trees, Plants in Flower at Castleton Gardens, II, Donations to the Department.

No. 38, December, 1892.—Experiments in the Cultivation of Vegetables, VI, Cultivation of Peas, Instruction in the Cultivation of the Grape Vine, Plants in Flower at Castleton Garden, III, Ferns: Synoptical List, XIV, Contributions to the Department, Index to Bulletins Nos. 1–38.

No. 39, January, 1893.—Report of the Director of Public Gardens and Plantations for the year ended 31st March, 1892.

No. 40, February, 1893.—Experiments in the Cultivation of Vegetables, VII, Plants in the Public Gardens, Report on Coffee Leaf Fungi, Report on Infected Sugar Canes, Instruction in the Cultivation of the Grape Vine, Coccidæ or Scale Insects, II, Ferns: Synoptical List, XV, Contributions to the Department.

No. 41, March, 1893.—Cocoa curing in Ceylon, Cocoa cured at Hope, II, Instruction in the Cultivation of the Grape Vine, III, Alfalfa or Lucerne, Improved Bee-keeping for Small Settlers, Fern Synoptical List, XVI, Contributions to the Department.

The Bulletin is supplied free of cost to residents in the Island, and is a most useful means for the dissemination of information. It is also sent in exchange for publications, acknowledged from time to time in its pages, which are of great interest and value to the Department.

The number of those in the Island to whom the Bulletin is sent is 675, the number abroad is 178.

Library.

The Library is gradually growing and so becomes more useful every year for the work of the Department. Books are as indispensible as tools are to a Carpenter, and the want of them has been severely felt. A list of works added during the year is given in Appendix.

Herbarium.

In the last Report attention was called to the necessity of efficient assistance in the Herbarium. Application has been made for a grant of funds for the purpose of securing it but it has not been acceded to. Meantime the work of the Herbarium cannot be carried on as such an important branch of the Department can claim. The Training Colleges and Schools are taking up the study of Botany and it should be possible to help them by notes from the Herbarium on the Native plants. To try to study Nature from books alone is worse than useless.

Besides the educational importance of the Herbarium there is also the commercial side of a collection of dried plants which was referred to more particularly in the last Annual Report.

During the year I delivered 3 of the series of the Institute lectures on Agriculture; viz. one introductory to the Series, and two on Plant Life. They were illustrated by Botanical Diagrams and Specimens.

The Director of the Royal Gardens, Kew, presented 729 specimens of dried plants, chiefly of West Indian species.

Office Work.

The Office Work is exceedingly heavy. Application has been made from time to time for extra assistance but it has not yet been supplied. The consequence is that the work of the Department is much hampered, and its usefulness cannot be extended, although the Director has to work many hours beyond the ordinary official hours. Even with a large amount of extra work, this report has been delayed beyond the usual time of sending it in, unavoidably and very much to my regret.

The number of letters written during the year amounted to 3,125; the number received to 2,839. This is independent of letters attended to at the different Gardens.

The following is a statement of the work which the Clerk has to occupy himself with:—

(1.) Correspondence:—

Entering letters received, stating subject, date &c.

Writing, press-copying, entering, &c., letters despatched.
Indexing both Letter Books.
Filing Letters and Papers dealt with.

(2.) Accounts:
Cash Book.
Ledger.
Petty Cash Book.
Monthly Cash Account for Audit Office.
Weekly Pay Bills for Gardens.

(3.) Minor Accounts:—
Postages.
Receipts of moneys for plants, &c.
Superintendent's Orders for Goods.
Petty Cash with Colonial Bank.
Salaries.
Subscriptions to Bulletin and Kew Bulletin.
Imprest Account with Mayor and Council *re* Parade Garden.
Library Books.

(4.) Miscellaneous:—
List of addresses for Bulletin.
Stamping and addressing covers for Bulletins (monthly).
Forwarding Kew Bulletins to Subscribers.
Keeping list of Contributions to the Department.
Seed Ledger, list of seed and plants received and despatched.
List of applications for plants, seeds, &c.
Distribution of seeds, *e. g.*, Onion and Tobacco seed to Island Correspondents.
Do. to Botanic Gardens.
Cataloguing Library Books.
Newspaper clippings, and indexing same.
List of quarterly supplies of stationery for Head Office and Superintendents.
Requisitions and Monthly Returns.
Free Grants of Plants, registering, &c.

(5.) Special Items:—
Appropriation Account
Estimates.
Instructors' Account.
Furniture and Stationery.
Accounts for Annual Flower Show.

Hope Industrial School.

In the last Report the question of instruction in the Industrial School was fully entered into, but no advance was made during the year in the way of putting this Institution on a more satisfactory footing, except some correspondence on the subject between Members of the Board of Visitors, myself, and the Honourable the Colonial Secretary.

As there appears to be a good deal of misconception as to the nature of the gardener's business and the training necessary to qualify for it, it may be useful to attempt to make the subject clearer.

In England where gardening is a regular business perhaps not more than one in every 1,000 of the population chooses it as a livelihood, and of those who are attracted to it not more than 5 per cent. are even moderately successful. It requires an aptitude and a love for gardening that few possess, in order to do well.

The training is severe,—to give an instance, supplied by one who has undergone it—a boy is apprenticed for, from 3 to 5 years, and has to work like a slave 12 hours a day, and extra time in winter making up hot-house fires. In the best gardens a premium of £10 or £20 is paid to the Head Gardeners. During the first year the boy gets no pay at all, and during the two next years about 3s. 6d. a week He then goes as a journeyman gardener for 5 years or more, working 13 hours a day. He may then get a place as a Foreman for from 4 to 8 years, but he cannot do so unless he has already found spare time to read a good deal about the theory of the subject. After having served as Foreman, he may, if he has been successful and is well recommended, get a post as Head Gardener.

Of course the object of the Industrial School would be a more humble one, viz, to turn out the boys at the end of their time not only as good labourers, but with some idea of the reasons for various agricultural operations, and some knowledge of proper methods of preparing produce for market.

Even to become good labourers requires constant drilling in the elementary operations of digging, forking, raking, hoeing, weeding, rolling, mowing, watering, &c., and all these require training by a man who understands the work. They cannot be taught by simply turning the boys into the garden and telling them to weed or dig

It is evident that if the boys are to learn anything about pruning, budding, grafting and the particular cultivation necessary for various plants, and the methods for curing their products, they must receive instruction from those competent to impart it. In large gardens in England, they are passed on from one special gardener to another, learning one art from one, and another from another, but here there is no one in the Gardens except the Superintendents themselves who could instruct them.

The plan that commends itself most to my mind would be to appoint someone as instructor from one

of the Agricultural Colleges either of England or America. It has been objected that such a person would know nothing of tropical agriculture, and therefore could not teach. But the principles of agriculture are the same in all climates, and the first essential is a sound foundation with capability of adaptation to differing circumstances. While the theory is the same, the practice is different, but a thorough knowledge of English Agriculture combined with a scientific training appears to afford a better promise of success than any preparation at present available in tropical countries.

Wallace in *Indian Agriculture* recommends for similar work in India : "Young farmers with a good general education, and who have been trained from their youth in those details of agricultural practice which can only be acquired by early association with the farm and its purtenances, have within recent years been induced to undertake scientific study and research, in many instances with the object of becoming land-agents, and in other cases so that they might be more able to contend with the increasing complications of the times, which have often proved too much for the old-fashioned farmers working according to old lights."

The apprentices, Leigh and Dawadu, sent to Hope Gardens by the Government of Lagos, have continued to do well, and leave for Kew Gardens in April to complete their training before being placed in charge of Botanical Stations in their native country.

Coffee.

A letter from Mr. Morris calls attention to the Report for 1892 from the British Consul in Guatemala in which he states that the coffee crop in 1892 was 74,652,985lbs., as compared with 52,197,853lbs. in 1891, or an increase of nearly 50 per cent.

The Consul also states that "a small number of Coolies have been brought from Jamaica by an American firm of Coffee Planters, and are found to do extremely well."

I append tables of exports of coffee from the Island from 1774 to 1892, which show the increase up to the maximum in 1814 A. D., and the fall in 1834 after the passing of the Emancipation Act.

A tabular Return of Coffee exported from Jamaica.

Year when Exported.	Lbs. of Coffee.	Remarks.
1774	739,039	
1775	493,981	
1788	1,035,368	
1789	1,492,282	
1790	1,783,740	
1791	2,299,874	
1793	3,938,576	August. Destruction of St. Domingo.
1794	4,901,549	
1795	6,318,812	
1796	7,263,539	
1797	7,869,133	
1798	7,894,306	Largest Ginger Crop.
1799	11,745,425	
1800	11,116,474	Bourbon Cane introduced.
1801	13,401,468	
1802	17,961,923	
1803	15,866,291	
1804	22,063,980	
1805	24,137,393	
1806	29,298,036	
1807	26,761,188	
1808	25,225,738	March 25. Abolition of Slave Trade.
1809	25,258,668	
1810	25,828,565	
1811	17,460,068	
1812	18,481,986	
1813	24,628,572	Storm in October.
1814	34,045,585	
1815	27,362,742	
1816	17,289,393	
1817	14,793,706	Storm in October, 1815, which ravaged Surrey.
1818	25,329,456	
1819	14,901,983	Storm in October which ravaged Cornwall.
1820	22,127,444	
1821	16,819,761	
1822	19,773,912	Extreme drought this year.
1823	20,326,445	Mr. Canning's Resolutions relative to Slavery
1824	27,677,239	in the West Indies.
1825	21,254,656	
1826	20,352,886	Severe drought in 1824.

