No. 1. APRIL, 1887.

BULLETIN

OF THE

BOTANICAL DEPARTMENT,

JAMAICA. (Island)-

PRICE—Two-pence.

JAMAICA:
GOVERNMENT PRINTING ESTABLISHMENT, 79 DUKE STREET, KINGSTON.
1887.

1—TEFF OR THAF.

(Eragrostis abyssinica, Link.)

Teff is a cereal a native of Abyssinia, growing at elevations between 4,000 and 7,000 feet. The grain is of a white or brown colour. It is very small but yet prolific, returning from 20 to 40 times the seed. It is made into flour by crushing it in a stone mill, and the husk is separated by sifting. The best kinds of Teff give a very white flour, exceedingly light, and easily digested. To make the finest kind of bread the sifting operation is repeated several times.

Until the end of last year this grain was quite unknown outside the boundaries of Abyssinia, but the Director of Kew Gardens, being of the opinion that it might be introduced with great advantage into mountainous districts of the British Empire, obtained a small supply from its native country. A portion has just been received from Kew, with information which will prove useful to those who wish to make the experiment of growing it.

2—CULTIVATION.

Olkraur, 27th Sept., 1886.

Thaf (in the Tigrina language) or Thief (in the Olmharigna language) belongs to the family of grasses and resembles the finest lawn grass.

There are two kinds: White Thaf and red Thaf. Both are, moreover, of two different qualities, according to the time of sowing, and are in consequence distinguished by the names of the Seasons: "Thaf-Hagaiz" and "Thaf-Tseddia." The first is called "hagaiz" from the name of the season which, according to Abyssinian reckoning, includes all our winter and the commencement of our spring: it is sown at the end of Megabit, in Myazya and Ghembot (March, April, and May.) The second is called "Tseddia" from the name of the commencement of the rainy season, which follows that of Hagaiz and precedes that of Keremt; it is sown in June and the commencement of July.

Thaf-Hagaiz is of slow, and Thaf Tseddia of rapid growth. These conditions produce great difference in quality, Thaf-Hagaiz being considerably superior; the white, especially, is used for the table by the Court and Chiefs. Thaf-Tseddia is of very inferior quality, and the flabby cake, or the "Tabita" which is produced from its flour, is as disagreeable to chew as if it were mixed with sand.

It is therefore the early sowing and vigorous growth of Thaf-Hagaiz, due to being two months longer in the ground, that render it of superior quality.

I ought, however, to add that "Hagaiz" and "Tseddia" cannot be sown indifferently for one another. The experiments which the natives tell me have been made have not met with much success. The seed of Thaf-Hagaiz must be used for the first sowing, and that of Tseddia for the second. The difference between them, both in the case of the white or red, is quite perceptible to the naked eye, by the want of plumpness characteristic of the Thaf-Tseddia relatively to the other.

These seeds almost equal barley in their growth and the rapidity with which they come up. Sown at the end of March or in April and May, they arrive at maturity at the beginning of September. Sown in June or July the crop may be reaped in October.

They are cultivated in the warm districts of the "Konalla" or lowlands, at an altitude of from 1,300 (4,264 ft.) to 1,800 (5,904 ft.) metres, and especially in the temperate regions of the "Onaynè Dega," at an altitude of from about 1,800 to 2,400 m. (5,904 ft. to 7,872 ft.)

The Thaf comes up very vigorously in heavy lands, but its large and high tuft is richer in herbage than in grain. The exuberance of its vegetation in these heavy lands causes it to be laid, and then its ear rots. It prefers light soils and adapts itself even to the most sandy; it then produces slender, wiry stems, and supports better the weight of the ear.

The land requires to be prepared and cleaned by three or four ploughings before sowing; but it is true that the ploughings in Abyssinia are light and not very deep. It is sown thickly on the surface of prepared ground. It is afterwards lightly hoed, if necessary, when it has come up.

It is not necessary to wait until it is quite dry like barley, to cut it, for when too ripe and dried, the grain sheds in the wind and at the least shock. It is cut as soon as the green ear turns to grey, in the early morning, and is placed in heaps with the ears inwards, and covered to preserve it from rain; it is then left to ripen and to undergo a certain amount of fermentation.

Its flour is only advantageously used in making "Tabita," a kind of large fermented pancake. The "Tabita" of Thaf is most easily digestible, and has none of the bitterness of some other kinds of grain.

(Signed) E. COULBEAUX,
Missionaire Apostolique en Abyssinio.

Analysis by Professor A. H. Church, M.A., F.C.S.

			In 100 parts.
Water	...	...	15.2
Albuminoids	...	...	8 2
Starch, &c.	...	...	68.1
Oil	...	...	2.8
Cellulose, &c.	...	...	2.8
Ash	...	...	2.9

The ratio between the albuminoids, or fleshformers, and the heat givers, or force producers (calculated as starch), is here 1 9. This ratio is less satisfactory than that of the majority of the millets, but is near that of Panicum miliare.

BULLETIN OF INFORMATION IN REGARD TO AGRICULTURAL MATTERS.

No. 1.

THE GOVERNOR directs the publication of the following digest of correspondence prepared by the Superintendent of Botanic Gardens relative to a Fungal disease which has become very destructive in the Island of Jamaica among crops of plants known as Colocasia esculenta and C. antiquorum, the produce of which is variously known by the local name of "Cocoes," "Eddoes," "Taro," "Tanias," or "Tanniers."

At the end of, or towards the close of, the year 1886, the attention of the Government of Jamaica was called by J. T. Wigham, Esq., Stipendiary Magistrate for Portland, to the prevalence of a "rot" or disease among the "Cocoes" cultivated in the district. Mr. Wigham reported that owing to the disease the article was only procurable in rapidly decreasing quantities, while in former years besides forming the chief food supply of the labouring classes, they were used in large quantities for the purpose of fattening swine.

A question which thus affected the food supply of the people was considered by the Jamaica Government to be of serious import, and the then Acting Chief of the Jamaica Botanical Department was instructed to visit the district and report upon the subject, who after carefully examining the various lands in cultivation and the plants affected, secured specimens for microscopical examination, after accomplishing which he furnished a Report to the Jamaica Government which in a condensed form was to the following effect :—

(*a.*) "That the disease appeared to attack in the first instance the base of the root, causing it to rot and the leaves to assume a yellow and wrinkled appearance, often destroying the entire plant defore the offsets or edible portion became fit for use.

(*b.*) "It was pointed out that the disease was probably due to the action of a destructive microscopic fungus which was found on examination to be present in the roots, one nearly allied to the destructive potato rot, *Peronospora infestans.*

(*c.*) "It was recommended, in view of the foregoing, that great care should be exercised in subsequent cultivations by obtaining (if possible) 'heads' from districts where the disease did not exist, and further to burn all infected plants, and not use them for feeding animals in a raw state ; which would tend to spread the disease.

(*d.*) "It was suggested for further confirmation that a set of specimens should be submitted to a specialist in Mycological science, and for that purpose some were sent to the care of the Director of the Royal Gardens, Kew, asking him to place them in the hands of a gentleman conversant with this class of work.

(*e.*) "The specimens were placed by the Kew authorities in the hands of Mr. Massee for examination and report, with the result that the primary report was fully confirmed and the species of fungus determined by Mr. Massee as *Peronospora trichotoma.*—n. sp.

(*f.*) "The suggestions made to cultivators, in the primary report, were also fully confirmed by the opinions of Messrs. Massee and Morris, and have since been endorsed by Mr. Fawcett, tho lately appointed Director of Public Gardens and Plantations in Jamaica, who summarizes them somewhat in the following manner :—

(*g.*) "'The attention of Magistrates, Clergy and others interested in the food supply of the people should be drawn especially to the recommendations that all plants however slightly affected should be burnt at once ; that all infected ground should be planted with other crops ; an interchange of good 'heads' for planting should be made, and generally that *rotation of crops* should be adopted.'"

The discovery of the disease has been deemed of such scientific importance that a paper on the species of Fungi causing it has been read before the Linnean Society of London by Messrs. Massee and Morris, which paper, when published, may probably afford further information as to the best means of combating it. In the meantime, should the disease unhappily be present in the Island of Trinidad (or anything resembling it), it is of importance that the fact should be at once communicated to the Superintendent of Botanic Gardens, Mr. J. H. Hart, who will at the earliest moment render his advice as to its identification with the Jamaica disease and afford other hints that may prove useful in the endeavour to exterminate it. Should it be found upon enquiry that the Island is free from the disease, then the efforts of all cultivators should be directed to see that it is not introduced by imported plants from other Colonies.

J. H. HART,
Superintendent Botanic Gardens.

March 31st, 1887.

By Command,

H. W. CHANTRELL,
Acting Colonial Secretary.

Government House,
2nd April, 1887.

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The Editor
The Torrey Club Bulletin
Colombia College
New York

No. 2. August, 1887.

BULLETIN

OF THE

BOTANICAL DEPARTMENT, JAMAICA.

CONTENTS:

PRICE—Two-pence.

JAMAICA:

GOVERNMENT PRINTING ESTABLISHMENT, 79 DUKE STREET, KINGSTON.

1887.

A.—Economic and Medicinal Plants.

Scientific Name.	Common Name.	Habitat.	Price at Castleton. Plants.	Price at Castleton. Seeds.
Menispermaceæ—				
Anamirta paniculata, Coleb.	Cocculus indicus	India	1d. each	
Bixineæ—				
Bixa Orellana, L.	Arnotta	Trop. America	1d. "	
Gynocardia odorata, R. Br.	Chaulmugra	Malay peninsula & N. India		
Ternstrœmiaceæ—				
Camellia Thea, Link	Tea	Assam	1d. each or 7s. 6d. per 100	2s. per 100
Malvaceæ—				
Hibiscus elatus, Sw.	Blue or Mountain Mahoc, Cuba bast	West Indies	1d each	
Sterculiaceæ—				
Theobroma Cacao, L.	Chocolate or Cacao	Trop. America	1d. each or 7s. 6d. per 100	3s pr 12 pds 21s pr 100 "
Cola acuminata, R. Br.	Kola Nut	W. Africa	1d. each	3d. a dozen
Linaceæ—				
Erythroxylon Coca, Lam.	Coca	S. America	3d. each	
Zygophyllaceæ—				
Guaiacum officinale, L.	Jamaica Lignum Vitæ	W. Indies & S. America	1d. each	3d. per pkt.
Simarubaceæ—				
Picræna excelsa, Lindl.	Jamaica Quassia, Bitter wood	W. Indies	1d. "	
Quassia amara, L.	Surinam Quassia	Brazil & Guiana	1d. "	
Ilicineæ—				
Ilex paraguayensis, St. Hil.	Paraguay tea	S. America		
Rhamneæ—				
Gouania domingensis, L.	Chew-Stick	W. Indies	1d. each	3d.per pkt.
Sapindaceæ—				
Paullinia jamaicensis, Macf.	Supple-Jack	W. Indies	1d. "	
Leguminosæ—				
Abrus precatorius, L.	Wild Liquorice	E. Indies	1d. "	3d. per pkt.
Cassia Fistula, L.	Purging Cassia	Tropical Asia	1d. "	
C. obovata, Collad.	Senna	Tropical Asia and Africa		
Tephrosia toxicaria, Pers.	Surinam poison	W. Indies	1d. "	3d. per pkt.
Cæsalpinia Sappan, L.	Sappan wood	E. Indies	1d. "	
C. Bonducella, Roxb	Grey nicker seeds	Tropics		
Baphia nitida, Loddig.	Cam-wood	W. Africa	1d. each	
Trachylobium Hornemannianum, Hayne	Copal tree	E. Trop. Africa		
Myroxylon Toluifera, H.B. & K.	Balsam of Tolu	S. America		
M. Pereiræ, Klotz.	" Peru	Central America		
Dipterix odorata, Willd.	Tonquin bean	Cayenne		
Mucuna pruriens, D.C.	Cowhage or Cowitch	India	1d. each	1d. per pkt.
Hæmatoxylon campechianum, L.	Logwood	Tropical America		
Tamarindus indica, L.	Tamarind	Africa	1d. each	3d. per pkt.
Myrtaceæ—				
Pimenta officinalis, Lindl.	Pimento, Allspice	W. Indies, Cent. & S. America	1d. each	3d. per pkt.
Eugenia caryophyllata, Thunb.	Clove	Moluccas		
Eucalyptus Globulus, Labill.	Blue Gum Tree	Australia	1d. each	
Umbelliferæ—				
Arracacha esculenta, D.C.	Arracacha	S. America	1d. "	

Economic and Medicinal Plants.

Scientific Name.	Common Name.	Habitat.	Price. Plants.	Price. Seeds.
Rubiaceæ—				
Cinchona Ledgeriana, Moens. ...	Ledger Bark	Bolivia	2d. each	
C. officinalis, L. ...	Crown Bark	Loxa	10s. per 1000	1s. 6d. per oz.
C. Calisaya, Wedd. ...	Yellow Bark	Peru and Bolivia	...	5s. "
C. succirubra, Pav. ...	Red Bark	Ecuador	...	1s. 6d. "
C. hybrid ...	Hybrid Bark	...	20s. per 1000	4s. "
Exostemma caribæum, G. Don. ...	West Indian Bark	West Indies		
Coffea arabica, L. ...	Coffee	Tropical Africa	1d. each	2s. per qt.
C. arabica var. Mocha ...	Mocha coffee	Arabia	1d. "	
C. liberica, Hiern. ...	Liberian coffee	W. Africa	1d. each or 7s. 6d. per 100	1s. per 100
C. benghalensis, Roxb. ...	...	Bengal		
Cephaelis Ipecacuanha, A. Rich. ...	Ipecacuanha	Brazil		
Sapotaceæ—				
Bassia latifolia, Roxb. ...	Mahwah tree	India		
Apocynaceæ—				
Landolphia spp. ...	African Rubbers	Africa	3d. each	
Tabernæmontana crassa ...	Rubber plant			
Asclepiadeæ—				
Asclepias curassavica, L. ...	Red-head	W. Indies	1d. each or 7s. 6d. per 100	3d. per pkt.
Loganiaceæ—				
Strychnos Nux-vomica, L. ...	Nux-vomica	E. Indies		
Boragineæ—				
Cordia Myxa, L. ...	Sebesten Plum	India		
Convolvulaceæ—				
Ipomæa Purga, Hayne ...	Jalap	Mexico	1d. each	
Solanaceæ—				
Cyphomandra betacea, Sendt. ...	Tree Tomato	S. America	1d. "	
Nicotiana Tabacum, L. ...	Tobacco	Trop. America	1d. each	2s. 6d. pr qt.
Piperaceæ—				
Piper nigrum, L. ...	Black pepper	E. Indies	3d. "	
" methysticum, Forst. ...	Kava	Polynesia		
" Betle, L. ...	Betel pepper	Java	3d. "	
Chloranthew—				
Hedyosmum nutans, Sw. ...	Cigar or headache bush	West Indies	1d. "	
Myristiceæ—				
Myristica fragrans, Houtt. ...	Nutmeg	E. Indies	3d. "	
Laurineæ—				
Cinnamomum zeylanicum, Breyn.	Cinnamon	Ceylon	1d. "	6d. per pkt.
Thymelæaceæ—				
Daphne tinifolia, Sw. ...	Burn-nose bush	W. Indies	1d. "	
Euphorbiaceæ—				
Ricinus communis, L. ...	Castor oil	E. Indies	1d. "	3d. per pkt.
Hevea brasiliensis, Müll. Arg. ...	Para rubber	Brazil	3d. "	
H. Spruceana, Müll. Arg. ...	Demerara rubber	Guiana		
Manihot Glaziovii, Müll. Arg. ...	Ceará rubber	Trop. America	3d. "	
M. utilissima, Pohl. ...	Cassava	Trop. America	1d. "	
Croton Tiglium, L. ...	Croton oil plant	India	1d. "	

Economic and Medicinal Plants.

Scientific Name.	Common Name.	Habitat.	Price.	
			Plants.	Seeds.
Urticaceæ—				
Castilloa elastica, Cerv. ...	Central American Rubber	Central America		
Bœhmeria nivea, Hook. ...	Ramie	China	1d. each or 7s. 6d. per 100	
Brosimum utile ...	Cow tree	S. America		
Cupuliferæ—				
Quercus Robur, L. ...	Oak	Europe and Asia	1d. each	
Orchideæ—				
Vanilla planifolia, Andr. ...	Vanilla	Trop. America	1d. each or 7s. 6d. per 100	
Scitamineæ—				
Elettaria Cardamomum, Maton ...	Cardamom	India.	1d. each	6d. per pkt.
Zingiber officinale, Rose ...	Ginger	Trop. Asia	1d. "	
Zingiber sp. ...	"	China	3d. "	
Curcuma longa, L. ...	Turmeric	India	1d. "	
Maranta arundinacea, L. ...	Arrowroot	W Indies, and S. America	1d. "	
Musa textilis, Nees ...	Manilla hemp	Malay Islands		
Liliaceæ—				
Smilax officinalis, Kth. ...	Sarsaparilla	Trop. America	3d. "	
Smilax China, Lun. ...	China root	China	1d. "	
Sanseviera zeylanica, Willd. ...	Bowstring Hemp	Ceylon	1d. "	
Palmæ—				
Arenga saccharifera, Labill. ...	Sugar Palm	Trop. Asia		
Caryota urens, L. ...	Jaggery Palm	E Indies.		
Areca Catechu, L. ..	Betel nut Palm	Trop. Asia	1d. "	6d. per pkt.
Elæis guineensis, Jacq. ...	African oil Palm	W. Africa	1d. "	3d. per pkt.
Cocos nucifera, L. ...	Coco nut Palm	Tropics	3d. each	
Phytelephas macrocarpa, Ruiz & Pav.	Ivory nut Palm	S. America		
Aroideæ—				
Dieffenbachia Seguine, Schott ...	Dumb Cane	W. Indies	1d. "	
Gramineæ—				
Saccharum officinarum, L., varieties	Sugar Cane	Tropics	10s. per barrel	

The prices in this List are quoted only for cultivators in Jamaica and in those West Indian Islands which have established Botanical Stations in connection with Jamaica. The Department cannot undertake to supply shippers.

B.—GENERAL DIRECTIONS FOR PLANTING.

1. Before Plants are sent for, the ground should be prepared and the holes made, so that the Plants may be planted out immediately on arrival.

2. For ordinary Timber Trees and Trees intended for Shade or Ornament, holes should be dug at least 30 inches in diameter and 24 inches deep. The soil taken out, if clayey or gravelly, should be thoroughly mixed with manure or fresh loam and be replaced in the holes, with the surface soil at the bottom. For Palms, Shrubs, and Plants in Borders, deep trenching of the whole surface will be found a most effective preparation.

3. For Trees mentioned in the last paragraph the holes may be placed at distances of 10, 12 or 15 feet apart. Trees intended for Avenue planting should be at least 15 feet from the side of the Road. Fruit Trees should be planted at distances proportionate to their size and growth, but as a rule, if not in Grass Pieces, Trees cannot be too thickly planted at first. Judicious pruning and thinning will always be available if the Trees become crowded.

4. Immediately on arrival the Plants should be carefully planted out and shaded with Ferns, Branches, or Banana Leaves. If the Plants are received in Bamboo Pots it is recommended that the Pots be carefully split in halves and the Plants put out with as little disturbance of the tender rootlets as possible. If weather is dry, in addition to the shading a daily watering for two or three weeks will be necessary. Except in dry and arid districts it is very injurious to allow Plants to stand in pits below the general surface. Such pits become pools of water during heavy rains and tend to rot off the Plants. Where the pits are admissible at all they should have a small drain to carry off the superfluous water as soon as possible.

C.—DESCRIPTIVE LIST OF SUGAR CANES CULTIVATED IN THE JAMAICA GARDENS.

No. 1. Tourkoury.—Of stout habit; 10 to 14 canes in a clump; about 8 feet high; length of joints 4 inches, circumference 4 inches; colour white; leaves light green; 4 feet 6 inches long, 1½ inches broad; healthy canes evidently suitable for moist districts; does not stand drought well. Percentage of trash 25½; juice 74½ (6.9 gals.); density of juice 1.064: Arnaboldi 21.

No. 2. Cuapa.—Of slender habit; 18 canes in a clump; average height 9 feet; colour black; length of joints 4 inches, circumference 4 inches; leaves heavy, 4 feet long, 2½ inches broad; stands drought well; not liable to get lodged; free from rust. Percentage of trash 31½; juice 68½ (6 3 gals.); density of juice 1.066: Arnaboldi 22.

No. 4. Batramie.—Of strong habit; 12 to 14 canes in a clump; average height 7 feet; colour striped; length of joints 4 inches, circumference 4 inches; leaves heavy, 4½ feet long, 3 inches broad; stands the drought well; not liable to get lodged; "a strong cane." Percentage of trash 33⅓; juice, 66⅔ (6.2 gals.); density of juice 1.074: Arnaboldi 24.

No. 5. Waphendnow.—Similar to last in habit and colour; a strong cane. Percentage of trash 31; juice 69 (6.4 gals.); density of juice 1.066: Arnaboldi 24.

No. 6. Tiboo.—Prolific cane; 12 to 14 canes in a clump; average height 8 feet; colour striped; length of joints 3 and 4 inches, circumference 5½ inches; leaves heavy, broad, and abundant; stands drought well; not liable to get lodged. Percentage of trash 31¼; juice 68¾ (6.4 gals.); density of juice 1.069: Arnaboldi 24.

No. 7. Hillii.—Of slender habit; 16 canes in a clump; height 9 feet; length of joint 5 and 6 inches, circumference 3½ inches; leaves heavy, round stem, 4 feet long, 3 inches wide; stands drought well; stools freely; a prolific small black cane suitable for poor soils. Percentage of trash 35; juice 65 (6.0 gals.); density of juice 1 067: Arnaboldi 22.

No. 8. Seete.—Of stout habit; 12 to 16 canes in a clump; height 8 feet; colour a greenish yellow when young, white when matured: length of joint 4 inches, circumference 3 inches; foilage very heavy; length 4 feet, breadth 3 inches; stands drought moderately well; a good cane for experimental trial in good soils. Percentage of trash 30; juice 70 (6.5 gals); density of juice 1.082: Arnaboldi 28.

No. 9. Ysaquia.—Of stout free habit; 15 canes in a clump; height 7 feet; colour brown with white stripes; length of joint 3 inches, circumference 5 inches; foliage rather heavy; stands drought fairly well; somewhat liable to get lodged and with rust on upper joints. Percentage of trash 37; juice 63 (5.8 gals); density of juice 1.084: Arnaboldi 28.

No. 10. Bouronappa.—Of stout vigorous habit; 20 canes in a clump; height 8 to 10 feet; colour light purple; length of joint 3 and 4 inches; circumference 4½ inches; foliage rather heavy; stands drought well; from its luxuriant quick-growing habit liable to lodge, but it is one of the finest canes of the series as regards luxuriance of growth and should prove an acquisition in districts with moderate rainfall. Percentage of trash 40; juice 60 (5.5 gals); density of juice 1.079: Arnaboldi 26.

No. 11. Barkley.—A white cane similar to last; fewer canes in the stool but of stouter habit; foliage heavy; stands drought moderately well; free from rust and of free vigorous growth. Percentage of trash 34; juice 66 (6.1 gals); density of juice 1.078: Arnaboldi 26.

No. 12. Pine.—Of light habit; 12 canes in a clump; height 9 feet; colour white; length of joint 4 inches, circumference 5 inches; leaves light, 4 feet long, 3 inches broad; stands drought well: stools moderately well. A fair hard cane, very healthy and clean. Percentage of trash 30; juice 70 (6·5 gals); density of juice 1.078: Arnaboldi 26.

No. 13. Nagapoury.—Of strong vigorous habit; 16 canes to a clump; colour cream white; length of joint 4 inches, circumference 5 inches; foliage heavy; does not stand drought but grows well in fairly moist situations; an excellent cane under irrigation. Percentage of trash 31; juice 69 (6.4 gals); density of juice 1 065: Arnaboldi 21.

No. 14. Naga.—Of fine slender habit; 20 and 25 canes to a clump; colour black; length of joint 4 inches, circumference 3 inches; leaves moderately heavy but narrow; stands drought well; evidently an excellent cane for arid districts or as a fodder plant on poor soils. Percentage of trash 35 ; juice 65 (6.0 gals) ; density of juice 1.072 : Arnaboldi 24.

No. 15. Tsimbie.—Of stout habit ; 15 canes to a clump ; height 9 feet ; colour yellow with purplish stripes ; length of joint 5 inches, circumference 5 inches ; foliage light and leaves narrow (2 inches) ; stands drought moderately well. A good striped cane of fine attractive habit. Percentage of trash 33 ; juice 67 (6.2 gals) ; density of juice 1 082 : Arnaboldi 27.

No. 16. Vulu-Vulu.—Of stout habit ; 10 to 12 canes in a clump ; height 8 to 10 feet ; length of joints 4 inches, colour fine yellow ; foliage light ; stands drought well ; not liable to lodge ; free from rust. Percentage of trash 35.75 ; juice 64.25 (5.9 gals) ; density of juice 1.078 : Arnaboldi 26.

No. 17. Kakœ.—Of stout habit ; 16 to 18 canes in a clump ; height 10 feet ; colour black violet ; length of joint $3\frac{1}{2}$ inches, circumference 5 inches ; foliage very heavy and of a dark green ; as in most of the black or violet canes this stands drought well ; it is free from rust and not liable to get lodged. Percentage of trash 36 ; juice 64 (5.9 gals) ; density of juice 1.084 : Arnaboldi 28.

No. 18. Egyptian.—This cane has not been very successful at Hope, but in 1884, the report was as follows:—Of vigorous habit and quick growth ; 30 to 40 canes in a clump ; height 7 to 8 feet ; colour striped green ; length of joint 4 inches, circumference 3 inches ; foliage light and narrow ; a fine clean healthy cane, very hardy and likely to thrive in dry districts. Percentage of trash 41 ; juice 59 (5 4) gals) ; density of juice 1.077 : Arnaboldi 27.

No. 20. Brisbane.—Similar to the Malay cane already tested and distributed as No. 76.

No. 21 Grand Savanne.—Of strong compact habit with stout joints ; 20 canes to a clump ; height 10 feet ; colour light purple ; length of joints $5\frac{1}{2}$ inches, circumference $5\frac{1}{2}$ to 6 inches ; foliage dark green and broad ; a good cane in appearance but not yet tested.

No. 22. Bourow.—Of light graceful habit ; number of canes to a clump 12 to 16 ; height 8 feet ; colour at first green then a golden yellow ; foliage light and narrow ; does not stand drought well but grows rapidly under irrigation ; not liable to get lodged. Percentage of trash 37 ; juice 63 (5 8 gals) ; density of juice 1.074 : Arnaboldi 24.

No. 23. Liguanea.—Of short stunted habit ; number of canes in each clump 10 to 12 ; height 6 to 8 feet ; colour dark purple or black ; length of joint $3\frac{1}{2}$ inches, circumference 5 inches ; foliage light ; length $4\frac{1}{2}$ feet, breadth 3 inches ; stands drought very well. Percentage of trash $33\frac{1}{3}$; juice $66\frac{2}{3}$ (6.2 gals) ; density of juice 1.076 : Arnaboldi 25.

No 24. Norman.—Of strong habit and erect ; number of canes in each clump 14 ; height 11 feet ; colour light purple or mauve ; length of joints 5 inches, circumference $5\frac{1}{2}$ inches ; foliage pale green with a light purplish vein running down the centre of each leaf. Percentage of trash 36 ; juice 64 (5.9 gals) ; density of juice 1.082 : Arnaboldi 27

No. 25. Green Rose-Ribbon.—Of stout upright habit ; number of canes in each clump 18 ; height 10 feet ; colour pale yellow ; length of joint 4 and 5 inches, circumference 6 inches ; foliage coarse and heavy This cane stands drought moderately well ; is somewhat liable to get lodged and shows rust. Percentage of trash 39 ; juice 61 (5.6 gals) ; density of juice 1.064 : Arnaboldi 21.

No. 26. Daura.—A weak yellow cane apparently of little value.

No. 27. Nain.—Habit strong, with large stools ratooning freely ; canes in each clump 35 ; height 10 feet ; colour light brown ; length of joint 5 inches, circumference 5 inches ; foliage of a fine texture and dark green, leaves short and broad. This cane stands drought well ; a clean healthy cane of very vigorous habit. Percentage of trash 34 ; juice 66 (6.1 gals) ; density of juice 1.066 : Arnaboldi 23.

No. 28. Queensland.—Of upright habit ; canes in each clump 30 ; height 12 feet ; colour pale yellow ; length of joint 6 inches, circumference 5 inches ; foliage large and heavy ; grows well in dry situations ; liable to get lodged ; free from rust. Percentage of trash 37.66 ; juice 62.34 (5.7 gals) ; density of juice 1.068 : Arnaboldi 23.

No. 29. Ko-Keia.—Slender upright habit ; canes in each clump 35 ; height 8 feet ; colour white with red stripes ; foliage moderately heavy. A prolific useful cane for fodder purposes. Percentage of trash 38 ; juice 62 (5.7 gals.) ; density of juice 1.079 : Arnaboldi 26.

No. 30. Lahina.—Of rather delicate habit at first but afterwards a strong fine cane ; canes in each stool 18 ; height 9-11 feet ; colour yellow : length of joint 5 inches, circumference $5\frac{1}{2}$ inches ; foliage pale green and moderately light. This cane does not stand drought well and is liable to get lodged. A bright free growing cane under irrigation, very much like the best type of Bourbon canes. Percentage of trash $37\frac{1}{2}$; juice $62\frac{1}{2}$ (5.8 gals) ; density of juice 1.076 : Arnaboldi 25 (Beaumé 10).

No. 31. Keni-Keni.—Of slender habit ; 12-15 canes in a clump ; 8-10 feet high ; length of joints 5 inches, circumference 4 inches ; colour white ; leaves green, 4 feet 6 inches long, $2\frac{1}{2}$ inches broad ; fine healthy cane suitable for "seasonable" districts ; does not stand drought well. Percentage of trash 33 ; juice 67 (6.2 gals) ; density of juice 1.080 : Arnaboldi 26.

No. 32. China.—Very similar in habit, size and characteristics to last. Percentage of trash 35 ; juice 65 (6.0 gals.) ; density of juice 1.066 : Arnaboldi 22. [Canes Nos. 28, 30, 31 and 32 all partake of general characteristics and belong to the best type of white canes.]

No. 33. Po-a-ole.—This would appear to be identical with the Mauritius cane No. 96 already described and tested in 1880. "A stout black cane of fine habit and growth, leaves rather heavy ; stands drought well ; rind rather hard ; not subject to lodge ; makes a good grain of sugar and yields at the rate of $2\frac{1}{2}$ hhds. per acre."

No. 34. Ko-poapa.—Of strong rapid growth ; 18 canes in a clump ; about 11 feet high ; length of joints 4 inches, circumference 5 inches ; colour white ; leaves moderately heavy, 5 feet long, $2\frac{1}{2}$ inches broad ; stands drought well ; not liable to get lodged ; a fine white cane, one of the best in the collection for dry districts ; always healthy and throwing good large stools. Percentage of trash 28 ; juice 72 (6.4 gals.) ; density of juice 1.063 : Arnaboldi 21 (Beaumé 8.2-5).