A tabular Return of Coffee exported from Jamaica.

Year when Exported.	Lbs. of Coffee.	Remarks.
1827	25,741,520	
1828	22,216,780	
1829	22,234,640	
1830	22,256,950	
1831	14,055,350	
1832	19,815,010	
1833	19,866,060	Emancipation Act passed.
1834	7,725,731	Seasons favourable.
1835	10,593,018	" "
1836	13,446,053	" "
1837	8,955,178	" "
1838	13,551,795	Entire Emancipation, August.
1839	8,897,421	Seasons favourable.
1840	7,279,670	
1841	6,433,370	Drought.
1842	7,048,914	
1843	7,367,113	Drought.
1844	7,148,775	"
1845	5,021,209	Seasons favourable.
1846	6,047,150	" "
1847	6,421,122	Drought.
1848	5,684,941	"
1849	3,430,228	Favourable.
1850	5,127,255	"
1851	5,595,273	Favourable seasons. Cholera 1850-51.
1852	7,127,680	" " Effects of Cholera.
1853	5,037,602	
1854	5,990,672	Favourable seasons.
1855	5,657,103	" "
1856	3,328,147	" "
1857	7,095,623	" "
1858	5,237,689	" "
1859	5,399,925	" "
1860	6,562,004	" "
1861	6,766,954	" "
1862	5,601,157	" "
1863	8,485,731	
1864	5,424,184	
1865	6,402,405	Insurrection, Morant Bay, 11th October.
1866	7,820,945	
1867	6,264,861	
1868	8,754,769	
1869	4,724,944	
1870	9,832,256	
1871	5,508,989	
1872	9,510,739	
1873	7,199,144	
1874	10,311,320	
1875	7,136,327	
1876	8,649,049	
1877	9,532,887	
1878	9,411,662	
1879	10,832,127	
1880	10,188,897	
1881	9,846,106	
1882	7,418,638	
1883	9,448,100	
1884	5,415,994	
1885	9,033,606	
1886	6,150,960	
1887	6,337,742	
1888	11,084,144	
1889	9,475,880	
½ Year 1890	8,221,116	
1891	8,476,167	
1892	9,735,760	

The causes of decline in exports till lately were probably the difficulties in the way of providing sufficient labour to work the coffee plantations, and secondly the increase in the area cultivated in Brazil and Ceylon.

But the Ceylon coffee was almost exterminated by the *Hemeleia vastatrix*, and in Brazil the emancipation of slaves has raised a serious labour question. It is difficult to see how the exports from Brazil can fail to dwindle to a very low figure. The emancipated labourers will only work in the future at their own grounds or only sufficiently to keep themselves in food, and the only source from which to expect continuous labour in Brazil is in colonisation by white men. But under a Government which is not perfectly stable, colonisation of the kind is scarcely likely to take place. The cultivation of coffee therefore will soon practically cease, and the exports will be confined to coffee picked from old bushes in the most desultory manner.

Present prices for coffee will probably be maintained for a long period, and the area under cultivation in Jamaica should therefore be very largely increased,

The following table shows the area in several parishes at an elevation of 2,000 feet and upwards, a proportion of which might be put into coffee.

Parish.	Sq. Miles	
Portland	80	Between 2,000 and 4,500 feet.
Manchester	126	" 2,000 and 3,000 feet
St. Ann's	54	" " "
St. Mary's	23	Above 2,000
Clarendon	45	Between 2,000 and 3,000
Trelawny	32	" " "

In some of these parishes, and in others also, much of the coffee land is "worn out". It is the general opinion that nothing can be done with such land. If it is allowed to revert to bush and forest again, it is possible that after the lapse of many years it might be profitable to put it again into coffee, but there seems to be great doubt about it In Manchester old Coffee lands are being planted with grass for cattle.

The problem of resuscitating these worn out lands is a difficult one.

In the cultivation of Coffee, the ground is kept as free as possible of weeds and it is found that the cleaner the ground is weeded, the more productive are the coffee-shrubs. But this state of fertility of the soil cannot last beyond a certain time. The nitrogenous compounds are washed out of soils by rain, and on well weeded coffee lands there is nothing to supply its place. To keep up the supply of nitrogenous material, small settlers may on their grounds close to their houses use horse or cow manure, but to carry such heavy material to the fields on a large plantation is too expensive; much might be done however by using the lighter artificial manures.

Another method of supplying nitrogen to an exhausted soil is by growing plants which obtain this substance directly from the atmosphere. It is only during the last few years that it has been discovered that the plants that are capable of doing this work are those belonging to the leguminous family, that is, all those of the same family as the pea, bean and clover. These are sometimes ploughed into the land and the decaying organic matter helps in the preparation of the soil for use as plant food, besides supplying nitrogenous material as food.

The growth of some of these plants might well be tried on worn-out coffee lands, especially on ridges. Ploughing or digging in the plants is out of the question, but when about to flower they might be cut down and left on the ground to rot. Or, they might be cut for feeding cattle; and if a leguminous plant suitable to the district were found, several crops of green fodder might be cut in the year. One of the clovers, such as Alfalfa or the Crimson Clover, under experiment at the Hill Garden, might be tried in various districts. One kind might suit the soil formed from metamorphic rocks as in the Blue Mountains, another may be more convenient for the growth on the limestone and red clay of Manchester.

There are circumstances operating against any large increase of the cultivation of coffee, and those are chiefly scarcity of labour, and want of roads. The former does not affect the settlers, but a deficiency in the means of communication affects all alike. It is a subject for the consideration of the Government how far help can be given in both.

I have been favoured with communications from several planters on the subject from which the following paragraphs are extracted:—

Portland No. 1:—"Coffee lands of Portland can be utilised, and I believe foreign capital would be invested in them if much was known of them. Where roads can be put, they should be. This would not only open the land to Coffee but many other things. If roads can be made passable, then Bananas can be grown, which are a quick crop, returning the money spent in preparing for Coffee. To go into the land almost without roads, and begin a slow-growing crop is discouraging in the extreme."

Portland No 2:—"I think the mountain lands of Portland would be taken up for the cultivation of Coffee if the Government could see their way to make riding tracks into the Crown lands for sale. The lands should be sold for a nominal sum say 4s. per acre where the roads were easy, and 2s. per acre in the highest slopes with a proviso that, say 10 per cent. of the land purchased should be put under cultivation each year for the first three years, and five per cent. for the next three years. The payment for the land should be, say 25 per cent. on possession, balance in equal payments divided over a period of six years. All new roads to such lands should be in the charge of the Main Road Department and not handed over to the Parochial Roads."

Trelawny :—"I do not see how the Government can give any assistance except by opening up new roads and improving the present lines.

"Coffee grows well and thrives in the Ulster Spring and Albert Town districts until it touches the clay and as that part of theParish is largely in the hands of a peasant proprietary, it is increasing in cultivation but only by slow degrees. A slight fall in price has immediately the effect of checking the planting for the next season. There aro thousands of acres now in forest which might be put under coffee cultivation; but without capital and labour I do not see any prospect of much increase beyond that natural to the location of small Settlers and the gradual taking up of the waste lands."

Clarendon :—"There is plenty of good Coffee land in Clarendon, the N. E. corner of Manchester and south boundary of Trelawny. As to development it is perfectly impossible to move without a continuous supply of labour. A continuous supply of labour cannot be had here without indentured Coolies. This is my experience after offering every inducement short of prices that would bo ruinous to obtain it. Whether it would pay to employ imported labour, or whether men would go into so long-winded a speculation without inducements of some sort I do not know. No one without the command of considerable capital, and the ability to live without any return for four years, need think of establishing a coffee estate. Roughly he would want, to establish 200 acres, at least £10,000.

St. Thomas :—"Labour is one of the most serious questions, and there is only one solution of it. There must be State-aided immigration of a very liberal kind and quality, if any good is to be done.

"Bananas will soon run out, Sugar cannot be started again, and there is nothing to fall back upon but coffee. Now it is not generally known that there are many hundreds of acres, I may say several hundred square miles of land (at least two in Portland and St. Thomas) that could grow coffee, but even if two hundred square miles could be put in Coffee at half a tierce to the acre, and say at 80s. per cwt., it would give Coffee to the value of £1,828,568, or nearly two millions a year,—plenty of money to get revenue from. Now not one single acre of this land can be touched without imported labour of the right sort. The present Coolies are of no use, so the first thing to do, in fact the only way out of the difficulty, is for the Government to give every facility to planters to import Coolie labour of the right kind, and the first move should be to raise the Immigration Department to the position of a first class agency, with orders to grant every facility for the importation of hill Coolies fit to cultivate Coffee. The native will not work continuously, and consequently we must do all in our power to stop any more lands being opened up as we cannot spare any more labour,—our very existence depends upon this . . . . The principal thing to do at present is to keep from Jamaica any new men coming here, until the question of being allowed to import suitable labour is settled."

Ginger.

The Collector of Taxes for Hanover reported that during the year much of the Ginger sold realised low prices on account of the imperfect way in which it had been cured.

The Collector-General reported that the average prices realised for Ginger in several Parishes were as follows :—

Kingston, 50/-55/; St. Ann's, 50/; Trelawny, 36/ and 44/; St. James, 52/; Hanover, 45/; Westmoreland, 60/; St. Elizabeth, 30/ and 48/; Manchester, 16/8 and 40/.