No. 35. Lakoua.—Of upright and somewhat slender habit ; about 12 feet high ; length of joints 6 inches, circumference 4 inches ; colour white ; leaves dark green ; 5 feet long, 3 inches broad ; healthy, vigorous cane and free from rust. Percentage of trash $30\frac{1}{2}$; juice $69\frac{1}{2}$ (6 4 gals.); density of juice 1.074: Arnaboldi 24 (Beaumé 9.4-5).

No. 36. Viluahuala.—Strong vigorous habit; 30 canes in a clump; about 11 feet high; length of joints 3 inches, circumference 4 inches; colour pale when young growing into a light purple; leaves dark green $4\frac{1}{2}$ ft. long, 3 inches broad; somewhat liable to lodge; free from rust Percentage of trash 24; juice 76 (7.0 gals); density of juice 1.055: Arnaboldi 18 (Beaumé $7\frac{1}{3}$)

No. 37. Sacuri.—Of strong habit and very rapid growth; 20 canes in a clump; average height 11 ft. length of joints 6 inches, circumference 5 inches; leaves somewhat heavy, 5 ft. long, 3 inches broad; likely to lodge; free from rust. Percentage of trash 25; juice 75 (7.9 gals.); density of juice 1.076: Arnaboldi 25 (Beaumé 10).

No. 38. Cuban—Habit light; 12 canes in each clump; height 10 ft.; joints long and straight; leaves light green, 5 ft. long $2\frac{1}{2}$ inches broad; suitable for moist districts only; a clean healthy cane resembling the Bourbon. Percentage of trash $33\frac{1}{3}$; juice $66\frac{2}{3}$ (6.2 gals.); density of juice 1.074: Arnaboldi 24 (Beaumé 9. 4-5).

No. 39. Horne.—Habit strong; 20-25 canes in each clump; height 10 feet; colour pale, with purple and violet stripes; length of joint $4\frac{1}{2}$ inches, circumference 5 inches; leaves heavy, 5 ft. long 3 inches broad; stands drought well and not liable to get lodged. Percentage of trash $24\frac{1}{4}$; juice $65\frac{3}{4}$ (6.1 gals.); density of juice 1.076: Arnaboldi 25 (Beaumé 10).

No. 40. Samuri.—Of slender habit; 16 canes in each clump; average height 8 ft.; colour black with pale purplish stripes; length of joiuts $2\frac{1}{2}$ inches, circumference 4 inches; leaves light 5 feet long, $2\frac{1}{2}$ inches broad, rather hard rind; stands drought well. Percentage of trash 40; juice 60 (5.5 gals.); density of juice 1.079: Arnaboldi 26 (Beaumé $10\frac{1}{2}$).

No. 41. Brèhèret.—Of strong habit; 14 canes in each clump; height 8 feet; colour black; length of joints $2\frac{1}{2}$ inches, circumference 5 inches; foliage light; 4 ft. long $2\frac{1}{2}$ inches broad. The joints of this cane are strikingly short and heavy; it stands drought well and would be very suitable for dry districts Percentage of trash $33\frac{1}{3}$; juice $66\frac{2}{3}$ (6.2 gals.); density of juice 1.079: Arnaboldi 26 (Beaumé $10\frac{1}{2}$).

No. 42. Mimuri—Of strong habit and rapid growth, 30 to 40 canes in each clump; height 10-12 ft.; colour light brown with the outer epidermal layer dry and chaffy; length of joints 4 inches, circumference $3\frac{1}{2}$ inches; foliage light; leaves 4 ft. long 3 inches broad; a clean healthy but somewhat peculiar looking cane; stands drought well. Percentage of trash 34; juice 66 (6.1 gals.); density of juice 1.084: Arnaboldi 28 (Beaumé 11. 1-5).

No. 42. Marabal.—Of slender habit; does not ratoon well; 8 to 10 canes in a clump; about 6 feet high; length of joints 4 inches, circumference 4 inches; colour brown; leaves thin, light green, 5 feet long, 2 inches broad; does not stand drought well; liable to get lodged; not subject to rust or worms

Salangore.—Of stout upright habit; hardy; of rapid and luxuriant growth; ratoons well; 25 to 30 canes in a clump; 8 to 10 feet high; length of joints 5 inches, circumference $5\frac{1}{2}$ inches; colour white; leaves thick, light green, 5 feet 3 inches long, 3 inches broad; stands drought well; suitable for moist districts; not liable to get lodged; not subject to rust or worms; produces a sugar of fine quality and colour, should be cropped immediately it is ripe as otherwise it begins to deteriorate.

No. 56. Hope.—At first a small slender cane, ultimately growing vigorously, often producing canes of 20 feet in length; 20 canes in clump; about 7 feet high; colour light purple; length of joints 4 inches, circumference 5 inches, leaves thick, dark green; 5 feet 6 inches long, 3 inches broad; stands drought well; not liable to get lodged; not subject to rust or worms.

No. 76. Malay.—Of short, stout habit; 12 canes in a clump; 6 feet high; colour whitish with green streaks; length of joints 4 inches, circumference 5 inches; leaves thick, heavy, dark green; 4 feet 6 inches long, 3 inches broad; does not stand drought well, rather delicate; liable to get lodged; subject to rust but not to worms.

No. 16. Martinique.—Of slender habit; 10 canes in a clump; 6 feet high; colour white; length of joints 4 inches, circumference 4 inches; leaves thin, light green; 5 feet long, 2 inches broad; does not stand drought well; liable to get lodged; free from rust; not subject to worms.

Elephant.—Of stout upright habit, a vigorous grower with early maturity, but brittle; 18 canes in a clump; 8 to 10 feet high; colour light green, turning yellow when ripe; length of joints 4 to 5 inches, circumference 6 inches; leaves thick, heavy, dark green, 5 feet long, 3 inches broad; stands drought well, liable to get lodged, free from rust, not subject to worms; requires very rich soil, a moist climate, and to be taken off as soon as it is ripe; ratoons well the second year, but like most vigorous growers it requires to be renewed in third or fourth year; in favorable localities it throws immense canes, looking almost like clumps of bamboos, the yield per acre has not, however, been quite equal to the show of canes, but it has yielded at the rate of two to two and a half tons of sugar per acre.

Otaheite.—Of slender, upright habit, hardy and ratoons well; 14 canes in a clump, 8 feet high; colour light purple; length of joints 5 inches, circumfereuce $4\frac{1}{2}$ inches; leaves thin, light green, 5 feet long, $2\frac{1}{2}$ inches broad; stands drought well, not liable to get lodged, free from rust, not subject to worms.

Red Ribbon.—Of stout habit, hardy, a rapid grower, ratoons well; 20 to 25 canes in a clump; 10 feet high; colour striped purple and red; length of joints 5 inches, circumference 5 inches; leaves heavy, dark green, 5 feet long, $2\frac{1}{2}$ inches broad; stands drought well; not liable to get lodged; not subject to rust or worms.

Java.—Of stout, upright habit, ratoons well; 12 to 15 canes in a clump; 8 feet high; colour light purple; length of joints 5 inches, circumference $5\frac{1}{2}$ inches; leaves heavy, light green. 5 feet 8 inches long, 3 inches broad; stands drought well; not liable to get lodged; not subject to rust or worms.

Violet. Of slender habit, ratoons well; 18 canes in a clump; 8 feet high; colour dark purple; length of joints 4 inches, circumference, 5 inches; leaves thick and heavy, dark green, 5 feet long, 3 inches broad; stands drought well; liable to get lodged; subject to rust and worms.

Mrs. Elizabeth, G. Britton.

Torrey Botanical Club

~~Columbia College~~

~~49th Street and Madison Avenue~~

~~New York~~

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No. 3. SEPTEMBER, 1887.

BULLETIN

OF THE

BOTANICAL DEPARTMENT,

JAMAICA.

CONTENTS:

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JAMAICA:
GOVERNMENT PRINTING ESTABLISHMENT, 79 DUKE STREET, KINGSTON.
1887.

A.—NOTES ON TREES SUITABLE FOR PLANTING IN AND ABOUT TOWNS IN THE WEST INDIES.

A very large number of seedling trees can be supplied from the Gardens at the nominal price of 1d. to 3d. each. Carriage is not undertaken by the Department, but can be arranged for at the rate of about 2 dozen plants for 3s.

The trees should not be planted closer together than 20 or 30 feet, according to the length of the branches. If it is found possible to plant them at regular intervals, it is preferable to have all the trees in one street of the same kind; if, on the other hand, they stand at irregular intervals, it is better to have a variety.

In forming new streets, the rule to be adopted for the position of the trees on the road is that they should be 4 feet from the foot path, and clear of the water-table. They should never be planted on the foot-path where they would hinder foot-passengers, and raise the pathway by the growth of their roots.

In a road or street, the holes should be dug larger than in ordinary ground, about 5 feet wide at the top, and 5 feet deep. The earth taken out from holes in streets should be replaced with good soil well mixed with well rotted manure.

If an iron grating is placed on the surface round the stem, the soil remains soft, and allows water and air to penetrate to the roots Probably the best plan in this climate would be to have a kind of grid-iron arrangement with the bars attached by nuts, so that as the stem expands, the innermost bars could be removed. The grating should be at least 3 feet square.

It is also necessary to protect the young plants by means of upright guards, which should be 4 or 5 feet high; and stakes are necessary until the plants are well established. Pruning is constantly necessary to keep the trees within bounds, and to give them a good shape. The trees, especially while young, require constant watering.

The following are a few of the trees suitable for planting:—

The Eucalyptus or Gum trees are natives chiefly of Australia where they form forests, but they are also found in the Malay Archipelago. They are the largest trees in the world, some which were measured proved to be more than 400 feet high. The leaves hang vertically, thus giving a remarkable character to the scenery. Several species of Eucalyptus grow more quickly than any other tree; the timber is at first soft, and is easily felled, split, and sawn, but when thoroughly dry, it becomes as hard as oak.

Eucalyptus trees have acquired a reputation for planting in malarial swampy ground, and that for two reasons, first because they absorb an immense amount of moisture from the soil, practically draining it, and secondly, because there is a large quantity of aromatic essential oil contained in their leaves, which becomes oxidized by the action of the air, and produces an active disinfectant,—peroxide of hydrogen.

The "Red Gum Tree" (*Eucalyptus rostrata*) of Southern Australia thrives in wettish soil with a clayey sub-soil, even when the water is slightly brackish. It is recommended as an antiseptic tree for cemeteries in tropical countries. It is of rapid growth, often attaining a height of 65 feet in 6 years, eventually reaching to a height of 200 feet. The timber is thought highly of, lasting well above or below ground or in water. The government of Victoria, whenever practicable, use no other timber for bridges and railways; as railway sleepers it lasts 12 years.

The Yate Tree *(Eucalyptus cornuta)* of South-west Australia, is reported to have reached a height of 8 or 10 feet in the first year in plantations at Lucknow. It prefers a wettish soil The wood is equal to the best ash.

The Iron-bark Tree *(Eucalyptus Leucoxylon)* supplies a valuable timber, worth 2s. 5d. a cubic foot in Melbourne. The wood bears twice the strain of American oak or ash. The tree grows to a height of 100 feet; it is generally found on slaty formations, but accommodates itself to any soil.

The Swamp Mahogany *(Eucalyptus robusta)* is said to thrive best in low, sour swampy ground near the sea-coast. It grows 100 feet high with a grand mass of foliage, and resists cyclones better than most other Eucalyptus.

Other desirable Eucalyptus are the Manna Gum Tree *(E. viminalis)*, the flooded Gum Tree *(E. saligna)*, the Tallow Wood *(E. microcorys)*, the Red Gum Tree *(E. tereticornis)*, and the Stringy Bark Tree *(E. obliqua)*. A mass of information is contained in Baron von Mueller's Works.

The Tamarind (*Tamarindus indicus*) though of slow growth, is suitable for planting near houses, as it is large and ornamental, affording pleasant shade with handsome, fragrant flowers. The fruit is useful, and the timber is beautifully grained and valuable for building.

Bauhinia variegata, a native of India and China, is a beautiful shrubby-looking tree of 20 to 30 feet in height, suitable for open spaces. The flowers are handsome of a rosy-white colour. The dark wood is sometimes called Ebony, but is of little use. The astringent bark has been used as a tonic in medicine, and also for dying and tanning. *Bauhinia megalandra*, a native of some of the West Indian Islands, may also be planted in the same way.

Cassia siamea (also known as *Cassia florida*) grows to a height of 80 feet at Castleton. It has large, showy, yellow flowers. It is a native of India and Malaya. *Cassia Fistula*, the India Laburnum, has flowers of the same kind, it is a middle sized erect tree, reaching a height of 40 to 50 feet. The pulp round the seeds is a mild laxative.

Lagerstroemia Flos-Reginae (Queen's Flower) when in blossom, is one of the most showy trees of the Indian forests. A moist, damp climate is most suitable for its growth and for the full development of its rose-coloured blossoms. It reaches a height of 50 to 60 feet. The timber is blood-red, and as it lasts well in water, it is used for boat-building. In Burmah, it is employed more than any other timber except teak, for a variety of purposes, but it soon decays under ground. The astringent roots have been used as a remedy for thrush; the bark and leaves are purgative.

Spathodea campanulata grows to a height of 80 feet at Castleton. The branches do not spread, but the mass of rich orange-coloured flowers gives it a most attractive appearance.

Caryocar nuciferum produces the Souari or Butter Nuts, the kernels of which have a pleasant nutty taste, and from which an oil may be extracted by pressure. The nuts have a very hard shell, and are enclosed, 2, 3, or 4, together in a fruit about the size of a child's head. The flowers are very large, and of a deep purplish brown colour The tree is a native of Guiana, where it often grows to a height of 100 feet. The timber is very durable, and is used for ship-building.

Sterculia carthaginensis, called "Chica" by the Brazilians and "Panama" by the inhabitants of the Isthmus, is a fine tree, 40 to 50 feet high It has become naturalized in the West Indies, and does well in the plains. The flowers are yellow, spotted inside with purple. The seeds are about the size of pigeons' eggs; they have an almond-like taste, and are sometimes eaten.

The Candlenut, sometimes called Walnut *(Aleurites triloba)* grows to a height of 30 to 40 feet. The seeds yield oil, which is a good drying oil for paint. In the Sandwich Isles 10,000 gallons are annually produced, and used there as a mordant for their vegetable dyes. The cakes, left after the oil has been expressed, is used as food for cattle and also manure. It thrives along roads.

The Mountain Mahoe *(Hibiscus elatus)*, a native of Jamaica and Cuba reaches a height of 50 to 60 feet The timber is valuable, especially to cabinet-makers; it has the appearance of dark-green variegated marble. The fibres of the bark make good ropes. The lace-like inner bark was at one time known as Cuba bark, from its being used as the material for tying round bundles of Havanah cigars

Three species of Ficus are growing well in the Parade Garden :—(1) *Ficus indica* is one of the Banyans, the roots which drop from its branches becoming new stems with spreading branches and fresh branch roots, so that of some of these trees it is said, "at the age of 100 years one individual tree will shade and occupy about one and-a-half acres, and rest on 150 stems or more, the main stems often with a circumference of 50 feet, the secondary stems with a diameter of several feet." (Mueller.) (2) *Ficus lucida*, another native of India, affords dense shade. (3) *Ficus Benjamina*, a native of North Australia has handsome, drooping, willow-like branches. It forms part of the avenue at King' House. All these trees form very shady avenues.

The Ginep *(Melicocca bijuga)* is a native of Guiana and New Grenada. It is a good shade tree, and there are very fine examples at King's House. The timber is hard and heavy, and the fruit has an agreeable flavour, but the stringy portion which is usually swallowed by children, is most injurious, and according to good medical authority has frequently caused death by coating the lining of the stomach.

The Flamboyante *(Poinciana regia)* is a native of Madagascar. It is a tree with very showy flowers, and is suitable for planting in open spaces, or in broad mixed avenues.

The Red Bead Tree *(Adenanthera Favonina)* is a native of the East Indies and China, growing up to an elevation of 4,000 feet in Sikkim. The common name is derived from the bead-like seeds, which are of a bright scarlet colour, and of a uniform weight (4 grains) so that they are used by jewellers in the East as weights. By rubbing the wood against a wet stone, a red dye is obtained, which is made use of by Brahmins for marking their foreheads after religious ceremonies of bathing. The tree affords hard, durable timber called "Coral Wood," or "Red Sandal Wood." There are trees in the Parade Garden and in Orange Street. They are well suited for avenues.

The Kananga *(Cananga odorata)* of India is largely cultivated there for its ornamental appearance. It is soft-wooded, quick growing, ultimately reaching a height of 150 to 200 feet. The specimen at Castleton is at present about 40 feet.

The Guango or Rain Tree (*Pithecolobium Saman*) is a native of Brazil and Venezuela. It is fast-growing and ornamental, and very suitable for open spaces. It is so much desired in India that in 1880, the Jamaica Botanical Department sent 130 lbs. weight of seed. Dr King, the Government Botanist in Calcutta, says of it,—"This wonderful tree grows faster than any hitherto introduced into Bengal with the single exception of Casuarina. It gives a beautiful shade and yields a pod with a sweet pulp which is greedily eaten by cattle. For avenues, cantonments, squares, and situations where dense shade is wanted, no tree is more suitable than this."

The Casuarinas are mainly Australian, but are also found in the East Indies and Polynesia. They grow quickly but are not good shade trees, for the leaves are represented by scales. The general appearance is something like the larch. The timber, called, "beefwood" in Australia, is hard; it makes excellent firewood, and as the ashes retain heat for a long time, it is much used for ovens and steam engines. *Casuarina equisetifolia*, the Swamp-Oak, is found in the East Indies and Polynesia. The hard wood is known as "Iron-wood"; it is durable under water, forms good posts, and bears a considerable strain. This is an excellent tree for planting in sandy districts along the sea-coast. *Casuarina stricta*, the Hurricane Tree, is found in the islands of the Pacific. At Castleton, it has grown to 80 feet. *Casuarina muricata*, from India, has a showy wood of great weight. Grown close, it forms pretty avenues in narrow roads.

The Betel-nut Palm (*Areca Catechu*) of Tropical Asia is a very graceful palm of remarkably perpendicular growth, with a trunk seldom more than 6 or 8 inches in diameter, it grows to a good height, —at Castleton, it has reached 60 feet. The flowers are very fragrant. There is an immense trade in the nuts in the East, for the Malays and other natives use them for chewing, rolling a small piece up with some lime in leaves of the Betel Pepper.

The Talipot or Umbrella Palm (*Corypha umbraculifera*) of India and Ceylon is a very fine Palm, 60 to 70 feet high, with fan-shaped leaves, 12 feet in diameter.

One of the Royal Palmettos (*Sabal umbraculifera*), a native Palm, is well worth planting.

The Oil Palm (*Elaeis guineensis*) has become quite naturalized, growing wild in some parts of Jamaica. The Cocoa-nut (*Cococa nucifera*) is also suitable for planting.

B.—DISEASES OR INJURIES IN PLANTS.

Smut in Corn.

A cob of corn has been received from near Malvern, St. Elizabeth, covered with what has the appearance of soot. This disease is well known to the English farmer, and is called "smut." The soot-like dust consists of immense numbers of minute "seeds" (spores) of a fungus (*Ustilago carbo).* In England it attacks wheat and several grasses besides.

Smut is spread from place to place in two ways. First, it is so light that every breath of wind carries some of it away to settle and grow in fresh soil. Secondly, some grains of smut, so few perhaps as not to be seen, adhere to corn which is used as seed, and therefore the disease is propagated together with the corn. It germinates in the soil, and gradually grows up through the plants which it attacks.

To kill the smut, and at the same time prevent it from being spread by the wind every plant of corn, every grass, which shows any sign of it, should be at once picked and burnt. It is of no use dealing with the corn alone, for if infected grass is left it acts as a nurse for the smut, from which it spreads to corn. Laborers in the field, settlers, in fact everyone, can do a service to the country by dealing with the disease in this way at once as soon as it is perceived.

Those who sow corn must adopt some method for killing the smut on the seed-corn, if they have any reason to think that the corn is infected. The simplest plan to adopt is as follows:—Dissolve one pound of bluestone in 5 quarts of boiling water. This is sufficient for 4 bushels. When cool soak the corn for 10 minutes. The seed may then be sown with every probability that the smut has been effectually killed.

Disease in Orange Trees.

Last May the following prescription was given to be used for Orange trees which had begun to die off. The bark was decaying at the collar, and from the original starting point the decay was spreading and in some cases had completely encircled the stem. The leaves had begun to turn yellow, and there is no doubt that the whole plantation was doomed, unless the remedy proved effectual:—

Apply to the wounds in the bark a mixture composed as follows:—2 lbs. stiff clay, 2 lbs. flowers of sulphur, ¼ lb. soft soap, 1 tablespoonful kerosene oil, mix with water to consistency of paint and apply with a brush. The oil should be added last, and the mixture should be allowed to stand 12 hours before being used.

It is satisfactory to have received the following statement, dated 2nd September:—

"After having applied on two different occasions—at an interval of 10 days—the preparation you were good enough to prescribe for my Orange trees – the disease—whether fungoid or animal which attacked them at the end of the stem just where it touches the earth—completely disappeared. The trees whose peel had been eaten away all round the stem have died but wherever there remained a strip of peel to connect with the peel on the roots the tree has recovered after lingering more or less according to the injury it had sustained prior to the application of your prescription.

There is no appearance of the disease at present on any of the trees and the peel newly formed is covering over that part of the stem which the disease had eaten away.

It seems to be rather singular that all the trees of a plantation numbering over 200 were attacked simultaneously by this disease and that they were mostly young trees though a few old trees in the immediate neighbourhood suffered equally." (Signed) Oscar Marescaux.

Cinchona.

Some Cinchona trees have lately been dying off. On investigation, it was found that the bark at the junction of stem and root had been injured, and that in consequence the mycelium of a fungus had penetrated between the bark and wood. The bark had become loosened on the roots, and decayed away. It is probable that the injury was caused by the wind during the last hurricane. It would be difficult to detect such injury at first, but probably an early application of the remedy prescribed above for the Orange trees would have saved the trees. Trees which are too far gone to save should be taken up by the roots, and barked. The bark may be stored, after thorough drying, for mildew does not affect the quantity or quality of the alkaloids, when once the bark is cured.

Coffee culture in Rio Janeiro.

Reporting on the general state of the province of Rio Janeiro, the British Consul thus speaks of the coffee:

In the districts of Cantagallo, S. Fidelis, and other parts, for some years past, the coffee trees have been subject to a disease manifested firstly in the yellowness of the upper leaves, and afterwards in the shoots, the trees soon drying up. In this way about one-tenth part of the trees in the above named districts have perished. This disease is supposed to be propagated by an insect which lives in, and feeds on the roots. It deposits its eggs in the knots of the roots causing the fibres of the same to rot. On this the eggs are seen, having the shape of mushrooms. This generally takes place in the heaps of weeds or grass which rot at the foot of the trees, forming a fine soil for the new root fibres. As a remedy against this evil it is recommended by Dr. Glaziou that the weeds and grass should never be heaped up to rot near the roots, but should be left to be dried by the sun and afterwards brought together and burned. The Orange trees are also subject to be attacked by the same plague. Dr. Glaziou is convinced if this rule be attended to that in two years' time the coffee estates will return to what they were formerly.—*Gardeners Chronicle.*

Scale Insects.

Stems of Orange trees, castor oil plants, and cassava have been received covered with scale insects. Orange trees growing at low elevations, or which are in an unhealthy state due to various causes, such as attacks from worms at their roots, seem to be especially liable to be affected with scale insects. Mr. Hubbard, the Agent of the United States Agricultural Department in Florida, has been very successful in his treatment for the destruction of these insects. He uses a kerosene and soap emulsion made up as follows :—

Kerosene	...	2 gallons
Common or soft soap	...	½ pound
Water	...	1 gallon

" Heat the solution of soap and add it boiling hot to the kerosene. Churn the mixture by means of a force-pump and spray-nozzle for 5 or 10 minutes. The emulsion, if perfect, forms a cream, which thickens on cooling, and should adhere without oiliness to the surface of glass. Dilute, before using, one part of the emulsion with 9 parts of cold water. The above formula gives 3 gallons of emulsion, and makes, when diluted 30 gallons of wash.

It is necessary in order to have a proper emulsion, that there should be violent agitation. A moderate amount of churning forms an apparent union between the oil and kerosene, but they separate again on standing, or when diluted. " The emulsion can be very quickly and easily made by using a good force-pump, so constructed that it can be inserted directly into the liquid which must be kept in constant and violent agitation by forcing it through some form of spray-nozzle back into the same receptacle." Unemulsified kerosene would probably injure the plants.

The kerosene emulsion may also be used against worms or insects attacking roots.

The spray-nozzle recommended by the United States Department of Agriculture is the eddy or cyclone nozzle, invented by Dr. Barnard, an assistant in the Entomological Division. " With the 'Aquapult' pump and 'Cyclone' nozzle, 4 gallons of wash is sufficient for 30 nursery trees of 1 and 2 years from the bud. Bearing trees of full size will require from 5 to 10 gallons of wash."

C.—NOTES ON ECONOMIC PLANTS.

Coca—It is reported that Coca leaves (Erythroxylon Coca) are becoming a recognised article of export from Peru, a demand having " sprung up for them for the manufacture of cocaine now so much used in surgical operations for killing pain." The quantity exported from Mollindo during the year amounted to 705 quintals, valued at 17,625 dollars.—*Gardeners Chronicle.*

D.—INTERESTING PLANTS IN FLOWER OR FRUIT AT CASTLETON GARDEN.

The Victoria Water Lily *(Victoria regia)* is now in flower and fruit. This noble plant was first discovered in the beginning of the century by the botanist Haenke and Father La Cueva in South America, but it was not till Sir Robert Schomburgk found it in the River Berbice in British Guiana in 1837 that it was brought into public notice, and described. It received by permission the name of the young Queen. When the flower is fully expanded, the outer petals are bent outwards and downwards, while the central petals, rose-coloured, remain erect; and thus a noble appearance is presented, as of a central rose-coloured crown supported by a series of pure white and gracefully curved petals. The leaves are circular in outline, 6 to 12 feet in diameter, with upturned rims 2 to 5 inches high. The lower surface of the leaves is traversed by several prominent nerves, which contain air-canals The leaves are thus well-adapted for the purpose of floating and keeping the plant always on the surface whatever the change of water-level; in fact they will support a very considerable weight if placed on a board so as to spread the pressure.

Barringtonia speciosa, a tree of the myrtle family, 40 to 50 feet high. Its flowers are large and handsome, a conspicuous feature being the numerous stamens, forming a long tassel in the centre, white below and carmine at the tips. A lamp-oil is expressed from the seeds which are now ripe. This tree is a native of the Malay Archipelago and Australasia, being generally found near the sea.

The Sierra Leone Peach *(Sarcocephalus esculentus)* sent here from Kew is now in fruit The arrangement of the flowers is peculiar; they are grouped in a head and are fused with one another and with the receptacle into a fleshy mass, afterwards the fruit.

E.—NOTES ON SOME PLANTS LATELY RECEIVED.

Seeds of *Ceropegia pusilla* have been received from Kew with the following note from Mr. Morris. " Besides the flowers which may be interesting in a West Indian Garden, the tubers of this plant are, according to Mr. Jamieson of Ootacamund, eaten both raw and boiled by the natives in the Nilgiris."

The Superintendent of the Forest Department, Singapore, has kindly sent seeds of a rare Palm, the Malawarin or Red-stemmed Palm of the Malayan Peninsula (*Cyrtostachys Rendah*). He speaks of it as follows :—" The plant is doubtless the most conspicuous and beautiful object the rich forests here possess. When planted on a lawn in suitable soil it readily throws up a succession of stems from the bottom of the parent stem and thus grows into a pyramid covered with leaf spathes of a dazzling bright red : these, when suddenly come upon in the forest standing out against a back ground of deep green, present an object not soon erased from the memory of the beholder."

F.—LIST OF FRUITS CULTIVATED IN THE GARDENS.

Scientific Name.	Common Name.	Habitat.	Price. Plants.	Seeds.
Anonaceæ—				
Anona muricata, L. ...	Sour-sop	West Indies	1d. each	3d. per pkt.
Anona reticulata, L. ...	Custard Apple	Trop. America	3d. "	6d. per pkt.
Anona Cherimolia, Mill. ...	Cherimoyer	West Indies	3d. "	6d. per pkt.
Anona squamosa, L. ...	Sweet-sop	Trop. America	3d. "	6d. per pkt.
Uvaria Kirkii ...	...	Trop. Africa	1d. "	6d. per pkt.
Guttiferæ—				
Garcinia Mangostana, L. ...	Mangosteen	Malay Archipelago		
Garcinia Morella, Desrouss ...	Cochin Goraka	E. Indies	1d. "	1s. per doz.
Garcinia Livingstonei, T. And. ...	...	E. Africa		
Garcinia indica, Chois. ...	Kokim oil	E. Indies		
Mammea Americana, L. ...	Mammee apple	Trop. America		
Ternstrœmiaceæ—				
Caryocar nuciferum, L. ...	Souari nut	Guiana	5d. "	
Malvaceæ—				
Adansonia digitata, L. ...	Baobab	Africa	3d. "	
Hibiscus Sabdariffa, L. ...	Indian Sorrel	Tropics	1d. "	3d. per pkt.
Sterculiaceæ—				
Cola acuminata, Br. ...	Kola nut	Guinea	1d. "	1s. per 100
Geraniaceæ—				
Averrhoa Carambola, L. ...	Caramba	E. Indies	3d. "	3d. per pkt.
Averrhoa Bilimbi, L. ...	Blimbing	E. Indies	3d. "	3d. per pkt.
Rutaceæ—				
Citrus medica, L. ...	Citron	India	3d. "	
Citrus " var. acida ...	Lime	...	1d. "	
Citrus " var. Limonum ...	Lemon	...		
Citrus decumana, L. ...	Shaddock	India and China	3d. "	
Citrus paradisi, var. ...	Grape-fruit	W. Indies	3d. "	
Citrus mandarin ...	Mandarin orange	China	1½d. "	
Citrus Aurantium, L. ...	Sweet orange	India	1s. each or 7s. 6d. per 100	
" " var. ...	Navel orange	Bahia		
" " " ...	Egg orange	St. Michael		
" " " ...	Maltese blood orange	Malta		
" " " ...	Pernambuco orange	Pernambuco		
" " " ...	St. Michael orange	St. Michael		
" " " ...	Tangierine orange	...		
" " " ...	Silver orange	...		
" " " ...	Variegated orange	...		
" " " ...	White orange	...		
Cookia Wampi, Blanco ...	Wampee	China	3d. each	
Ægle Marmelos, Corr. ...	Bhael tree	India		
Rhamneæ—				
Zizyphus Jujuba, Lamk. ...	Jujube	India, Trop. Africa, Australia		
Zizyphus rugosa, Lamk. ...	...	India and Ceylon		
Ampelidæ—				
Vitis vinifera, L. vars. ...	Grape vine	West Asia	6d. "	
Sapindaceæ—				
Melicocca bijuga, L. ...	Ginep	S. America	1d. "	6d. per doz.
Nephelium Litchi, Camb. ...	Litchee	China		
Nephelium lappaceum, Linn. ...	Rambutan	Malayan Archipelago		
Cupania edulis, Schum. & Thom. ...	Akee	W. Africa		3d. per doz.