Information was sought from the Collectors of Taxes as to the reasons for varying prices, whether proceeding from the difficulties in curing or from some other cause, and also as to the method of curing in different parishes.

It appears from the answers with which I was favoured, quoted below, that the variation in prices in the different parishes arises generally from causes independent of curing,—but that low prices anywhere indicate want of care in curing, or that ratoon ginger is harvested.

Further consideration will be given to this subject, and I hope to visit some of the districts when the harvest is being brought in.

Hanover Collectorate.

"My remarks in my last quarterly report were based on ginger which came under my observation as several lots were sold to the Traders here, mildewed, and in one or two cases soft and spongy. I enquired at the time what was the defect in curing which had caused the depreciation in the condition and quality of the ginger and I was told, that ginger to be successfully cured after it is scraped, must be kept away from damp or rain and be subjected to every day exposure to the sun in a dry place, until it is perfectly hard. The ginger mildewed had not received proper attention in this respect, which accounts for the low price which the ginger of this parish brings; and the soft spongy ginger had not arrived at proper maturity—otherwise, green—and had been put away damp into bags. I thought as the matter at various times came within my notice, that this want of proper attention to a valuable commodity was productive of a great loss. In the Seafort Town District I understand that greater care is exercised and as a result much higher prices obtained."

E. P. Puller.

Revenue Office, Sav.-la-Mar.

"As far as I have been able to ascertain, the price obtained was due not so much to superior preparation by the producer as to competition on the part of purchasers.

"I am able to state, that the mode of preparing ginger in this parish is by scraping and washing and carefully drying it in the sun.

"The low prices given in the early part of the season is for ratoon ginger which is often reaped be-

fore it has attained maturity and almost invariably mildews for want of the constant sunshine which prevails only later in the ginger season."

AUBREY G. FACEY.

Internal Revenue Office, Black River.

"The information I have been able to gather is this:—The Ginger is scraped and peeled with knives by the growers. The knives are specially imported and known as Ginger Knives. The ginger is then washed once or twice and turned out to dry on mats, care being taken to provide against mildew,

"I have never heard of ginger being boiled for purposes of curing, I should imagine that such a process would deteriorate its strength, and impair its value to an appreciable extent.

"The difference in price is due to the quality of the ginger as well as competition. A very superior description is grown at Seafort Town in Westmoreland on the borders of St. James, and owing to a very keen ginger trade done in Montego Bay, where most of this commodity is taken, the Westmoreland traders if desirous to compete, must be prepared to outbid the traders from Montego Bay.

"In the Pisgah Districts of this Parish a good quality of ginger is cultivated, which has been known to fetch 54/ to 58/ in Black River, but the bulk of the ginger brought down to Black River is of an ordinary description, where there is little or no competition, which accounts for the difference in prices between St. Elizabeth and Westmoreland."

S. E. PAYNE

Collectorate, St. James.

"The process of removing the skin of ginger by means of boiling, is not known in this parish so far as I can gather, aud is regarded as one calculated to reduce the spice of the article, and lessen its value as such.

"The mode adapted for removing the skin, is by paring with a sharp, thin narrow blade knife (properly called scraping), a protracted and tedious job. It is then dried on a paved terrace, boarded platform, or mats made of the stalks of the leaves of the banana or plantain trees, care being taken all the time while drying that the ginger does not get wet, and, at the same time, it is frequently and carefully turned over to avoid mildew.

"I am afraid the price obtained between one parish and another is no criterion of quality, so long as the ginger is at all passable ; all depends on the demand of the trade for the article by the exporting merchant during the particular season, to fulfil an obligation to supply a certain quantity probably, and it therefore must be procured if even at a loss. This principle descends to the smallest shopkeeper, who finds it at times to his advantage to procure as much ginger (or coffee as the case may be) to be placed to the credit of his account with larger traders with whom he may be dealing, and who in turn may be equally glad to get such a remittance at a given time even in preference to cash.

"I have no doubt that produce is thus procured at prices unwarranted by the ruling market's value abroad, and the small shopkeeper probably discovers for the first time, when he delivers his purchase, a loss in weight, and likely in monetary value too, from depreciation in quality, and so on with the next man in his turn."

J. W GRUBER.

Collectorate, Manchester.

"I have very much pleasure in forwarding you the information asked for.

"I had no personal knowledge of the subject, and was altogether dependent on the kindness of George Nash Esq., who possesses an intimate acquaintance with the subject, and whose letter I now submit."

R. C. J. BACQUIE.

Enclosure.

"*Ginger.*—There are two descriptions grown here, the yellow and the blue, the yellow being the superior quality. To obtain best ginger it must be planted every year on virgin soil ; it is ready for harvesting from March to December in ratoons, and plant ginger after Christmas up to March and April. The crops grown on the same land after the first year are called ratoons 1st, 2nd, 3rd respectively. The gathering is much after the manner of taking in a potato crop, the pieces or stems (from which the ginger is taken) being left in the ground, and moulded up, are what form the ratoons which year by year become inferior in quality and is abandoned when it cannot bring more than 16s. per 100lbs.

"Ginger said to be grown in Manchester, the bulk of it comes from over the border of the Parish some miles in Trelawny, St. Ann and Clarendon. It is purchased in centres there up to 40s. to 45s. per 100lbs. according to the fineness in quality (it takes some years to be a competent ginger buyer), the purchaser having to transport same. The best descriptions are brittle, and easily broken, which depreciates its value, considering its bulk and lightness a heavy item for cartage has to be added. A barrel of best quality will be many lbs. lighter than a barrel of inferior ; some finds its way to Montego Bay ; what comes this way is shipped via Kingston, a distance of over 90 miles from where grown. The distance for transport is not so great in Westmoreland, Sav-la-Mar and other places. This may account for the difference in price between this and the Westmoreland ginger.

It may be that the Westmoreland buyer pays too high, or that the grower abandons the ratoons and keeps to the growing of new plant-ginger every year, and so maintains a uniform price, or that the soil is better adapted and yields bolder samples, hence better results. The writer inclines to the opinion that the difference in prices arises from the distance in road and rail carriage. It may be noted that some of the ginger shipped from the districts stated "via Manchester," brings the highest price in the English market, which will go far to prove that the quality can hardly be considered inferior.

"*Preparation of Ginger.*—When taken out of the ground it is washed free from dirt, then experienced hands peel between what are called the toes to avoid their being broken off, as the large branching, or bold pieces bring the best price. It is then handed to less experienced hands to peel off the outer portion of the skin. The knife used has a very narrow blade which is riveted into the handle and cannot shut The blade cannot be too thin and narrow, as it has to cut between the toes which grow very close to each other. When peeling is finished, each piece is thrown into a bowl of clean water, and afterwards thoroughly washed, then put on mats, *i.e.* stands are made of crutch-sticks driven into the ground and of even height; strengthening pieces go in parallel lines. Mats made of thatch palm are then spread, and drying commences. The ginger must not get wet when once it begins to dry, and is taken in every evening. Some parties use lime-juice in washing, with a view to make the ginger white, and ensure a better price. It is invariably found, when so treated that it mildews, thus injuring and considerably reducing the value. No ginger is as good as that which is washed in pure clean water properly, and thoroughly dried.

Curing with boiling water.—I am glad to say is not resorted to on this side as far as I am aware.

"In view of the constant demand for virgin soil for the production of fine ginger, its exhausting effects on the soil, the wholesale destruction of valuable timber in forest land, fire being the only agent for cleaning up for planting, one can only realise by a visit to the district the alarming destruction from year to year going on, the drying up of streams, the tens of thousands of pounds of valuable timber lost in smoke, the now varying rainfall, the soil becoming so impoverished that only ferns will grow on it afterwards, with other attendant evils. The conclusion arrived at, is, the sooner the production of ginger is abandoned, the better. A howling wilderness of barrenness marks its progress in every direction, and £20 worth of ginger is the outcome of ten times twenty pounds of destruction."

GEO. NASH.

FORESTRY.

The subject of Forestry is continually coming up, and grows more important every year.

Mr. Hooper in his Report of 1886 put forward recommendations for the consideration of owners of land as well as of Government.

He deals with the objection that it is not worth while to conserve timber that has no value, as it is cheaper to employ lumber imported from America, by quoting instances that came under his own observation of the sterling value of timber for strictly local purposes, and also by reference to Sir Joseph Hooker's opinion that the question is rather, whether in the future, forest timber will not acquire a distinct value when population spreads and roads are opened up.

I take every opportunity of trying to impress upon all those who have any land at all—whether settlers or large owners, or public bodies, the prospective value of timber. It has been estimated by authorities in forestry that the lumber forests of the United States will be practically exhausted in ten years' time, and that as the small amount of replanting that is going on will make no very great difference in that time, lumber can only be obtained from Europe where forests are under a system of State conservancy. The consequence will be that lumber will be so dear after a time that land covered with suitable timber will be extremely valuable, probably more so than Logwood Estates are at the present time.

In consequence of notices published in the Bulletin and in the newspapers, nearly 1,700 Eucalyptus seedlings have been distributed all over the Island, which have not only a hygienic value when planted in quantity, in malarial districts, but besides, great value as timber.