LIST OF FRUITS, *coutinued.*

Scientific Name.	Common Name.	Habitat.	Price. Plants.	Price. Seeds.
Anacardiaceæ—				
Spondias graveolens, Macf. ...	Common Hog plum	W. Indies	1d. each	3d. per doz.
Spondias purpurea, L. ...	Spanish Plum	W. Indies and Colombia		
Spondias dulcis, Forst. ...	Jew Plum	South Sea Island	3d. each	
Spondias lutea, L. ...	Hog Plum	W. Indies and Trop. America	1d. "	
Anacardium occidentale, L. ...	Cashew	Trop. America	1d. "	
Mangifera indica, L. ...	Mango	India	1d. to 1s. each according to variety	
Leguminosæ—				
Castanospermum australe, Cunngh.	Moreton Bay Chestnut	Australia		
Tamarindus indica, L. ...	Tamarind	Tropics	1d. "	
Inocarpus edulis, Forst. ...	Otaheite chestnut	Indian Archipelago		
Rosaceæ—				
Chrysobalanus Icaco, L. ...	Coco-plum	West Indies		
Eriobotrya japonica Lindl. ...	Loquat	Japan		
Combretaceæ—				
Terminalia Catappa, L. ...	Almond	India	1d. "	
Myrtaceæ—				
Eugenia Jambolana, Lamb. ...	Jimbolin	India and Malay Archipelago		
E. Jambosa, L. ...	Rose-apple	E. Indies to Australia	1d. "	3d. per pkt.
E. malaccensis, L. ...	Malay-apple	Malayan Islands	1d. "	6d. per doz.
E. javanica, Lam. ...	Wax-jambo	Malay Islands	1d. "	6d. per doz.
E. brasiliensis, Lam. ...	Brazil cherry	Brazil	1d. "	6d. per doz.
Psidium Guava, Radd. ...	Guava	Trop. America	1d. "	3d. per doz.
Psidium " pomiferum, L. ...	Dwarf guava	"	1d. "	3d. per doz.
Psidium pyriferum, L. ...	Spanish guava	"		
Psidium Cattleyanum, Sabin. ...	Purple guava	Brazil	1d. "	6d. per doz.
Grias cauliflora, L. ...	Anchovy pear	W. Indies	1d. "	6d. per doz.
Bertholletia excelsa, H. B. ...	Brazil nut	S. America		
Lecythis zabucajo ...	Sapucaia nut	Brazil		
Lythrarieæ—				
Punica Granatum, L. ...	Pomegranate	E. Indies	1d. "	6d. per pkt.
Passifloreæ—				
Passiflora quadrangularis, L. ...	Granadilla	Trop. America	3d. "	
Passiflora edulis, Sims. ...	Sweet cup	"	1d. "	6d. per pkt.
Passiflora laurifolia, L. ...	Pomme d'or	S. America	1d. "	6d. per pkt.
Passiflora maliformis, L. ...	Sweet cup	"	1d. "	6d. per pkt.
Carica Papaya, L. ...	Papaw	"	1d. "	6d. per pkt.
Rubiaceæ—				
Vangueria edulis, Vahl. ...	...	Africa		
Sapotaceæ—				
Chrysophyllum Cainito, L. ...	Star apple	W. Indies	3d. "	
Achras Sapota, L. ...	Naseberry	Trop. America	3d. "	
Lucuma mammosum, Gaertn. fil. ...	Mammee Sapota	W. Indies	3d. "	1s. per doz.

LIST OF FRUITS, *continued.*

Scientific Name.	Common Name.	Habitat.	Price.	
			Plants.	Seeds.
Oleaceæ—				
Olea europœa, L. ...	Olive	W. Asia		
var. atroviolacea ..	...	...		
var. conditiva ...	...	...		
var. regalis ...	...	...		
var. uvaria ...	...	...		
var. hispanica ...	...	...		
var. rubra ...	...	...		
var. polymorpha ...	...	...		
Boragineæ—				
Cordia Collococca, L. ...	Clammy cherry	W Indies	1d. each	3d. per pkt.
Laurineæ—				
Persea gratissima, Gaert. fil. ...	Alligator-pear	Trop. America	1d. "	1s. per doz.
Proteaceæ—				
Macadamia ternifolia F. v. M. ...	Queensland-nut	Queensland		
Euphorbiaceæ—				
Aleurites triloba ...	Candle nut or Wal-nut	Tropics	3d. "	2s. per doz.
Phyllanthus distichus, Muell. Arg.	Jimbling	Tropics	3d. "	
Urticaceæ—				
Artocarpus incisa, L. fil. ...	Breadfruit	E. Indies and Polynesia	3d. "	
Artocarpus integrifolia, L. fil. ...	Jac-fruit	E. Indies and Polynesia	3d. "	1s. per doz.
Artocarpus nobilis ...	Bread-nut	...		
Ficus Carica, L. ...	Fig	Mediterranean Region		
Scitamineæ—				
Musa sapientum, L. ...	Banana	Tropics	3d. "	
Musa paradisiaca, L. ...	Plantain	Tropics	3d. "	
Musa Cavendishii, Paxton ...	China banana	China	3d. "	
Bromeliaceæ—				
Ananas sativa, vars. ...	Pine apple	W. Indies	Suckers 3d. each	
Palmæ—				
Cocos nucifera, L. ...	Coco-nut	Tropics		

Note.—A subscription of 2/ will insure the delivery of the next 12 numbers of the Bulletin.

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BULLETIN

OF THE

BOTANICAL DEPARTMENT,

JAMAICA.

CONTENTS:

PRICE—Two-pence.

JAMAICA:
GOVERNMENT PRINTING ESTABLISHMENT, 79 DUKE STREET, KINGSTON.
1887.

A.—COFFEE.

A Short Treatise on Coffee Planting as applicable to Jamaica, by W. A. Sabonadière, formerly of Ceylon, and now of Arntully, Coffee Plantation, Blue Mountain District.

Introductory Remarks.

The Coffee bush is a native of Abyssinia, whence it must have been introduced into Arabia; but it was not till the year 1652 that Coffee was introduced into London as an article of commerce, and that the first Coffee-house was opened by a Greek named Pasqua Rossie.

For some years after the introduction of Coffee into Europe, the only source of supply was Arabia, but in 1690 the Governor General of the Dutch East Indies received a few seeds, and planted them in a garden at Batavia. The plants grew and flourished so well that the culture was extended in Java, and a plant was sent to the Botanic Garden at Amsterdam. Young plants from the seeds of the Amsterdam shrub were sent to Surinam, where the cultivation was established in 1718. The West Indies received plants ten years later. Thus the progeny of the single Coffee shrub growing in the Amsterdam Botanic Garden now produces more Coffee than all the other plants in the world.

The Coffee tree in its native state will grow to 15 or 20 feet in height; the leaves are a dark glossy green, like Laurel; the blossom is similar to Jasmine with a strong odour, the fruit is somewhat like a cherry, of an oval shape, each cherry contains two cells, and each cell one bean or seed, unless by a freak of nature it happens to be a *Pea Berry*, containing only one.

Selection of Land, Soil, Elevation, etc.

Judging from my Jamaica experience of nearly four years I would name 2,500 to 3,500 feet above the sea as the best elevation for Coffee in Jamaica. The safest limit on the Blue Mountain Range is 4,000 feet, above which I should now be loth to plant, unless I was compelled by having no other available land. I deem 4,500 to 5,000 feet certainly too high, especially in spots exposed to cold and wind; for the winters here are far more marked, and "Northers" more frequent than they are in Ceylon at like elevation; and I fancy it is the same as in Ceylon, in countries as near the Equator. Below 2,500 feet it might be advantageous to grow Coffee under moderate banana or other suitable shade—trumpet trees are used for that purpose in the Manchester hills. The best aspect for Coffee is an eastern one, facing the rising sun; the best land, undulating or a moderate slope strewn with boulders, or under ledges of rock; the best soil is chocolate-coloured mould, due to the decomposition of rocks containing felspar. The fault of Jamaica land in the Blue Mountains, is that it is mostly very steep, and so land has to be selected here and there where most suitable, thus causing Jamaica Coffee estates to be generally in detached fields and spread over a large extent of land, though the planted area is quite small as compared to the large properties in the East Indies, where thousands of acres could be walked through with scarcely a break. This extensive felling of the forest perhaps made Ceylon more liable to attacks from various enemies of the Coffee tree, such as Black Bug and Leaf Disease, the latter as is well known having nearly ruined the Coffee Planters. It may be that our compulsory retention of so much bush has been the saving of our Jamaica properties in this respect. When planting Coffee, all ridges should be left uncleared as shelter against cold and wind, and because the Coffee seldom or never thrives upon them.

Climate.

As to Climate none seems more suitable than that of Jamaica for Coffee planting; though occasionally in the high mountains northers, cold, heavy wash, and breakaways do much damage. In the Manchester mountains and lower districts it may sometimes be too dry, and the want of good running streams for water power must be a great drawback.

Felling, Clearing, and Lopping.

In Jamaica, felling and lopping is commonly done by job work, as much as 4s. per square chain being given for that work if the wood-land is heavy, and a proportionate sum for clearing and making ready for lining and holing. Here on steep land not very heavily timbered I have had both works done for £2 10s. an acre.

The trees should be well and evenly lopped and laid as level as possible so as to secure a good burn, and the felled land should be allowed to lie from six weeks to three months before fire is applied according to the weather that has previously prevailed. If land could be planted without burning and the virgin soil thus preserved intact it would be a great saving of humus, but it would cause all other works of planting and weeding to be excessively expensive. The best time for felling is towards the end of the year so as to secure a good burn before April when it is the best time to commence planting. Good burns may also occasionally be had in August and September, and the planting done during the October seasons, but the Spring seasons are undoubtedly the best for planting.

Nurseries.

In Jamaica, nurseries are not so much the rule as they were in Ceylon, the common practice seems to be to purchase plants, here called *suckers*, from settlers, and stump them or put them out as *flying suckers* as may be most suitable: on the old Estates under the large trees, self-sown plants (from the "rat" Coffee) may generally be found, and when carefully selected, are almost as good as *Nursery* Plants, but to the latter must be yielded the palm, especially if they can be put out with a ball of the original mould adhering to the roots; but it is very difficult in the Blue Mountains to meet with a nice level and not stony piece of land suitable for a Nursery, and near a spring for watering purposes.

A nursery should be made into beds dug quite a foot deep in good rich soil, and should be shaded until the plants get strong. The parchment berries should be put in about an inch deep, 2 or 3 inches apart in the rows, with 4 to 6 inches allowed *between* the rows. A nursery usually requires watering at first and during hot weather. If the little plants come up too thick they should be thinned out and carefully transplanted into other beds, care being taken not to bend the tap root, and with finger and thumb to see that they are firmly fixed into the soil.

Lining.

Owing to the steepness and roughness of the land, lining is very difficult to execute properly in Jamaica: the usual mode is with a long, single, stout rope, with pieces of colored rags fastened in at the distance apart at which it is intended to place the pegs. I have adopted the Ceylon plan of lining at Arntully, that is using 8 or 10 ropes, first laying them down and then using a moveable transverse rope, putting in the pegs where the two ropes meet. I have noticed how very wide apart the old Coffee is usually planted in Jamaica, commonly eight feet, sometimes stretching to nine; this is far too wide. I am planting Ceylon fashion, six by six, and would certainly not put my trees further off each other than seven feet square, if I could possibly avoid it. The advantages of close lining are that the trees cover the ground and prevent the growth of weeds. It is a mistake to have too small a number of trees to the acre, or to have many *galls*, or bare spots which have never been supplied.

Supplying.

Supplying the places of plants that have died off, is a work of the utmost importance and should be taken in hand from the first and followed up from time to time, so that the fields may be made as even and regular as possible. I admit it is a most difficult proceeding in Jamaica because of the steep nature and general looseness of the land, causing frequent earth-slips, and the rolling of stones and logs which kill, break and cover up the young plants; this makes it a most difficult and tedious process to raise Coffee here, compared to what it usually was in Ceylon; the plants on these steep lands should therefore be protected by a peg or two driven stiffly about four to six inches above the plant, so as, if possible, to turn off rolling stones, loose earth and trash.

Holing.

In most Jamaica soils on the upper mountains, holing is really not required, the soil being naturally loose and porous. In this case the best tool to use for planting is a stout iron digger, three feet long, about one inch thick, pointed at one end, and flattened at the other to a width of say three inches; with this the earth about the peg can be well loosened to a fair depth, the stones and roots removed, and the plant put in at once. Much care should be taken to keep the tap root straight, and also to spread out the fibrous roots, in fact to put back the plants as nearly as possible as they were in the ground previous to being transplanted. It is necessary also to be most particular not to allow the men to plant too deep, and below the *collar*.

In the lowlands, and where the soil is naturally stiff, holes should most certainly be dug; they should not be less than eighteen inches wide and deep, and should be filled up with the best of the surrounding mould, or what has come out of the hole if good, and no stones or trash should be allowed to get in. In uncertain weather stumps are most safe to plant, they should not be much thicker than an ordinary lead pencil. Planting should only be confided to trustworthy and experienced persons, and the gang should not be too large so that they may be well under supervision. A light showery, cloudy day, is best for planting; if very wet the mould becomes mud, and the planting cannot be done properly.

(*To be continued.*)

B.—GRAPES.

Cuttings of the following Grape Vines can be supplied, price 2d. each :—

1. Muscat of Alexandria—Oval White Muscat Grape. The best and handsomest White Grape in cultivation. Must have well drained soil and warm aspect. A shy bearer in cold, damp situations.
2. Black Barbarossa—Round Black Vinous Grape. Bunches sometimes very large and handsome. Quality only second rate except when very ripe. A vigorous grower, and needs a large arbour or trellis. Requires heat.
3. Alicante—Oval Black Grape. Bunch and berry very large, ripens late and keeps well.
4. Mrs. Pearson—Round White Muscat Grape, very prolific, late in ripening but keeps long. Does well grown in pots.
5. Foster's White Seedling—Oval White Sweetwater Grape—First class in quality, ripens early and very prolific. This variety will probably be found most suitable for the hills.

The following directions on Grape Vine Culture have been distributed with the cuttings :—

1. Vines are best raised from single eyes, making healthier plants and coming sooner into bearing than when propagated from layers or canes with several eyes.
2. Sand or sandy loam in shallow boxes is the best material in which to strike them. When placed in a warm moist situation they readily form roots and as soon as this takes place they should be planted out where they are intended permanently to remain. Water should be given only sparingly, but the plants should never be permitted to become dry. Established vines when in active growth require abundance of water. After a crop is taken off water should only be used to keep the foliage clean and healthy, so as to promote the ripening of the canes for the next bearing.
3. So soon as the new growth commences and a few leaves are formed, some support (as twigs, small branches, &c.,) should be provided for the vine to run upon and it should be allowed to grow for

the first season without restriction, except in the case of laterals which should be kept pinched back to one leaf.

4. If intended to be trained on trellis the growth of a pair of laterals near the ground may be allowed; but cutting back the first season's growth to within ten or twelve inches from the surface is the better plan.

5. The eye when first planted should be just beneath the surface and the soil pressed firmly about it. This is essential.

C.—ORANGE SEEDLINGS.