Besides the Eucalyptus plants, seedling trees have been given to the Kingston and Liguanea Water Works, to plant at Rose Hill on the catchment area of the source of the Wag Water River which supplies part of the Kingston supply. Probably about 3,000 trees have also been generally distributed. These were the following :—

Grevillea robusta	...	771	Mahoe	...	71
Naseberry Bully	...	125	Timber Sweet Wood	...	75
Fiddle Wood	...	736	Walnut	...	10
Sappan Wood	...	100	Cogwood	...	29
Lancewood	...	50			
					1,960

Besides these, I obtained for the same purpose through the kindness of Mr. J. A. Stephens of Radnor, 1,950 Naseberry Bully seedlings, but I understand that these unfortunately died through want of proper treatment at Rose Hill.

If owners of land, wishing to plant trees on their properties, will give timely notice, say a year beforehand, of their intention to plant, and the kinds desired, every effort will be made to supply them free of charges, except for the carriage and packing. I would also ask those who have useful trees that seed, to send me seeds; expenses for collecting and forwarding will be refunded.

Mr Hooper goes into the question of the most useful trees and recommends as follows, with special reference to Cashaw, Cedar, Mahogany, Logwood, Juniper. "As regards export, I consider that for years to come, even with rigid conservation, the Island will hardly be in a position, to supply in great quantity, any species of hardwood timber that may come into common demand in Europe. Hitherto, shipments of fancy woods have been made mostly at a loss, and there is little expectation of prices going up. Still a moderate demand for close-grained small hardwoods for application to special uses could be met at the present time with some profit, when the export of heavy large timber would not secure any gain.

"If the Island cannot supply an external demand for large hardwood timber at the present time,

there is a home demand for some produce which steps should undoubtedly be taken to have supplied, without having recourse to imported material. I refer here especially to the timber required for the Jamaica Railways, both in sleepering the permanent way and in constructing the rolling stock. Concerning the latter, I have no information as to the class of timber nor the amount required—but with regard to the sleepers, the late Director of the Public Works Department has been good enough to afford the following information :—

"Before the Government purchased the line, the Cashaw sleepers alone were used, except on the part between Spanish Town and Old Harbour, in which pot sleepers had been used.

"'The cashaw sleepers are very durable, but unsuitable on account of the impossibility of getting, in sufficient quantity, straight pieces of sufficient size. An attempt was made early by the Government to procure sawn sleepers of other hardwoods than cashaw, but very few, if any, were used, as the price asked was considered high, and it was impossible to get any guarantee as to the time within which the sleepers would be delivered. It was then decided to use creosoted sleepers, which were procured from England of satisfactory quality at the price of 4s. 2d. each, including freight and all other charges.

"'These sleepers give satisfactory results, they are light to handle, and the elasticity of the wood enables the spike to take a firm hold, which is not always the case with hardwood sleepers. Cashaw is the only hardwood that has had a full trial, and that wood has been abandoned for the reason stated above. Recent offers have been made to supply, hardwood sleepers at reasonable prices, and arrangements are being made for procuring a supply. but, I doubt that they will supersede the creosoted sleepers.'

"From this it appears the matter of using hardwood for sleepers is not lost sight of, and I would strongly recommend that a series of experiments be undertaken with sleepers of various hardwoods along the Porus line, where it runs through savannah forest. For such a purpose it will be sufficient to adze the sleepers without going to the expense of sawing them, and once laid it will be a matter of careful and continued watching to determine the comparative value of each species for this particular use. Creosoted sleepers have not proved a complete success in all parts of the world. In the dry districts of central India the creosote has a tendency to come to the surface in times of great heat, and then to be washed away by the torrential rains that follow. Without comparing the climate of southern Jamaica with that of Central India, it is still possible to imagine the creosoted pine sleepers acting similarly in the districts of Vere during such droughts as have happened in 1884 and 1885, and the sequel to the loss of the creosote is that the rail crushes into the wood and has to be moved into a fresh sleeper. Hardwoods on the other hand, though expensive to handle, are durable and solid, once in their place, and it is for the consideration of the Government how to encourage their utilisation in this and similar ways. With careful treatment the savannah forests could be made to yield cashaw of good size and regular growth, and among the various species grown in the lower levels of the parish of St. Catherine there are other species that will be found suitable with the cashaw, and with the same qualities of toughness and general durability, and that are not attacked by insect life.

"There are certain species which deserve special consideration, and among these I would especially mention the cedar (*Cedrela odorata*) as being one of the most important woods in the colony. Not only in Jamaica and the West Indies, throughout tropical and sub-tropical regions, the generality of timbers are so hard and heavy as to render them unfit for conversion into small articles of common use, while of the species which are neither very hard nor very heavy, the majority are useless, so far as the qualities of the wood are concerned, being spongy, open grained, and without strength in any direction, The species of wood possessing the qualities of strength, elasticity and lightness are few in numbers and when found, as in the cedar, united with beautiful grain and fragrant exhalation, it naturally follows that the wood is in great demand. Like its congeners, the Toon of the East Indies (*Cedrela Toona*) and the Sydney Cedar of New South Wales (*C. australis*) it is largely used for all purposes, and it is to be hoped that the West Indian species will not share the fate of the Australian one, which is now only to be found in certain undisturbed spots for the most part up the out-of-the-way feeders of the rivers from the coast ranges in New South Wales and Queensland. Already in Sydney it is considered a *bois de luxe*, and scarcely used, except in wainscot and other work of interior finish, whereas it was formerly in general use, where now redwood from California is employed. There is no doubt a large supply of Cedar trees in Jamaica, but they are for the most part mature trees, numbers of them decaying. But there is, so far as I have seen, a dearth of young cedar plants, and even of middle sized trees. With the increase of penkeeping the pastures have been preserved from all foreign growth, and the natural regeneration of such species as prefer an open forest waste has been seriously interfered with. It is possible, therefore, at no distant time that cedar timber will not be forthcoming to supply the quantity the island is called upon for, and on this account I would urge on proprietors the protection of such seedlings as appear even in their pastures, until such time as from their height or thickness of stem they can withstand the cattle. It is a hardy species growing in rocky soil where few others can exist, and I believe will repay attention.

"Mahogany is another wood which deserves attention. In the past, Jamaica mahogany was much prized in English markets, where it fetched, when good, a higher price than the Central American timber, on account of its hardness and curly mottled grain. Of late years the small amount of wood that has reached England from this source has been of very inferior quality, and in London the brokers are of opinion that all the good timber has been cut out. . . . In other West Indian islands, notably in Barbados and Antigua, mahogany has been largely planted and protected, and in Jamaica I am sure that proprietors would do well to follow the example, or at any rate, even if they do not sow or plant they might well protect the young natural growth of mahogany and other valuable wood on their estate, or, as I suggest elsewhere, force their tenants to such action before the rendition of yam clearances.

"Logwood, again, is a tree which might with advantage be made the object of intelligent study

on the part of proprietors, and it is possible with care to ensure its reproducing itself under the most favourable circumstances. On some estates there are grazing lands under logwood, and the pasture is kept clean, but it can scarcely be expected that the logwood will reproduce itself if seedlings are not allowed to freely establish themselves in the ground, and it will be advisable for proprietors to keep their cattle out from logwood pastures for some few years before and after cutting the old trees. In this way the forest will remain pasture for say three quarters of the time, and if the ground is cut over for logwood regularly, a rotation of closed pasture equal to, say one quarter of the whole area will have to be arranged. . .

" Juniper cedar is a timber which requires especial looking after and encouragement, unless it is to disappear. Naturally found over a small area only above 4,000 feet, it has been cut whenever it could be got at, so that it is now rarely seen."

Having offered recommendations for the growth of special trees to the notice of all owners of land in the Island, he continues with more particular reference to work that he suggests should be carried out by Government :—" With regard to forest conservancy generally in Jamaica, I would advocate its introduction at once upon the practical grounds that there is an absolute necessity for regulating the water supply in the eastern district,—also for protecting the lowlands from the torrential flow of the rivers, and on the south side of the Island for general protection against the terrible north winds which occasion so much damage and danger to property and life.

" I do not base my argument that immediate steps should be taken in this direction upon the question of the recent diminished rainfall in Jamaica, for although observations by scientists and others in various portions of the globe tend to show that there is connection between denudation and a lessened fall of rain, it cannot be asserted as yet as a scientific fact that the former causes the latter. It can, however, confidently be asserted that forest conservancy is more than justified in the interest of climate generally especially in tropical regions where it so often occurs that disastrous droughts are only divided or separated from each other by a torrential fall of rain which runs off to the sea without doing more than ephemeral good to the parched crops. It may be stated as a fact that a drier and severer general climate closely follows upon extensive denudation of forest.. Summers are hotter, winters are colder, the air drier, and the conditions of animal and vegetable life are less favourable. . .

" I do not anticipate any difficulty in introducing forest conservancy into Jamaica, but I would advocate its extension being gradual. It must be borne in mind that it is invariably a matter of expense to the community at large, at first, and in the case of Jamaica I do not foresee any means whereby it can be made a self-supporting branch of the service for some years to come much less its becoming a true revenue department. Its value will however be traceable in indirect ways, and apart from climatic effects it will enable Government to have a complete knowledge of its timber resources, and be useful in many subsidiary ways. . .

" To sum up the suggestions I have made, they may be briefly stated as follows :—1st. To reserve the highlands of the Blue Mountains, escheating all lands liable to forfeiture, and arranging amicably with neighbouring proprietors for the surrender of such backlands useless to them that they may be willing to part with, and obtaining all lands in private hands and the ridge and near it.

" 2nd. The demarcation and survey of the reserve so formed and its protection against fire and theft and trespass, employing Maroons for that purpose.

" 3rd. The retention as forest reserves of all blocks of Crown lands on the limestone formations that exceed two thousand acres in extent ; to restrict ground provision cultivation in them wherever possible or expedient, protecting the reserves against felling of valuable timbers and generally conserving them. . .

" At present there is no Forest Department, the administration of the Crown lands being attached to the office of the Director of Public Works. With the large acquisitions which will now be made, the Crown lands will require a separate administration of its own, and it is this separate administration which will have to be provided that I would form into a forest branch of the present department it is attached to."

The legislation on the subject has not been on the lines laid down by Mr. Hooper, and the laws passed were finally repealed during the last session.

Reports on Free Grants of Plants.

Rev. C. M. Buckley (For Petersfield Churchyard.)—All the plants are doing well, with the exception of a few Eucalypti, which are dead.

Rev. J. W. Austin, (Chapelton Churchyard)—I am pleased to say that all (save one) of the plants are in a flourishing state, and in another year will be quite an ornament to the village churchyard.

Surgeon-Major Moore Keys (Camp)—The plants supplied are doing well, and they are carefully tended. The water supply is sufficient and used twice daily. A few have died by the scale insect pest. On the whole considering the high winds and exposed situation, the venture has been successful, and has considerably improved the appearance of the Camp.

R. M. Humphreys (Falmouth District Prison)—In consequence of the exposed nature of the ground many of the plants have died, but those which were somewhat sheltered from the sea breeze have thriven well. The Eucalyptus plants which I had hoped to have successfully grown near the edge of the Lagoon in front of the prison did very well for a time, and some reached the height of 8 or 9 feet, representing two years' growth, and appeared to be robust healthy plants, but owing to the exceptionally high tides which prevailed during the greater part of the summer, the sea-water percolated through the soil to the surface of the land, and in consequence of the excessive heat which we experienced at the same time, the ground was covered with an incrustation of salt which proved fatal to vegetable life of all kinds.

I am glad to say that the exterior of the prison has been greatly improved in appearance by the growth of such plants as I have been able to save. Among the plants which have done well are the Crotons, Hibiscus, Casuarinas, Panax, Eucalyptus drepanophylla, E. rostrata, and a few others, and I feel very grateful for the privilege of having a liberal and gratuitous supply of plants of great variety from your Department.

Revd. J. S. Fraser (Lacovia Churchyard)—The Eucalyptus plants, except three, have all died, they appear to be delicate plants. The rest of the plants are all growing nicely.

Reports on Onions grown from seed imported from Teneriffe and disaributed gratis.

Mr. C. Plummer, Kingston—The onion seeds turned out very fairly ; about half the seeds sown grew, and I transplanted them early in February ; everyone bulbed nicely, although the ground was not specially prepared. I reaped a satisfactory crop. Some measured 8 inches in circumference. This I consider very fair, seeing we had no rain at all to speak of in the city during the time they most needed it.

Mr. E. Griffin, Kingston (Montpelier)—Onion seed germinated well, but was swept away by heavy rains. I had sown some onion seed which came direct from Bermuda, but so far as germinating is concerned that I obtained from you was far superior, and I have no doubt, if the river had allowed me, I would have grown some first class onions.

Revd. M. A. Collins, Kingston—I sowed the seed in the rainy season and only a few of them came up. Several grew to a good size. Under proper conditions, I think onions will do well here.

Mr. P. H. Baxter, Kingston—I regret to say that my peacocks destroyed the onions when they were shooting up.

Mr. B. . Gosset, Farm Hill—Weight of 3 onions grown, 21 oz., 11 oz , and 7 oz respectively.

Mr. F. H. Barker, Retreat— From the packet of seed (½ oz.)I got 20lbs. of very fine onions and would have got much more but during my absence the onions were thinned and transplanted, when the dry weather set in and all the transplanted ones died. The seed was planted early in November and the onions were taken up early in April. The trial has satisfied me that onions can be grown here with profit, and I intend trying the cultivation on a larger scale this fall if I can procure seed.

Mr. M. H. Edwards. Linstead The seeds sprouted well and were coming on nicely, but just as they were about to form bulbs my peafowls got in and destroyed them all.

Mr. R. S. Thompson, Guys Hill—The onions were not a success as they suffered much from drought.

Mr. A. A. Stewart, Walkers Wood—We had such heavy rains for weeks after planting that the greater part of my seeds were washed away—what survived gave very good onions, large and mild in flavour.

Rev. G. McNeill, Shooter's Hill—We succeeded nobly with the seeds. In spite of the severe drought which followed the sowing, they bore excellently.

Mr. W. F Bailey, Shooter's Hill—The seeds failed to produce anything like good results. Plants came out excellently but were all seriously affected by the dry weather in December. I think April to May would be a much better time to sow the seeds here.

Mr. T. H. Grant. Shooter's Hill—The plants grew to the height of about one inch when the drought set in and most died. From those that lived I got about one quarter pound. The bearing was fair. Had the drought not troubled them, I expect I would have got a few pounds of onions.

Rev. J. Reinke, Mile Gully—The seed was planted as nearly according to directions as possible, but I got nothing. A few of the seeds came up but soon died off. Those I formerly succeeded with were planted in May having been started in boxes.

Mr. J Shearer, Duncans—Seeds sown at Vale Royal failed entirely apparently on account of insects in the soil ; those sown at Cave Valley Estate in St. Ann, 1,800 ft. alt. are growing fairly well. I have had some bulbs from them about 2 inches in diameter and of good flavour.

Mr. J. W. Gruber, Montego Bay—Some of the seeds grew, but none of them came to anything.

Mrs. A. M. Lake, Montego Bay—The seeds entirely failed owing, I think, to the poverty of the soil as I could not manure as highly as was recommended, and the drought also probably prevented their growth.

Mrs Noble, Little River—The onion seed has turned out successfully I think. I have 5¼lbs. some quite large and full flavoured, some measuring 5 inches in circumference. I certainly think with perseverance one would find them very remunerative.

Mr. H. B. Salmon, Black River—Onions did not come to anything, I am afraid the climate here is too hot.

Mr. W. Baillie, Walkers Wood—The seed germinated well, and made a good start, but the continued dry weather has checked them, and the bulbs are on the whole small with here and there a fair-sized one.

Mr. C. L. Walker, Walkers Wood—The seasons being heavy in October last, most of the seeds were washed away, but some grew and produced very good onions.

Mr. John R. Braham, Moneague—The plants bulbed freely but were not large, being what I can best describe as pickling onions, and ranging from ¾ inch to 1½ inch diameter. I consider my attempt therefore a commercial failure. Eschalots would have decidedly paid better.

Mr. A. W. Douet, Claremont—I regret that the onion seed sent me for trial did not turn out well. The seed grew well but did not bulb to any size.

Mr. J. M. Cover, Brown's Town—The onion seeds have turned out first class considering the sharp drought we have had, and I have taken out some which measured 3 inches in diameter. I have no doubt that with proper cultivation and a good supply of liquid manure, that we could turn out onions just as large as those from America.

Mr. Geo. Lannaman, Brown's Town—I sowed the seeds and had them transplanted according to the directions in the Bulletin and they were coming on nicely, but the heavy rains in November and the early part of December destroyed them completely.

Mr. Ed. W. Pratt, St. Ann's Bay—I failed to raise any onions from the seed you supplied, and am unable to account for the failure.

Mr. W. G. Groves, Ocho Rios—The seeds I got last year from you turned out very well and yielded a good return.

Rev. A. J. Andrews, Chapelton—I tried the seeds in two places in my own ground ; in one the soil was really of too clayey a nature to promise success, in the other the seeds grew freely and well, but unfortunately none of them would bulb.

Mr. T. A. Manley, Porus—I regret to say the onion seeds did not turn out as well as I expected. None of the red grew, and the others owing to the severe drought, did not yield largely.

Mr. C. N. Heming, Davis Town—The October rains washed most of the seeds away, but a few grew and produced fairly large onions.

W. Fawcett
Director.

Appendix I.

List of Recipients of Plants or Seeds distributed free or in exchange from the Botanic Gardens, Jamaica: —

Plants.

Colonel Caulfield, Superintendent District Prison Falmouth, Superintendent General Penitentiary, Constabulary Quarters, Falmouth, Rev. H. Seymour Isaacs, Rev. J. W. Austin, Rev. C. M. Buckley, Rev. J. S. Fraser (for churchyards) E. Griffin, J. W. Fisher, L. Isaacs, J. Bowrey, E. G. Orrett, H. Kemble, C. W. Chapman, R. S. Haughton, R. Melhado, G. C. Lindo, P. H. Baxter, E. Hosack, R. H. Butler, E. Stewart, Dr. Cooke, W. Clark, G. Henderson, J. Stephens, A. Hopwood, M. Edwards, P. Moodie, R. Stewart, F. H. Barker, W. Douet, J. Lannaman, A. Stewart, H. Fowler, A. J. Hopwood, A. DeMontagnac, Geo. Massy, C. F. Warren, L. Mackinnon, R. Cocking, D. Archer, R. Kitson, W. Groves, Capt. Baker, A. Webb, A. Martin, J. Clark, H. Silvera, A. Sutherland, Dr. Gibb, D. James, G. Douet, J. Reece, Capt. Taylor, Hon. N. Porter, J. Gruber, H. Vickers, A. Bancroft, R. Tomlinson, H. Cunha, H. Walcott H. Rowe, Dr. Calder, J. R. Hopwood, D. Moodie, R. Johnson, A. Hamilton, J Wilensky, R. Elworthy, S. Cotter, J. Owen, R. Breakspear, R. Simmonds, J. Shearer, J. Beach, (Florida) A. L. Archer, (Antigua) Royal Gardens Kew, Botanic Gardens Melbourne, (British Honduras) Mrs. James, Mrs. Maclaverty, Mrs. Hotchkin, Mrs. Farquharson, Mrs. Isaacs, Mrs. Hamilton, Miss Barrett, Miss Marescaux, Miss Johnson, Revds. D. Griffith, J. Reinke, E. Key, H. Walder, Q. R. Noble, Dr. Nicholls, (Dominica.)