A prevalent opinion in Jamaica is that the seed of the Sweet Orange produces indifferently Sweet, or Bitter Orange Trees, Citron, Lemon, or Shaddock Trees. Macfadyen, a very careful botanist, writing in 1837, after a residence of more than 12 years in the island, states in his FLORA OF JAMAICA that "It is a well established fact, familiar to every one who has been any length of time in this Island, that the seed of the Sweet Orange very frequently grows up into a tree bearing the bitter fruit, numerous well attested instances of which have come to my own knowledge. I am not however aware, that the seed of the Bitter Orange has ever grown up into the sweet-fruited variety. These two varieties of Orange would therefore appear to bear the same relation to each other, as subsists between the Apple and the Crab. The Crab is considered to be the original stock of the Apple, and its seed always produces a small acerb fruit, whereas although the seed of any of the approved kinds of Apple, such as the golden pippin, may occasionally grow up into a tree producing an esteemed variety of fruit, not inferior perhaps to that of the parent tree, yet in infinitely the greater number of instances it will be small and acerb, and in other words a Crab. We may therefore conclude that the Bitter Orange was the original stock, and that, to certain accidental circumstances, such as the soil and climate being peculiarly favourable, and to cultivation, we are to ascribe the production of the Sweet."

Duchassaing confirms Macfayden, stating that in Guadeloupe the seeds of Sweet Oranges often produce bitter fruit.

On the other hand, Dr. Ernst, in charge of the Botanic Garden at Caraccas, says that Sweet Orange seed may give acid, but never bitter, fruit. Sir D. Brandis, late Inspector General of Forests in India, states that, as far as he has been able to ascertain, the very extensive orchards of Sweet Orange trees in Khasia have all originated from seed. Gallesio, an Italian, who devoted almost his whole lifetime to the subject, published in 1811 his TRAITE DU CITRUS, in which he is most emphatic that both bitter and sweet kinds can be propagated by seed with absolute certainty. He says, "I have for a long period of years sown the pips of the Sweet Orange, taken sometimes from seedling Orange trees, sometimes from grafts on the Bitter Orange or on the Lemon I have always had trees with sweet fruit. This result is the experience for more than 60 years of all the gardeners of the district of Finale. There is not one example of a Bitter Orange tree produced by the seeds of the Sweet Orange, nor of an Orange tree with sweet fruit produced by the seeds of the Bitter Orange. In 1709, frost having killed the orange trees of Finale the practice arose of raising the trees from seed; there was not a single one of these plants which did not produce fruit with sweet juice." He adds that the Orange tree having been propagated in Italy for many centuries exclusively by means of grafting, it caused no little surprise to the inhabitants to find that the fruit from seedlings was sweet, and moreover that the trees thus raised were larger, more productive, and hardier than the former kinds.

The evidence goes to show that Macfadyen's experience was exceptional in finding that the seeds of the Sweet Orange sometimes produce trees with bitter fruit; and there is no evidence whatever that there is any foundation for the popular opinion mentioned above. In fact, if it were true, it would upset the conclusions arrived at by Sir J. D. Hooker, who has studied the Orange tribe in India. He maintains, in the FLORA OF BRITISH INDIA, that while the Sweet, the Bitter and the Bergamotte Orange are varieties of the same species, the Citron, Lemon and Lime are varieties of a quite distinct species, and the Shaddock is again another species of the genus Citrus. Now, though it frequently happens in nature that different varieties are produced from seed, it has never been known to occur that the seed of one species gave rise directly to a distinct species. This would out-darwin Darwin. Nevertheless, there is an element of truth in this, as in most other widespread popular beliefs, and it is to be found in the fact of hybridization frequently taking place through the agency of insects. The pollen is carried from the flower of a Shaddock to a Sweet Orange tree, and the result would probably be a fruit, partaking of the nature of the Shaddock and the Orange. If the different varieties and species of Citrus were all growing together, it might happen that the same tree would produce fruit more or less like the different kinds. On the other hand, it is not probable that many seeds of these hybrid fruits would be fertile: this is a point worthy of experiment. Even so, the seed would not produce a true Sweet Orange or Shaddock tree but a tree partaking of the character of both.

The danger, in planting seedlings of the Sweet Orange, appears to be small,—they will only exceptionally produce hybrid trees. Great care, however, should be taken to keep the different varieties and species of these trees as far apart as possible; and if the object is to cultivate Sweet Oranges only, it is advisable to cut down all other varieties, and in fact gradually to exterminate from the plantation all inferior kinds even of the sweet Orange.

The seedlings distributed by the Botanical Department are raised from seed obtained from Messrs. Wray and Nephew, through the kindness of Mr. Holwell. The Oranges are used in the manufacture of Orange Wine, and great care is exercised to obtain only the very sweetest Oranges, in order to produce Wine of the finest quality. This is the best guarantee therefore that the fruit has not been hybridized, and that the seed will come true. The Botanical Department is indebted to the Firm for being able to propagate a large quantity of seedlings of the best kind.

D.—SUGAR CANE MANURES.

Summary of conclusions arrived at on the action of Manures for Sugar Canes at the Experiment Fields, Barbados, by J. B. Harrison, Esq., M.A., Island Professor of Chemistry and Agricultural Sciences, and J. R. Bovell, Esq., taken from their Second Annual Report, 1887.

1. Manuring the sugar cane with only the mineral constituents of manures is useless, the cane not having the power, as stated by M. Ville, of assimilating free nitrogen from the air.

2. The addition of readily available nitrogen to the purely mineral manures produce large increases in the weight of canes grown, but excessive dressings, (over 3 cwt. of sulphate of ammonia to the acre) cause a marked decrease in the richness and purity of the juice.

3. Under the climatic conditions existing at *Dodds* during the years 1885, 1886 and part of 1887, and upon the soil of the experimental fields, nitrate of soda was decidedly inferior to sulphate of ammonia, as a source of nitrogen.

4. The addition of superphosphate in moderate proportions to manurings of nitrogen and potash causes a very great increase in the yield of canes, and in the available sugar in the juice per acre.

5. The addition of superphosphate in quantities beyond that capable of supplying about 75lbs of "soluble phosphates" per acre, (equivalent to about 16 per cent. of "soluble phosphates in the ordinary manuring of one ton to five acres of commercial sugar cane manures) does not produce a corresponding increase, and if applied in very large proportions may even reduce the produce below that obtained from manuring with nitrogen and potash only.

6. The addition of potash to manurings of superphosphate and nitrogen, may not increase the yield of total produce to any very marked extent, but from its tendency to increase the development of the canes causes a large increase in the amount of "available sugar" in the juice per acre.

7. The presence of potash in the manures in rather high relative proportions apparently tends to increase the amount of sucrose in the canes. This point is worthy of further investigation.

8. The presence of an excess of Potash in the manures, does not injuriously affect the purity of the juice by increasing the glucose, or appreciably the amount of potash salts contained in it.

[A few copies of the full Report have been kindly sent to the Botanical Department, and have been distributed amongst Sugar Planters in Jamaica.]

E.—WEIGHT OF BARK FROM CINCHONA TREES (Cinchona officinalis.)

Enquiries having been made as to the amount of bark that may be expected from trees of various heights, 10 trees were cut down and barked with the following result:—

I	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X	XI.	XII.
Number of Tree.	Height in feet and inches.	Branched at—feet from ground.	Circumference at base in inches.	Circumference at first branch in inches.	Circumference of first branch in inches.	Weight of wet bark from stem in ounces.	Weight of dry bark (taken at one-third.)	Weight of wet bark from stem and branches in ounces.	Weight of dry bark (taken at one-third.)	Weight of wet bark from root in ounces.	Weight of dry bark (taken at one-third.)
1	6.4	.	6½	.	.	15	5	.	.	.	
2	7.8	.	4½	.	.	10	3⅓	.	.	.	.
3	10.0	.	7½	.	.	28	9⅔	.	.	.	.
Average ..	8.0	.	6⅙	.	.	17⅔	6	.		.	
4	9.10	6½	10	4	2	.	.	33	11	.	.
5	10.0	4	11	7½	5	.		60	20	.	.
6	15.3	4½	15	10½	4	.	.	120	40	.	.
7	20.6	.	16½	.	.	.	.	156	52	.	.
Average ...	13.11	.	13	.	.	.	.	92¼	31	.	.
8	10.0	.	6	.	.	.	.	18	6	10	3⅓
9	11.0	.	12	.	.	.	.	46	15⅓	24	8
10	14.3	.	9½	.	.	.	.	48	16	14	4⅔
Average ...	11.9	.	9	.	.	.	.	37⅓	12½	16	5⅓

The trees, Nos. (1) to (7) are from the Plantation at Newhaven Gap, which was first made in 1868. It is impossible now to ascertain the age of any of these trees, as some are seedlings and some are shoots from coppiced trees. There are probably very few of the original trees left, perhaps No. (7) is one of these. No. (1) may be taken as an example of a tree six years old.

Nos. (8) to (10) are from the Plantation called "Upper Buzza" made in 1879-80. These trees are therefore 7 or 8 years old.

The dry bark in the Table has been taken at one-third the weight of the wet bark. This would give 11lbs. 2ozs. for dry stem bark; the actual weight being 12lbs. Root bark does not lose so much in drying, for instead of one-third (viz. 1lb.), more than one-half was obtained—1lb 12ozs. One-third, on the whole, is a safe estimate, for there is considerable waste in drying on a large scale on account of the constant shifting of the bark from the drying-houses to the barbecue which causes friction and reduces a good deal of it to dust.

It is instructive to take Columns II. and IV. together and compare the amount of bark harvested. No. (2) for instance, is much higher than No. (1), but being more slender gives much less bark. It therefore pays well to attend to thinning. Perhaps the most convenient time for Crown Bark is when the trees are 6 years old. If the plants were put in four feet apart, half the trees should be thinned out, and it will be well to uproot them, for the shoots would interfere with the other trees, and besides the root bark will be more than 50 per cent. of the bark from stem and branches.

The amount of bark per acre may be roughly estimated by taking an average tree and multiplying the weight of bark by the number of trees on an acre. Trees planted 6 feet apart, are 1,210 to the acre; 8 feet apart, 680 to the acre; 10 feet apart, 435 to the acre.

F.—A DISEASE IN COCOANUT PALMS.

The following is the Report on a disease which has appeared among the Cocoanut Palms in the neighbourhood of Bath:—

To the Acting Colonial Secretary.

On my return journey from Bath Gardens I rode up the hills from Bath on 9th September to inspect the cocoanut walk on a property called Ardshiel, belonging to Mr. George Donaldson, situated at an elevation of about 1,000ft.

On examination I found that the disease was due to scale insects, and had evidently travelled from the point of its first appearance in the direction of the prevailing currents of wind. The damage done by the last hurricane was evident, but it is in no way connected with the disease.

The effect of the disease is to cause the lower leaves, and then the upper, to turn brown, and eventually drop off. In time the terminal bud (the "heart") is also attacked, and as the growth of Palms is confined to this portion of the plant the whole cocoanut tree dies.

The scale insects (the females, which constitute the disease) do not fly, but are transferred from one plant to another by various agencies: birds, insects, spiders, dead leaves or twigs, to all of which they may be attached. Wind acts in a secondary way, not being able to detach the scale insects themselves but carrying spiders, &c., to which they adhere. The young larvæ are active in running about, but this method of spreading cannot affect tall Palm Trees. In the present case the scale insects appear to have been brought from a distance by some such agency as insects or birds, and then to have been spread through the cocoanut walk by means of the wind.

Mr. Donaldson told me that he had frequently noticed the scale insects on sugar canes in the plains during dry weather, but that they disappear during the rains. He observed that at Ardsheil there had been no want of rain during the present year.

A remedy against scale insects is published in Number 3 of the Bulletin, which it is advisable to use when they attack Orange trees. The expense of applying the solution is enormously increased in the case of a lofty Palm. I would suggest, that owners of Cocoanut Palms should carefully watch their trees, and as soon as the disease appears, lop off the leaves affected and burn them.

(Signed) W. F.

[The disease seems to be spreading fast, and will probably soon appear in the Liguanea plains, and elsewhere. An effectual remedy is the Kerosene emulsion advised in the last Bulletin, and the only question about its application is the practical one of expense.]

G—PLANTS IN FLOWER OR FRUIT.

Cam Wood or Bar Wood (*Baphia nitida*) has grown at Castleton to a height of 24 feet, and measures 30 inches in circumference at the base. It has papilionaceous flowers, white, with a small orange-yellow blotch near base of the standard. Some hundred tons of the wood are imported into Great Britain annually from the West Coast of Africa. The logs are about 4 feet long and a foot in diameter. It is a dyewood, yielding a brilliant deep red colour, and is used for the same purposes as Brazil wood. The mordant employed is sulphate of iron; common English Bandana handkerchiefs are dyed with this material. In Africa, the natives colour their bodies with the pounded wood, and make use of the wood also in Fetish ceremonies.

A Dillenia (*Dillenia indica,* otherwise *speciosa*) is in fruit at Castleton. It is a round-headed, handsome tree, 60 feet high, with hard rough leaves 8 to 10 inches long, and large showy flowers 6 inches across with white petals, and a mass of yellow stamens in the centre. The true fruit which is about 3 inches in diameter, is composed of 20 cells, arranged round an axis, each one with several seeds enveloped in a jelly-like pulp; the whole is covered round with the calyx-leaves which have become thick and fleshy, forming a large heavy fruit 6 inches in diameter. Both fruit and leaves are used in India for making curries and jellies. The acid juice, mixed with sugar and water, forms an excellent cooling drink in fevers, and is also useful for cough mixture. The rough leaves are employed in the same way as sand-paper for polishing. Both bark and leaves are astringent and are used medicinally. Their timber is hard and durable, especially under water.

The Champaca (*Michelia Champaca*) is another East Indian tree, 30 feet high with flowers of a rich Orange colour, and exquisite perfume. It is sacred to Vishnu, and is planted round the temples. The bitter, aromatic bark is used in Mauritius as a febrifuge. The wood is fragrant, and is useful for cabinet-work, and for house-building. The Champaca is a near relation of the Magnolia.

Colvillea (*C. racemosa*) is a Madagascar tree named after a former Governor of Mauritius, Sir Charles Colville. It is a beautiful tree growing to a height of 40 or 50 feet, with scarlet flowers growing in dense clusters. It is allied to the Flamboyante (*Poinciana regia*), also a Madagascar tree.

The Cananga *(C. odorata)* is a native of Ava, Tenasserim, Java and the Philippines, but it is cultivated as an ornamental tree throughout India and the Tropics. It is a tall tree with straight trunk and smooth ashy bark. The flowers are drooping, of a greenish yellow colour, fragrant and about three inches in length. It belongs to the same family *(Anonaceæ)* as the Sweet Sop, but the fruit is not edible.

Caryota (*urens*) is an Indian Palm 50 or 60 feet high. It is so valuable to the natives of India and Ceylon that it is largely cultivated The inner portion of the stem is soft, and contains large quantities of starch which is made into an excellent sago. The natives make bread of this, and also a kind of thick gruel. During the hot season it yields an abundance of toddy or palm wine, the best trees giving according to Roxburgh, as much as 100 pints in 24 hours. This toddy is used, not only as a drink, but more important still, to make a kind of sugar, called jaggery. The leaves and leaf-stalks afford the *Kittul Fibre*, the Indian Gut of the English market, which is very strong, and made into ropes, fishing-nets, lines, brushes, brooms, baskets, &c. It is said to be also useful in the manufacture of paper. The ropes used for capturing and tying wild elephants are made of this fibre.

H.—NOTES ON SOME RECENT ACQUISITIONS.

Para Rubber.

Mr. Morris writes from Kew Gardens as follows :—

"By this mail we are sending you a small box containing seeds of *Hevea brasiliensis* (Para rubber) which have been obtained for you from Ceylon. This tree is likely to thrive in warm humid districts, like Bath and Black River, and I have no doubt will prove eventually a useful introduction. There is a tree in bearing at Castleton but doubtless you will be glad of a further supply of seed."

Phœnix paludosa.