Seeds.

A. N. Sutherland, J. Duff, E. Griffin, S. Cover, J. Cover, W. Cover, F. Petgrave, H. Hitchings, C. Hemming, R. Kitson, M. Edwards, A. Stewart, J. LeRay, P. H. Baxter, W. Manley, C. Plummer, J. Hanna. T. Fletcher J. Manly, M. Bowen, J. Williams, J. Gruber, T. Grant, S. Cridland, B. Fullerton, J. Hibbert, A. Lake, F. Lindo, A. Shakespeare, E. Pratt, W. Lessels, H. Salmon, D. Chandler, T. Martin, J. Underwood, C. Nairne, G G. Merriam, J. Jesurun, F. Barker, W. Plummer, G. Lannaman, R. Domville, J. Grant, A. Wilson, J. Braham, P. Wates, E. Orrett, J. T. Graham, A. Webb, J. Welsh, J. Smikely, L. Dias, J. Wright, J. Wilensky, S. Cridland, G. Duff, S. Wood, F. Jenoure, C. Helwig, H. Walcott, O. Abrahams, R. Silvester, E. Young, W. Thomas, W. Sabonadiere, H. Ibbott, W. Edgar, W. Baillie, J. Owen, Dr. Calder, R. Cocking, J. Stephens, B. Gosset, C. Walker, A. Douet, A. Stewart, A Hopwood, J. Palache, J. Shearer, E. Barry, C. H. Levy, C. Gunter, A. Isaacs, W. Chisholm, R. Thompson, J. Salmon, R. J. Domville, R. Sidgwick, Dr. McCatty, R. Elworthy, A. Facey, J. Fuller, W. Ramsay, E. Wilson, Mrs. Noble, Revd. J. Reinke, G. McNeill, M. Collins, H. Walder, A. Hedmann, J. Thomas, A. Andrews, W. Griffith, Mrs. Wedderburn, Mrs. Heaven, Mrs. Chisholm, Mrs. Wynne, J. Bowrey, T. Sargood, Col. White, Insp. McLeod, J. Carter & Co., London, Siebrecht & Wadley, New York, Reasoner Bros., Florida, Vilmorin-Andrieux, Paris, J. Beach (Florida) Baron Von Mueller, (Melbourne) Royal Gardens, Kew, Botanic Gardens at Cambridge, Dublin, Edinburgh, Glasgow, Demerara, Trinidad, Barbados, British Honduras, Grenada, St. Lucia, St. Vincent, Antigua, Montreal, Washington, Cape Town, (Cape Colony) Grahams Town, Port Elizabeth, King Williams Town, Graef Reinet,, Uitenhage, Natal, Mauritius, Seebpore, Mungpoo, Darjeeling, Saharanpur, Lucknow, Cawnpore, Bombay, Odeypore, Ootacamund, Ceylon, Straits Settlements, Hong Kong, Sydney, Brisbane, Rockhampton, Adelaide, Port Darwin, Melbourne, Hobart Town, Tasmania, Wellington and Dunedin, New Zealand; Botanical Stations, Fiji, Gold Coast, Lagos, Gambia, Agri. Horti. Society of India, Agri. Horti. Society Madras, Acclimatization Society's Gardens, Brisbane.

List of Donors of Plants and Seeds to the Botanic Gardens, Jamaica.

Plants.

J. T. Palache, A. deMontagnac, P. Maclaverty, Dr. Henderson, Mrs. Heaven, Mrs. Henderson, Messrs. Reasoner Bros., Florida, J. Beach, Florida, A. L. Archer, Antigua, Royal Gardens, Kew.

Seeds.

Miss T. Moulton-Barrett, Mrs. Heaven, H. P. Deans, R. Stewart, R. B. Nunes, Dr. Grabham, Revd. H. H. Isaacs, Machado and Quesada, H. McDermot, CaymanIslands; Reasoner Bros., Baron Von Mueller,, Melbourne; Royal Gardens, Kew; Botanic Gardens at Demerara, Trinidad, St. Vincent, Antigua, Mauritius, Seebpore, India; Saharanpur, India; Mysore, India; Ceylon Hong Kong; Rockhampton, Queensland; Adelaide, S. Australia; Port Darwin, S. Australia; Melbourne; Forest Dept., N. S. Wales; Agri. Horti. Society, Madras.

APPENDIX II.

List of Plants from Kew, received at Hope Gardens.

Acridocarpus pruricus, A. Juss., Natal.	Growing
Adiantum cuneatum, var. Legrandi	"
" var. Fergusoni	"
" var. Pecottei	"
" var. Weigandi	"
Æschynanthus Lobbiana, Hook., Java	"
Agave Kerchovei, Lem., Mexico	"
" Franzosini. 5	"
" heteracantha, Zucc. Mexico	"
" Hookeri, Jacobi, Mexico	"
" Kerchovei, Lem. var. inermis. Mexico	"
" Lynchii.	"
" pulcherrima, Otto, Mexico	"
" Schottii, Engelm. Mexico	"
" Thomsoniana, Jacobi, Mexico	"
" vivipara, Linn, variegata. Mexico	"
Aloë Cooperi, Baker, S. Africa	"
" dichotoma, Linn. f. S. Afr.	"
" heteracantha, Baker,	"
" Lynchii, Baker, x. (Kew hybrid)	"
" mitriformis, Willd. var. spinulosa, S. Afr.	"
" neglecta, Tenore,	"
" Serra, DC., S. Afr.	"
" sp.	"
Anthurium hybridum, Hort.	"
" Kalbreyeri, Hort. New Granada	"
Aristolochia Gigas, Linn., var. Sturtevanti	Dead
Asplenium latifolium, Don. India to China	Growing
Aspidium repandum, Willd. Philippines	"
Attalea Guichire, Hort.	"
Bauhinia Galpini, N. E. Br., Transvaal	Dead
Begonia socotrana, Hook., Socotra.	"
Brahea nitida, Hort	Growing
Dæmonorops grandis Mart. Malaya	"
Caryota Rumphiana, Mart. Borneo & Moluccas	"
Cereus (T. T. Peacock)	"
" speciosissimus, DC. Mexico	"
" tetracanthus, Labour. Bolivia.	"
Combretum sundaicum Miq. Sumatra	Dead
Cordyline congesta, Steud., Australia	"
Cotyledon macrantha, var. rubra	"
" nodulosa, Bak., Mexico	"
" sulcatum	"
Cycas Seemanni, A. Br. Fiji	Growing
Cymbidium Lowianum, Reichb f. India.	"
" eburneum, Lindl, India.	"
Cypripedium Lawrenceanum, Reichb f.	"
Didymochlæna, lunulata. Desv., Trop. Amer.	"
Didymosperma porphyrocarpon, H. Wendl. & Drude, Java.	"
Diospyros discolor, Willd. Philippines	"
Dioon spinulosum, Dyer, Mexico	"
Erythrina indica, var. alba, Lam. Trop. Asia	"
Eurya japonica, latifolia, variegata. Thunb. Japan	Dead
Euphorbia sp.	"
" canariensis, Linn. Canary Islds.	"
Ficus religiosa, Linn. India	Growing.
" sp.	"
Flacourtia Ramontchi, L'Herit. Madagascar	"
Furcræa albispina	"
gigantea, Vent. var. Willemetiana. Trop. Amer.	"
Gasteria verrucosa, Duval., var. latifolia	"
" carinata, Duval., S. Africa	"
" triangularis	"
" nigricans Duval., S. Africa (2)	"
" maculata, Haw., S. Africa	"
" dicta, N.E.B., S. Africa	"
" verrucosa, Duval., S. Africa	"
" disticha, Haw., var. angustifolia, S. Africa	"
" disticha, Haw., S. Africa	"
" rigida	"

Geonoma Spixiana, Mart., S. Amer.	Growing.
" pumila, H. Wendl., Trop. Amer.	"
" Princeps, Linden, Peru	"
" Schottiana, Mart. Brazil	"
Dracontium Gigas, Engl., Nicaragua	"
Licuala amplifrons	"
Lycaste gigantea, Lindl., S. Amer.	"
Mamillaria Ehrenbergii, 5	"
" megacantha	"
" angularis, triacantha	"
" uberiformis	"
" magninanma, var. arietina 4	"
" gracilis	"
" gracile, var. pulchella	"
Musa coccinea, Andr. Ind. China	"
Nephrolepis rufescens, var. tripinnatifida	"
Orbignya Lydiae	"
Pandanus graminifolia	"
Pedilanthus tithymaloides, Poit., W. Indies	"
Phaius Bensoniæ, Hemsl. Moulmein	"
Plumieria Jamesoni	"
Platycerium æthiopicum, Hook , Guinea	"
Phyllocactus aurora	"
" Gordonianus	"
" Landoni	"
" Niobe	"
Pittosporum ferrugineum, Ait., Australia	"
Pilocereus Consolei 3	"
Pteris ensiformis, Burm., India to Australia	"
Pterocarpus indicus, Willd., Ind. and China	"
Puya Webberi	"
Rhipsalis paradoxa	"
Rochea coccinea, DC., Cape	"
Sandoricum lucidum	"
Socratea exorhiza 2	"
Streblus aspera, Lour. Trop. Asia	"
Strelitzia Reginæ, Ait. S. Africa	"
Strychnos Ignatii, Berg. Philippine Islds.	"
Strychnos (Brehmia) spinosa, Law., Africa	"
Tacca pinnatifida, Linn. E. Indies, &c.	"
" artocarpifolia. Madagascar, &c.	"
Tecoma sp :	"
Trachycarpus khas yanus, Wendl. India and Burma	"
Urceolina miniata., Andes	"
Vitis rotundifolia, Michx., Amer.	"
Xanthorrhœa minor, R. Br. Australia	Dead
" sp (Dobson.) Australia	"
" gracilis, Endl. "	"
" australis R. Br. "	Growing
" Talei, "	"

Appendix III.