Seeds of this palm have also been received from Kew. The stem is 12 to 15 feet high, 3 or 4 inches in diameter. It is a native of the Sunderbunds, at the mouth of the R. Ganges. It grows only in swampy land, generally in tidal streams and brackish water.

Cedron.

Mr Hart sends from Trinidad a fruit of *Simaba Cedron*. The Cedron of commerce is the kernel of the stone. From time immemorial it has been prescribed as a remedy for the bites of snakes, scorpions, &c. Inhabitants of New Grenada, where the tree is a native, always carry a piece of the seed with them. If they happen to be bitten, a small portion is scraped off and applied with water to the wound, and about 2 grains of the powder mixed with brandy is taken internally. The active principle has been named *cedrine*. There is no doubt that it possesses febrifugal properties, and is successfully prescribed in New Grenada in cases of intermittent fever.

I.—THE VALUE OF THE CULTIVATION OF TIMBER.

How fatal are the results which attend careless indifference on this point is singularly shown by what has followed in Italy on the disforesting of the once well-wooded peninsula. Not alone have the recent terrible inundations in the north of Italy been directly traced to this cause, but the fatal *aria cattiva*, the poisonous breath of the marsh lands which has within 20 years or so invaded almost every province of the peninsula, now reigns supreme driving from the once fertile plains thousands of the unhappy inhabitants. Here we see the direct influence of false economy in this one direction. When we consider in addition that Italy could undoubtedly, by proper management, grow a large portion of the timber which at present she has to import, we see another direction in which a false economy has impoverished and impoverishes an already poor nation. England, without having reached this sad position, cannot be said to be beyond blame. There exists in our country many a broad stretch of land which, by the action of science, might be rendered productive, and at the same time beautiful. The growth of timber is not of a nature to tempt the speculative demands of modern private initiative; it is for this reason that it behoves Government, or, at least, local authorities, to take up the question. They, at least, standing virtually independent of the consideration of immediate gain, are the only fit instruments by which such work can be done ; but the system once set in order, the returns, it is evident, will be no less regular, even more so than from the ordinary sources of profit. A close study of the matter—an enquiry into the admirable methods adopted on the Continent, in France, in Belgium, and in Germany, would form an interesting subject of inquiry either for some Government commission or for some privately appointed body. The question is one of something more than passing interest. Whence are we to obtain our supply of timber ? Nature unaided will soon cease to be able to satisfy our demands, but we have here another of the many instances where science intelligently directed can solve the difficulty, and thus once again be of the utmost service to the world, not alone practically, but æsthetically.—*Builder.*

The Secretary
Torrey Botanical Club.
Columbia College
49th St, Madison Square
New York

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BULLETIN

OF THE

BOTANICAL DEPARTMENT, JAMAICA.

CONTENTS:

PRICE—Two-pence.

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

1888.

LIST OF TIMBER AND SHADE TREES CULTIVATED IN THE GARDENS.

Scientific Name.	Common Name.	Habitat.	Price of single Plants.
Dilleniaceæ -			
Dillenia indica, L. ... (D. speciosa, Thunb)	Dillenia	E. Indies	2d.
Magnoliaceæ—			
Michelia Champaca, L. ...	Champaca	E. Indies	2d.
Anonaceæ—			
Bocagea virgata, B. & H. ... (Oxandra virgata, A. Rich.)	Lancewood	W. Indies	2d.
Cananga odorata, Hf. & Th. ...	Cananga	Ava, Tenasserim, Java and Philippines	2d.
Bixineæ—			
Hydnocarpus venenata, Gærtn. ... (H. inebrians, Vahl.)	...	Ceylon	
Guttiferæ—			
Calophyllum Calaba, Jacq. ...	Santa Maria Wood	W. Indies to Brazil	2d.
Garcinia pictoria, Roxb. ...	Gamboge Tree	E. Indies	2d.
Ternstrœmiaceæ—			
Caryocar nuciferum, L. ...	Souari nut	Guiana	6d.
Malvaceæ—			
Pachira aquatica, Aubl. ...	...	Central and Northern South America, W. Indies	
Pachira Barrigon, Seem. ...	...	Panama	2d.
Bombax malabaricum D. C. ...	Malabar Silk Cotton-tree	E. Indies	2d.
Hibiscus elatus, Sw. ... (Paritium elatum, G. Don.)	Blue or Mountain Mahoe	W. Indies	2d.
Sterculiaceæ—			
Cola acuminata, R. Br. ...	Kola nut	West Africa	2d.
Pterospermum acerifolium Willd.	...	E. Indies	2d.
Guazuma tomentosa, H.B.K. ...	Bastard Cedar	Tropical America and E. Indies	2d.
Tiliaceæ—			
Berrya Ammonilla, Roxb. ...	Trincomalee Wood	India and Ceylon	
Zygophylleæ—			
Guaiacum officinale, L. ...	Jamaica Lignumvitæ	W. Indies and South America	2d.
Rutaceæ—			
Citrus decumana, L. ...	Shaddock	Malayan and Polynesian Islands	3d.
Zanthoxylum clava-Herculis, L. ...	Prickly Yellow	W. Indies	2d.
Simarubeæ—			
Simaruba amara, Aubl. ...	Simarouba, Bitter Wood	N. Brazil, Guiana, Dominica, St. Vincent	2d.
Picræna excelsa, Lindl. ...	Jamaica Quassia, Bitter ash, Bitter wood	W. Indies	2d.
Meliaceæ —			
Cedrela odorata, L. ...	W. Indian Cedar	W. Indies	2d.
Swietenia Mahogani, L. ...	Mahogany	W. Indies, Central America and Peru	2d.
Chloroxylon Swietenia, D. C. ...	Satin wood	India and Ceylon	
Sapindaceæ—			
Sapindus inæqualis, D.C. ...	Soap-berry	W. Indies and Tropical America	2d.
Melicocca bijuga, L. ...	Ginep	Northern South America and Trinidad	2d.
Nephelium Litchi, Camb. ...	Litchee	China	
Cupania edulis, Schum. & Thonn.... (Blighia sapida, Koen.)	Akee	W. Africa	2d.

LIST OF TIMBER AND SHADE TREES, *continued.*

Scientific Name.	Common Name.	Habitat.	Price of single Plants.
Anacardiaceæ—			
Mangifera indica, L. ...	Mango	India	2d. to 1s. according to variety
Semecarpus Anacardium, L. ...	Marking nut	E. Indies and N. Australia	2d.
Semecarpus acuminata, Thw. ...	...	Ceylon	...
Semecarpus cuneifolia, Roxb. ...	...	India	...
Spondias graveolens, Macf. ...	Common Hog plum	W. Indies	2d.
Leguminosæ—			
Tamarindus indica, L. ...	Tamarind	Tropics	2d.
Pithecolobium filicifolium, Benth.	Wild Tamarind	Central America and W. Indies	2d. 2d.
Pithecolobium saman, Benth. ...	Guango	Tropical America	2d.
Enterolobium cyclocarpum, Griseb.	...	Tropical America and W. Indies	2d.
Poinciana regia, Bojer ...	Flamboyante	Madagascar	2d.
Pterocarpus indicus, Willd. ...	Rose wood	E. Indies and China	
Erythrina umbrosa, H.B.K. ...	Madre di Cacao	Venezuela	2d.
Erythrina indica, Lam. ...	Indian Coral tree	E. Indies and Polynesia	2d.
Erythrina corallodendron, L. ...	Coral Bean tree	Tropical America and W. Indies	2d.
Calliandra latifolia, Gr. ...	Horse wood	W. Indies	2d.
Cæsalpinia coriaria, Humb. ...	Divi Divi	Tropical America and W. Indies	2d. 2d.
Cassia siamea, Lam. ... (C. florida, Vahl.)	...	E. Indies	2d.
Adenanthera pavonina, L. ...	Red bead tree, Red Sandal wood	E. Indies and China	2d.
Albizzia Lebbek, Benth. ...	Woman's tongue tree	Trop Asia, Trop. Africa and N. Australia	2d.
Brya Ebenus, D.C. ...	West Indian Ebony	Jamaica and Cuba	2d.
Hæmatoxylon Campechianum, L. ...	Logwood	Tropical America	2d.
Rosaceæ—			
Prunus occidentalis, Sw. ...	Prune tree	W. Indies and Central America	2d.
Combretaceæ—			
Terminalia latifolia, Sw. ...	Broad leaf	Jamaica	...
Terminalia Catappa, L. ...	Almond tree	Malaya	1d.
Terminalia tomentosa, Bedd. ...	...	India, Burma and Ceylon	...
Terminalia coriacea, W. & A. ...	...	India	...
Myrtaceæ—			
Eugenia Jambolana, Lam. ...	Jimbolin	E. Indies to Australia	...
Eugenia Jambos, L ...	Rose apple	E. Indies to Australia	1d.
Eugenia malaccensis, L. ...	Otaheite or Malay apple	Malaya and Malay Is	1d.
Eugenia javanica, Lam. ...	Wax Jambo	Malaya and Malay Is.	1d.
Psidium montanum, Sw. ...	Mountain Guava	Jamaica	1d.
Lythrarieæ—			
Lagerstrœmia Flos-Reginæ, Retz.	Queen's Flower	E. Indies and China	6d.
Sapotaceæ—			
Mimusops Elengi, L. ...	...	India	...
Lucuma mammosum, Gærtn. fil. ...	Mammee Sapota	Tropical America and W. Indies	3d.
Chrysophyllum Cainito, L. ...	Star apple	Tropical America and W. Indies	3d.

LIST OF TIMBER AND SHADE TREES, *continued.*

Scientific Name.	Common Name.	Habitat.	Price of single Plants.
Ebenaceæ—			
Diospyros discolor, Willd. ...	Mabolo	Philippines	...
Boragineæ—			
Cordia Sebestena, Jacq. ...	Scarlet Cordia	W. Indies	2d.
Cordia alba, Roem. & Schult. ...	White Cordia	Tropical America and W. Indies	2d.
Cordia Myxa, L. ...	Sebesten plum	Tropical Asia and Australia	...
Bignoniaceæ—			
Catalpa longisiliqua, Cham. ...	Yoke tree	W. Indies	2d.
Spathodea campanulata, Beauv. ...	Spathodea	Tropical Africa	2d.
Verbenaceæ—			
Tectona grandis, L fil. ...	Teak	E. Indies	2d.
Gmelina asiatica, L. ...	...	India and Ceylon	2d.
Laurineæ—			
Cinnamomum camphora, F. Nees ...	Camphor	China and Japan	...
Cinnamomum zeylanicum, Breyn ...	Cinnamon	E. Indies	2d.
Persea gratissima, Gærtn. fil. ...	Alligator or Avocado Pear tree	Tropical America and W. Indies	2d.
Euphorbiaceæ—			
Hevea brasiliensis, Müll. Arg ...	Para rubber	Brazil and Venezuela	6d.
Hura crepitans, L. ...	Sandbox	Tropical America and W. Indies	2d.
Hippomane Mancinella, L. ...	Manchineel	Tropical America and W. Indies	2d.
Manihot Glaziovii, Müll. Arg. ...	Ceara rubber	Tropical America	4d.
Aleurites moluccana, Willd. ... (Aleurites triloba, Forst.)	Walnut Candle nut tree	Tropics	3d.
Urticaceæ			
Artocarpus integrifolia, L. fil ...	Jac-fruit	E. Indies and Polynesia	3d.
Artocarpus incisa, L. fil. ...	Breadfruit	E. Indies and Polynesia	3d.
Ficus indica, L. ...	Banyan	India	1s.
Ficus benjamina, L. ...	Willow Fig	E. Indies Queensland	1s.
Ficus lanceolata, Roxb. ...	...	India	1s.
Ficus lucida, Thunb.	...	E. Indies	1s.
Ficus rhododendrifolia ...	...	...	1s.
Casuarineæ—			
Casuarina stricta, Ait. ...	Drooping or Coast She-Oak	S. E. Australia	2d.
Casuarina Cunninghamiana, Miq. ...	Fire Oak	N. S. Wales and Queensland	...
Casuarina equisetifolia, Forst. ...	Swamp Oak	E Africa to Polynesia	...
Casuarina torulosa, Ait. ...	Forest or River oak, Beefwood	S. E. Australia	...
Coniferæ—			
Juniperus bermudiana, L. ...	Juniper Cedar	Florida, Bermuda, West Indies	2d.
Pinus muricata, Don ...	...	California	...
Pinus Massoniana, Lamb. ...	...	China	...
Podocarpus coriacea, Rich. ...	Yacca	West Indies	2d.
Podocarpus elongata ...	...	...	...

The prices in this List are quoted only for cultivators in Jamaica and in those West Indian Islands which have established Botanical Stations in connection with Jamaica. The Department cannot undertake to supply shippers. The prices are slightly raised to cover the expense of carriage from Castleton to Hope and the prices in former lists will be raised in the same proportion. If, however, purchasers compare the expense of carriage from the two Gardens they will find that the total cost is much less than formerly.

The Lists are, in the first instance, catalogues of plants growing in the Gardens, and it is only those that have prices attached which are available for distribution. Some of those plants are not in stock throughout the year, but it is impossible to publish complete monthly lists.

Statement of Freight Charges allowed by the Royal Mail Company to the Botanical Department for conveying Plants to the West Indian Islands :—

Wardian Case ... 42″ × 20″ × 18″ more or less ...	£0	10	6
Box or Barrel or Package of similar capacity	0	6	0

COFFEE.

A Short Treatise on Coffee Planting, by W. A. Sabonadière, (continued).

Roads and Drains.

What macadamized roads and railways have done for England and other countries, good bridle roads and paths have effected for coffee estates. In Ceylon on estates that were not too steep, even cart roads were open through the fields for the purposes of manuring and carting the coffee to the main government road, and thence to the railway or shipping port. In Jamaica, especially in the higher Blue Mountain plantations, it would be next to impossible (without immense expense) to make such cart roads, the land is too steep, rocky, and liable to frequent breakaways, but good bridle roads and narrow paths for facilitating the work and enabling tho supervision to be better done can easily be opened. The bridle roads should not exceed a gradient of from 10 to 7½ feet rise in one hundred feet. About the paths one need not be so particular, as they have often to be taken through very rocky and inaccessible places; if they are broad enough to be walked along, and have to be braced up and down to avoid impediments, it does not signify as they open up out-of-the-way portions of the estate and make them easily accessible to the labourers and supervisors of work. There is no doubt the better an estate is roaded, the better it will be supervised, and the better the order in which it will be kept. In the steepest places it is a good plan to plant the lemon or fever grass along the lower side of the path, as it helps to keep it up. It is also advantageous to plant the same grass in breakaways to prevent the further slipping of the land, and another good plan is to cut some drains at a moderate gradient, say 1 in 10, to 1 in 20 to catch the water in the worst places, and turn it into the natural ravines. The elaborate plan of drawing coffee estates as carried on in the palmy days of Ceylon would not answer in Jamaica, because the land is mostly too steep and rocky. All planters will have noticed how well coffee usually looks and bears below the roads, because of the fresh mould being constantly thrown upon them each time the road is cleaned after weeding. The advantage of fever grass is that it does not injure the coffee or spread from seed, as does Guinea grass.

Weeding.

Weeding is about the most expensive work on a coffee estate, especially if an old one, where the seed has got full possession of the soil; in such cases it is difficult to keep the coffee moderately clean under an expenditure of from 30s. to 40s. per acre, per annum, which means by ordinary Jamaica cultivation, from 6s. to 8s. per acre for four or five weedings annually. In Ceylon on young estates where the burn had been a good one, the weeding was taken in hand even before the lining and holing were commenced, it could then be done by monthly contracts at from 18s. to 24s. per acre per annum or 1s. 6d. to 2s. per acre monthly. On old estates the monthly weeding system was adopted as the only way of keeping decently clean an estate which formerly had been very weedy; this was effected at a cost of from 3s. to 4s. per acre per mensem, or 36s. to 48s. per acre per annum, and no doubt it paid, in coffee fields that yielded from 5 to 10 cwt. per acre.