Catalogue of Books added to the Library.

(The names of Donors are printed in italics in square brackets.)

Baillon, (Prof. M. H.) Mémoire sur la Symétrie et l'Organogénie florale des Marantées (Extract) *Recueil d'observations Botaniques.* Paris. 1861. 8vo.

Baillon. (Prof. M. H.) Sur la Constitution de l'androcée des Cucurbitacées. (Extract) *Association francaise pour l'acancement des Sciences.* Paris. 1878. 8vo.

Baillon. (Prof. M. H.) Sur les Toluifera et sur l'origine des Baumes de Tolu et du Pérou. (Extract) *Association francaise pour l'arancement des Sciences.* Paris 1873. 8vo.

Balfour, (Prof. I. B. and others.) Annals of Botany, Nos. 21, 22, 23, 24. London & Oxford. 1892. 8vo.

Cassino. (S. E.) The Scientists' International Directory. Boston. 1892. 8vo.

Dixon, (E. J. and others.) Wattle Bark —Report of the Board of Enquiry, Melbourne. 1878. 8vo. [*Kew.*]

Ellis (J. B. and Everhart, B. M.) The North American Pyrenomycétes. Newfield, N. Jersey. 1892. 4to.

Fream. (W.) Elements of Agriculture. London. 1892. 8vo.

Fremlin, (R.) The Potato in Farm and Garden. London. 1883. 8vo.

French, (C.) A Handbook of the Destructive Insects of Victoria. Part I. Melbourne. 1891. 8vo.

Gray, (Prof Asa.) Structural and Physiological Botanical Text Book. Cambridge. 1857. 8vo. [*Kew.*]

Griffiths, (W.) The Principal Starches used as Food. Cirencester. 1892. 4to.

Hitchcock, (A. S.) A Visit to the West Indies (Extract) *Botanical Gazette.* May. Bloomington. 1891. 8vo. [*Kew.*]

Hooker. (Sir J. D.) Icones Plantarum. Fourth Series. vol. I. Pt. 4. vol. II. Pt. 1. vol. III. Pts. 1 & 2. London. 1892. 8vo. [*Bentham Trustees through Kew.*]

Hooker, (Sir W. J. and G. A. W. Arnott) The British Flora. Sixth Edn. London. 1850. 12mo. [*Kew.*]

Hooker, (Sir J. D. and others.) Botanical Magazine. Vol. xlviii. London. 1892.

Huxley, (Prof. T. H.) Lessons in Elementary Physiology. London. 1890. 8vo.

Huxley, (Prof. T. H. & H. N. Martin) Practical Biology. Revised Edn. by G. B. Howes, & D. H. Scott. London &c. 1892. 8 vo.

Jackson, (J. R.) Commercial Botany of the Nineteenth Century. London &c. 1890 8vo.

Journal of the Royal Agricultural Society of England. Third Series. Vol III. Parts 1 & 2. London. 1892. 8vo.

Kuntze, (Dr. O.) Die Bewegungin der botanischer Nomenclatur von End 1891 bis Mai 1893. (Extract.) *Bot. Central blatt,* Bd. liv. 1893. Nos. 25, 26. [*Author.*]

Lindley, (John) An Introduction to Botany. Fourth Edition. Vols. I. & II. London. 1848. 8vo. [*Kew.*]

Lindley, (John.) Flora Medica. London. 1838. 8vo.

Lindley (John and Thomas Moore) The Treasury of Botany. 2 vols London. 1866. 8vo. [*Kew.*]

Moritz. (E. R. and G. H. Morris.) A Text Book of the Science of Brewing. London 1891. 8vo.

Munro. (John M. H.) Soils and Manures : with Chapters on Drainage and Land Improvement by John Wrightson. London &c. 1892. 8vo.

Murray, (Geo.) Phycological Memoirs. Part I. London. 1892. 4to.

Nicholson, (Dr.) Hortus Antiguensis. Vols. 1 and 2. (MSS.) Antigua. 1841.

Sargent, (C. S.) The Silva of North America. Vols III. & IV. Cambridge, U S.A., 1892. Fol.

Shaw, (C. W.) The London Market Gardens. London, 1883. 8vo.

Short't, (Dr. John.) A Monagraph on the Cocoanut-Palm: Madras. 1888. 4to. [*Kew.*]

Sim, (T. R.) Handbook of the Ferns of Kaffraria. Aberdeen. 1891. 8vo. [*Author.*]

Swartz, (O.) Icones Plantarum, incognitarum quas in India occidentali. . . Pts. 1 - 13. Erlangæ. 1794. Fol

Wallace, (Robt.) Indian Agriculture. Edinburgh. 4to.

Wallace, (Robt) The Rural Economy and Agriculture of Australia and New Zealand. London. 1891. 8vo.

Ward, (H. Marshall.) The Oak. Edited by Sir John Lubbock. London. 1892. 8vo

Watson, (W.) Cactus Culture for Amateurs. London. 1889. 8vo.

Watt, (Dr. George and others.) Dictionary of the Economic Products of India. Vol. VI, Part I, P - R, London and Calcutta. 1892. 8vo.

White, (W. N.) Gardening for the South. New York. 1868. 8vo.

Woodhead, (Dr. G.) Bacteria and their Products. London. 1891. 8vo.

Veitch, (Robt & Son.) Reports upon experiments for the prevention and cure of the Potato Disease. Plymouth. 1892. 8vo.

Veitch, (Jas.) A Manual of Orchidaceous Plants. Pts. 8 and 9. London. 1892-93. 8vo.

Appendix IV.
Meteorological Tables.

Month.	Hill Garden.—Elevation 4,907 Feet.																Newhaven Gap—Elevation 5,600 Ft.			Blue Mountain Peak—Elevation 7,406 Feet.					
	Pressure.		Temperature.—Degrees Fahrenheit.							Dew Point.		Humidity.		Wind.			Temperature.								
	7 a.m.	3 p.m.	7 a.m.	3 p.m.	Max.	Min.	Range.	6 feet underground. 7 a.m.	6 feet underground. 3 p.m.	7 a.m.	3 a.m	7 a.m.	3 p.m.	Direction.	Force—Miles.	Rainfall—Inches.	Max.	Min.	Rainfall—Inches.	Date of Observation.	Time of Observation.	Temperature.	Max. temp.	Min. temp.	Rainfall—Inches.
1892.	ins.	ins.	°	°	°	°	°	°	°	°	°						°	°				°	°	°	
April ...	25.349	25.343	58.8	64.0	68.4	57.0	11.4	61.0	61.0	52.2	58.9	78	93	ESE	50.5	1.90	74.3	48.5	0.00	30.4.92	1.40 p.m.	61	73	39	6.85
May ...	.335	.334	63.5	64.7	68.0	59.7	8.3	61.1	61.1	56.8	61.5	78	90	E	26.0	9.87	69.3	44.5	0.00	28.5.92	10.30 a.m.	65	70	45	11.80
June ...	.324	322	62.3	65.2	69.1	60.2	8.9	61.0	61.1	59.4	59.8	91	84	ESE	73.5	10.80	76.3	52.5	0.00	29.6.92	10.15 "	53	71	45	27.30
July ...	.361	.383	62.4	68.4	72.7	61.7	11.0	61.4	61.7	58.0	63.3	87	84	ESE	74.0	2.96	76.3	52.5	0.15	28.7.92	11.30 "	66	69	46	6.15
August ...	.356	.362	62.2	67.4	72.4	61.0	11.4	63.0	63.3	56.4	60.5	81	81	SE	32.0	1.52	76.3	54.5	2.98	5.9.92	10.20 "	68	74	45	4 60
September ...	.330	.319	63.0	66.2	70.9	60.8	10.1	63.9	63.9	53.5	62.1	70	87	SE	17.5	8.37	78.3	52.5	8.10	1.10.92	10.30 "	66	74	52	7.85
October ...	.295	.269	61.3	63.4	67.7	60.1	7 6	63.3	63.3	57.9	60.6	89	93	SE	20.5	32.65	75.3	54.5	44.85	1.11.92	3.15 p.m.	54	70	45	42.60
November ...	.302	.286	59.3	64.1	68.5	59.0	9.5	61.9	61.9	56.0	59.5	89	87	E	82.6	35.97	70.3	48.5	60.35	30.11.92	10.15 a.m.	61	67	40	58.30
December ...	.337	.321	56.4	61.7	65.6	54.5	11.1	60.9	61.0	52.9	58.2	88	88	E	39.9	3.04	71.3	45.5	10.00	31.12.92	1.30 p.m.	58	71	40	11.80
1893.																									
January ...	.330	.315	55.2	61.5	66.6	53.2	13.4	61.2	61.3	50.4	56.8	85	81	ENE	27.7	2.69	70.3	46.5	2.00	31.1.93	11.30 a.m.	66	68.9	...	7.60
February ...	.350	.339	55.3	62.2	66.4	53.4	13.0	60.3	60.4	51.1	57.7	86	86	E	97.8	12.72	70.3	46.5	0.70	28.2.93	11.0 "	64	67.4	33.3	2.75
March ...	.350	.338	55.1	62.3	66.5	52.4	14.1	60.6	60.9	48.7	57.4	80	83	E	43.2	1.33	73.3	43.5	4.00	31.3.93	12.15 p.m.	60	70.9	47.3	2.35
Means ...	25.334	25.327	59.6	64.2	68.5 Mean 63.1	57.7	1 .8	61.6	61.7	54.4	59.6	81	86	Easterly.	48.7	123.82 Total.	73.4 Mean 61.2	49.0	133.13 Total	...	...	61.8	70.5 Mean for 11 Mths. 57.9	43.4	189.95 Total.

KINGSTON PUBLIC GARDEN.

Elevation, 60 feet.

Month.	Pressure.		Temperature Degrees Fahrenheit.					Dewpoint.		Humidity.		Wind—Miles per day.		Rainfall—Inches.
	7 a.m.	3 p.m.	7 a.m.	3 p.m.	Max.	Min.	Range.	7 a.m.	3 p.m.	7 a.m.	3 p.m.	Direction.	Force.	
1892	In.	In.	°	°	°	°	°	°	°	°	°			
April ...	30.058	29.993	73.5	83.1	86.1	69.3	16.8	65.6	68.3	76	62	SSE	107.3	0.81
May ...	30.012	.964	77.3	83.5	86.9	72.8	14.1	69 6	70.8	77	66	SSE	105.3	1.07
June ...	30.011	.971	78.1	83.5	87 0	73 5	13.5	69.9	71.6	76	68	SE-S	146 4	3 20
July ...	30 046	.999	77.1	86 5	89 4	73 5	15 9	69.2	72.1	77	62	SSE	120 5	0.20
August ...	30 000	.957	75.9	85.1	88.6	72.9	15.7	69.8	73 9	81	69	SSE	99.4	1.00
September ...	29 982	.923	75 2	83 7	88 5	72.8	15.7	69 9	72.5	84	69	SSE	86 3	3.15
October ...	29.942	.886	74.2	81.9	86.0	71.7	14.3	71.3	72 6	91	74	SSE	76.5	7.36
November ...	29.968	.900	72.2	83 0	86.4	70.1	16.3	68.4	70.9	88	67	S	73 6	2 99
December ...	30.027	.963	69.7	81.8	85.4	67.1	18.3	64.8	68.2	84	64	S	77.5	0.72
1893														
January ...	30.018	.952	68.9	82.3	85.6	67.3	18.3	63.5	66.0	83	58	S by E	100.7	0.38
February ...	30.053	.989	69 6	82.8	85 6	67.6	18.0	63.8	67.1	82	59	SSE	107 0	0.88
March ..	30.067	30 001	70.7	82.4	85.6	67.8	17.8	62.9	67.4	76	61	S by E	117.7	0.00
Means ...	30.015	29.958	73.5	83.3	86.7	70.5	16.2	67 3	70 1	81	64	SE	100.7	Total 21.88
					Mean 78.6									

Castleton Gardens.—Elevation 580 Feet.

Month.	Pressure.		Temperature: Degrees Fahrenheit.					Dew Point.		Humidity.		Rainfall.—Inches.
	7 a.m.	3 p.m.	7 a.m.	3 p.m.	Max.	Min.	Range.	7 a.m.	3 p.m.	7 a.m.	3 p.m.	
1892.	In.	In.	°	°	°	°	°	°	°	°	°	
April ...	29.63	29.62	66.9	77.5	83 9	62.7	21.2	64.8	72 3	93	78	2.38
May ...	.62	.59	71.2	79.8	84.5	67.5	17.0	69.8	70.9	96	74	4.77
June ...	.64	.59	72.2	80.0	85.4	68.1	17.3	69.6	74.7	93	86	11.02
July ...	.64	.65	71.4	83.3	87.3	68.1	19.2	69.5	73.2	96	63	3.03
August ...	.59	.59	69.3	80.0	84.4	67.5	16.9	57.0	74.1	65	82	7.89
September ...	.58	.54	68.9	79.4	85 7	67.2	18.5	68 1	73.6	93	84	12.42
October ...	.54	.53	71.0	77 4	81.1	69 5	11.6	70 0	74.1	95	80	32.92
November ...	.55	.54	70.0	77.0	80.4	67.0	13.4	64.1	69.1	96	76	2.52
December ...	.61	.59	64.7	76.8	79.5	63.2	16.3	64.1	69 1	96	84	29.32
1893.												
January ...	.60	.57	64.4	76.2	79.4	61.8	17.6	62 9	70.0	96	81	3.99
February ...	.64	.63	65.7	77.4	80.1	63.1	17.0	64 0	70.4	93	79	13.94
March ...	.65	.63	64.5	77.8	81.9	61.2	20.7	61 5	66.5	90	69	2.27
Means ...	29.62	29.58	68 3	78.4	82.8	65.6	17.2	65.4	71 5	91	78	Total 126.47
					Mean 74°.2							

KING'S HOUSE GARDEN—ELEVATION, 100 FEET.

Month.	Pressure.		Temperature. Degrees Fahrenheit.					Dew Point.		Humidity.		Rainfall—Inches.
	7 a.m.	3 p.m.	7 a.m.	3 p.m.	Max.	Min.	Range.	7 a.m.	3 p.m.	7 a.m.	3 p.m.	
1892.	In.	In.	°	°	°	°	°	°	°	°	°	
April ...	30.1	30.0	70.4	84.4	88 2	64.9	23 3	64.9	76.0	84	54	2.60
May ...	30.0	29.95	72.8	83 8	88 6	69.9	18.7	71.1	79.5	93	61	4 85
June ...	30 1	30.1	75 6	84 8	88 5	70.2	18.3	70.9	...	85	...	2.65
July ...	30.1	30.1	74.8	87 5	93 8	68.9	24.9	70.2	76 9	84	75	0.30
August ...	30.0	30.0	74.6	85.0	91.6	67.9	23.7	69.9	79.5	84	85	3.15
September ...	30.1	29.99	73.4	84.6	88 1	68.5	19.6	69.5	77.6	90	79	13.65
October ...	30 0	29.99	71.9	82.0	87.1	67 7	19.4	68.7	77.9	90	87	9 60
November ...	30.0	30.0	70.3	83.2	86.4	66.1	20.3	67.6	79.3	93	87	5.45
December ...	30.0	30.0	66.4	82.5	87.5	61 9	25.6	63 1	77.6	90	84	0 85
1893.												
January ...	29.88	29.88	67.8	84.2	88.9	60 6	28.3	63.3	76.6	84	79	0.75
February ...	29.83	29 75	68.6	84.6	88.7	62 2	26.5	64 3	77 8	84	79	0.95
March ...	29.81	29.78	67.5	85.6	89.1	63.1	26.0	62.1	76.0	81	72	0 70
Means ..	29.96	29.94	71.0	84.3	88 8	65.9	22.8	67.1	77.7	86	76	45.50 Total.
					Mean 72°3							

HOPE GARDENS—ELEVATION 600 FEET.

Month.	Pressure.		Temperature. Degrees Fahrenheit.					Dew Point.		Humidity.		Rainfall—Inches.
	7 a.m.	3 p.m	7 a.m.	3 p.m.	Max.	Min.	Range.	7 a.m.	3 p.m.	7 a.m.	3 p.m.	
1892.	In.	In..	°	°	°	°	°	°	°			
April ...	29.22	29.22	70.6	82.8	86.2	67.8	18.4	64.7	69.5	81	57	4.34
May ...	.19	.19	73.8	82.1	86.1	70.8	15.3	68.4	71.9	81	71	6.67
June ...	.20	.20	74.2	83 0	86 7	72.8	13.9	64.9	71.4	73	59	3.34
July ...	.25	.25	74.1	86.3	89.7	71.5	18 2	68 5	77 8	84	72	0.77
August ...	.20	.20	73.6	84.4	87.2	72.6	14.6	68.0	72.4	81	67	2.69
September ...	.17	.16	72.3	81.8	84 3	72.6	11.7	69.5	73.2	93	74	11.19
October ...	.13	.13	72.5	78.7	81.8	71.9	9.9	69.7	73.9	90	84	16.78
November ...	.16	.16	70.2	83.6	85.0	68 9	16.1	66.6	72.2	90	67	7.35
December ...	.20	.17	66.2	81.2	–	65.6	–	62.3	70.6	87	71	1.35
1893.												
January ...	.20	.18	64.5	81.1	84 7	61.9	22.8	60.4	70.1	82	69	1.18
February ...	.21	.20	66.2	81.7	86.3	64.0	22.3	61 6	68.1	87	62	1 56
March ...	.21	.20	67.0	82.8	87.9	63.1	24.8	61.3	65.4	82	56	0.00
Means ...	29.19	29.19	70.4	82.4	85 9	68.6	17 6	65.5	71.3	84	67	57.22 Total.
					Mean 77°4							

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