In steep lands the heavy hoe should if possible be altogether done away with, and light hoes or scrapers used, and in fields where the land is very steep, the mould loose, and grass not very bad it should be done by hand. In the young fields of virgin land, I would most certainly have the hoe (large or small) utterly discarded and the hand and a pointed stick alone permitted. In old coffee, the custom is for the weeders in order to save themselves trouble (specially *job* weeders) to draw the mould away from, in lieu of towards the stem of the tree, this should not be permitted. Uncovering the roots naturally does much injury to the trees, and every endeavour should be made to keep them well covered, and as much as possible undisturbed. The mould thus drawn around the roots composed as it is of decomposed weeds and other vegetable matter, acts as a good fertilizer. The process of moderately *moulding* the roots is as beneficial as laying them bare is injurious to the coffee tree. All weeders are usually expected to pull all suckers and gormandizers from the trees, but it is most difficult to get a man to do his work neatly and properly. Weeders should be made to sweep clean the roads which pass through their jobs.

Topping.

Pruning is one of the most necessary as well as the most important and difficult operation that a coffee planter has to see properly carried out. In consequence of the trees being topped, a process which is quite contrary to their natural propensity to soar to a height of 15 to 20 feet, they throw out vertical shoots called suckers or gormandizers, as well as an exuberance of young shoots in all directions, all which have to be taken off and regulated, so as if possible to cause the tree to bear average crops, and prevent its getting into a mass of confused and matted branches. As a beginning when the tree is sufficiently high it must be topped In virgin soil where the trees are young and healthy it is better, in my opinion, to leave them alone until they have attained a height of one foot *above* where it is intended to top them and have borne the maiden crop In this way they can generally be topped in the brown bark, which renders the tree much less likely to be split down from the heavy bearing of the top branches than if cut when the bark is green and sappy. When the proper time arrives, the men should each have a stick with the proper height marked off; they should cut the two primaries next above this mark about a couple of inches off the stem in a slanting direction outwards, the top should then be taken off with a clean cut, the cut to face northwards as being less exposed to the sun, forming a cross-like appearance. In exposed places, such as ridges, topping must of necessity be lower because of the direful effects of wind; and also in ruinate lands, that may have been replanted. Mr. Francis, of Cedar Valley, informs me that he has tried the local practice of topping quite low, say two feet from the ground, afterwards allowing a sucker to grow up the required height. The plan just mentioned, as I can well believe, strengthens the lower branches, makes them cover the ground, and prevents the tree from the tendency coffee has in such lands to lose its lower branches, and run up into what would be called an *Umbrella* tree. After the sucker has grown to the needed height, it can be topped. In these ruinate lands I would not recommend a height of more than 3 feet; in virgin lands 4 to 4½ feet is a suitable height, but if the exposure is unfavorable they must be topped lower, as the planter's judgment may best decide. Young coffee trees should also be staked, as a protection against wind.

Pruning.

The pruning itself should be commenced soon after the tree commences to throw out its secondaries It is well to treat a coffee tree as one trains and educates a child, viz: "from its youth up." By so doing and by regular pruning and handling or searching or feathering as it is termed in Jamaica, one may save a heavy expenditure in the future, for when full grown trees have been neglected they become matted with heavy cross branches and it is not only expensive, but difficult even with the aid of saw and knife to get them back into good order. One of the first rules to be given is that all gormandizers and suckers, and all cross wood must be taken off: next that space about a foot in circumference must be cleared round the stem so as to admit light and air; then all overplus of young shoots must be thinned out; lastly, the trees must be trimmed round and all dead wood and weak whippy branches removed. In young coffee these rules should most strictly be followed, and care taken to cut the secondaries named so close to the primary as to destroy the *eye* and prevent their shooting again. In neglected coffee where the cross wood may be bearing, I would recommend the sacrifice of cutting it away to get back the tree into proper order. In fact the tree should if possible be so regulated as not to overbear itself, and sufficient wood should be left to secure a good crop the following year. In pruning a great deal has to be left to the experience and discretion of the Superintendent in charge of the field work. No absolutely definite rules can be laid down, except for young trees, each coffee tree must be treated according to its actual condition, according to soil, elevation, exposure and climate, and experience can only be acquired by steady practice and observation.

Feathering.

Feathering is a term applied to the process of removing young shoots with the hand The most experienced labourers should be selected, as the proper trimming of the trees is a very important work. As to rules; those for pruning and keeping the centre of the tree open should be observed, and the double or treble shoots thinned out, and those going in the right outward direction preserved, care being taken to leave sufficient bearing wood for the coming crop. In Ceylon this work was considered of such importance that it was done *twice* before crop when labour was plentiful; here in Jamaica from scarcity of labour or economy, it is perhaps not even done once during the year. Much more might easily be written about pruning, but it would be too long for such a paper as this; and I would therefore refer any one needing further information on the subject, to consult Laborie's, Hull's, or my own work on coffee planting.

Manuring.

Manuring was largely and expensively carried on in Ceylon where the facilities were much greater than in Jamaica. Here the soil is decidedly superior, so that our coffee fields do not need manuring as badly as was the case in Ceylon, to enable the trees to bear good and paying crops. However as manuring is sure to do good and as much of our coffee is old, it would no doubt be most beneficial to apply some suitable fertilizer. If the difficulties of transport were not so great first to the estate itself and then to the upperfields and good grazing land for cattle not so scarce, there is no doubt more of this work would have been done in Jamaica. In any case a few directions will not be out of place especially for settlers, and low-lying coffee plantations, where cart roads are available, and cattle kept. As to the best for coffee, cattle manure pure and simple must bear the palm, I mean that from a stall where the cattle have been well bedded with grass and trash. Well decayed coffee pulp and cattle manure, are equally good, if not better than the latter alone: mixed with stable manure it is good also, but stable manure is more heating—about one half to one bushel, according to size of the tree, is a good dose of the above named mixtures, and should have lasting effects for 2 or 3 years In steep land manure should be applied in a semi-circular hole or trench about a foot to eighteen inches above the tree, say a foot deep, and nine inches broad; care must be taken not to cut the main and larger roots; cutting the fibrous roots does less harm, and in fact is a mode of root-pruning. In flat land the hole may be cut all round the roots, and should the coffee be regular and cover the ground, the holes may be cut in the centre of the four trees, about two feet square and one foot deep, the feeding roots soon finding their way to it. The manure should be well mixed with the mould, and the earth over the hole well trodden down,—the stem must not be buried up as it is injurious to do so. If settlers only took care of all the excrement from their houses, from cattle, pigs, or goats, and mixed it well with grass and trash in a pit dug for the purpose, and applied the mixture when well decayed to their coffee trees, they would secure far better crops than at present, and would keep their coffee pieces in much better condition.

In Ceylon, manuring was of such importance that cattle sheds were erected here and there over the estate, and cattle stall fed in them, with the Mauritius grass which was planted and grew so luxuriously in the ravines. Artificial manures, especially Australian bone dust were also very largely used, usually mixed with cattle manure, or *poonac*—the refuse of oil cake derived from the cocoanut after the oil has been extracted in hydraulic or other presses. But such an expensive style of manuring would scarcely be profitable here as our transport difficulties are so great. Nor do I believe it is necessary on our Blue Mountain properties, as the Jamaica soil is so good, that ordinary careful weeding and pruning put the trees into good condition and enable them to produce paying crops.

PROSPECTS OF CINCHONA BARK.

In to-day's sale a good supply of South American bark was offered. Several lots crown bark, fair to good quill, brown to silvery, sold at 8½d. to 1/10d. per lb., Loxa at 1/6d. Of red bark four bales good coloured soft bark, very dusty, were bought in at 4/3d. per lb. A parcel of good bold thick bark somewhat hard, and containing a good deal of outer bark, is held at 10/ per lb. High class red bark is extremely scarce, and as much as 14/ per lb. is paid for really fine lots. At the public sales held at Colombo on May 5, a slight advance was established. The shipments from Ceylon, as compared with last season, show a reduction, but it is quite possible that this will be of a temporary nature, as it appears that the arrivals at Colombo from the interior are still very heavy. The following are the latest figures relating to the Ceylon exports :—October 1, 1886 to May 5, 1887—8,862,534lbs., same period 1885-86—9,056,039lbs., ditto 1884-85—5,844,776lbs.

A Java Cinchona Planter of high standing, who has recently made a tour through Ceylon to investigate the condition and prospects of the cinchona cultivation in that Island, gives it as his opinion that the large exports from Ceylon will be played out in the course of two or three years, when Java planters will be fully coming on the market with their barks, of which one million lbs. are equal to several millions from Ceylon, so far as alkaloidal richness is concerned. The Ceylon cinchona owners therefore stand between two fires ; to harvest before 1889-90 will be a necessity for them, and yet by so doing freely the market is likely to be kept in its present depressed condition. The Dutch Indian planter is also of opinion that the area under cinchona cultivation in Java is generally under estimated, and that for general vigour and beauty of growth the plantations in western and southern Java are unrivalled. Java Planters have discarded all inferior varieties of cinchona, and give their attention solely to the better kinds of Calisaya, more especially Ledgeriana. C. officinals is almost unknown with them ; whereas in the climate and soil of Ceylon this hardy species, and its hybrid Robusta, is the most successful. The prospects of cinchona planting in India do not appear by any means brilliant, for authorities well able to judge believe that apart from the harvest in the Government Gardens, the private plantations in India are not likely for some time to yield a total output exceeding 1,000,000lbs. per year. The bulk of the Government crop, in the Northern Plantations at any rate, is employed locally in the manufacture of febrifuge.—*Chemist and Druggist.*

HOW TO RAISE FERNS FROM SPORES.

Take a shallow, porous, red earthenware pan, about 3 inches deep, put an inch of broken flower-pot in the bottom, over that a thin layer of moss or other fibrous material, then fill up the pan with ordinary Fern compost upon the top of which scatter a few nodules of clay, press lightly so as to make fairly flat. Now place a small piece of paper in the centre, upon which pour gently a whole Kettleful of *boiling* water, which the paper will prevent from disturbing the soil. Remove the paper, place a sheet of glass over the pan, and let it cool. We have now a congenial soil, and all spores of fungi, or eggs of insects are killed, thus leaving the Fern spores a clean field.

Now take a frond bearing ripe spores, i.e., speaking generally, brown ones, and lay it for a day or two between two sheets of white paper in a dry place. We shall then find the paper stained with a brownish dust. This dust is made up of the spores and their cases, and it is only necessary to tap this sheet gently over the prepared pan to finish the operation. Cover immediately with the glass. Make a note of your sowing, species, variety, and date, and place, put the pan in some damp shady corner out of the way, taking the precaution that worms do not get in from below. If possible forget its existence for about three weeks, when a faint trace of green will be visible, showing the spores have begun to develop. Very soon the little scales will become perceptible, and in a few weeks more the whole pan will be covered. To this there succeeds an apparent dormancy, lasting sometimes for weeks : the reproductive phenomena are, however, now going on, and the next thing will be the sudden appearance, at first here and there, and eventually in a crowd, of the first little fronds proper, when the success of the sowing may be recorded.

Should, however, the prothalli cover, as is probable, the whole of the pan, it becomes manifest that there will soon be a great struggle for existence, as the little plants require elbow-room. It is therefore well at this stage to prepare other pans in the way indicated, and with a pointed knife or stick pick out small patches about the size of peas. Insert these carefully in the soil, just so that they adhere to it, and about an inch apart, and cover again with glass ; the result will be a greatly accelerated growth.

To the beginner's great surprise, it is most likely that instead of Ferns appearing according to the names in his register ; other species altogether may predominate, even at first to the entire exclusion of those he looked for ; these latter will, however, probably appear later. This is owing to the fact that some varieties whose spores naturally fly about and settle upon all the Ferns around them, germinate and develop much more rapidly than others ; hence, if any of their spores have settled upon the fronds from which the sowing was made, there is no possibility of discriminating them, and all that can be done is to weed them out eventually, should they threaten to choke out the sorts especially desired.

The next, and, to the connoisseur, the most fascinating stage of Fern propagation by spores, is the careful search through the resulting crop for new and improved forms among the rising progeny. Here and there the experienced eye will detect some unusual or especially promising feature as the young fronds develop ; these may either be marked and left where they are, or better still, carefully lifted out, and placed in a pan reserved for that purpose. By and by, new fronds arise, which perhaps confirm, perhaps upset his expectations ; but to the persistent cultivator every now and again his warmest hopes are more than crowned, and he has the proud pleasure of scoring another success, and adding one more gem to his and others' collections.

Should fungi appear or worms get in, it is well to prick out sound patches of the prothalli at once into other pans prepared as already indicated; with care this can be done at any stage of development.

In selecting spores for sowing not only should the best varieties be selected, but also the best and most characteristic portions of the fronds should be sown from. Thus if a good crested form is in question, and heavier cresting aimed at, the spores should be taken from the heaviest crest itself if possible. Some very fine and constant forms have been raised from spores taken from plants which only showed a trace of variation in one small subdivision of a frond, the spores upon which produced plants so characterised throughout.—*Gardener's Chronicle.*

TREES FOR CULTIVATION.

Seedling, Timber and Ornamental Trees available for distribution at the Nurseries, Cinchona.

The Yellow Cypress of N. W. America and California (*Thuja gigantea*) is a good timber tree, suitable for building purposes. The wood is bright yellow, and fine grained. The inner bark is soft and pliable and useful for making mats, sails, ropes, &c. This graceful tree generally grows from 50 to 70 feet in height, and in favourable situations attains 200 feet. It will probably do well on the hills in Jamaica. Although called a Cypress, it is in fact an Arbor-Vitae.

Lawson's Cypress (*Thuja Lawsoniana* B. & H.) is described by Murray as the handsomest tree seen by him in his expedition in N. America, the habit being most graceful, with the branches at first curved upwards, as in the Spruce, and towards the ends hanging down like an Ostrich feather; the leading shoots when young, droop like those of the Deodar. The tree attains a height of 100 feet, and a diameter of 2 feet. The timber is good, easily worked, with a strong odour. Murray described it as a true Cypress. (*Cupressus Lawsoniana,* Murr.)

The Chinese Arbor-Vitae (*Thuja orientalis,* L.) is a native of China and Japan.. The name Arbor-Vitae is derived from the Chinese and Japanese names for the plant. In China it is known as "Hak," everlasting life, and in Japan as "Hiba," tree of life, so called from the evergreen nature of the shrub.

The Large Fruited Cypress (*Cupressus macrocarpa,* Hartw.) is one of the finest of the true Cypresses. It is a native of Upper California where Hartweg discovered it, growing to a height of 60 feet, with a trunk 3 feet in diameter. It resembles in habit a Cedar of Lebanon, having a far spreading, flat top.

Another beautiful Californian Cypress (*Cupressus Goveniana,* Gord.) also discovered by Hartweg is much smaller, growing only to a height of from 6 to 16 feet. It is very ornamented with spreading slender branches.

The Horizontal Cypress (*Cupressus sempervirens,* L. var. *horizontalis*) is only a variety of the common Cypress of South Europe and is so named from its horizontal spreading branches.

The above plants are on sale at 1d. each or 7s. 6d. per 100.

Free Distribution of Acorns and Seedling Oaks, (*Quercus Robur.*)

In 1885, Mr. Morris obtained a barrel of acorns from the Royal Gardens, Kew, which have done well in the nurseries at Cinchona, and there are now some hundreds of plants available for free distribution. Carriage of plants must be paid for. Another barrel has lately arrived from Kew and Acorns will be be sent free by Post to those who make application for them. The bags should be returned. There is also a limited number of plants of the Turkey Oak (*Quercus Cerris*) available. Both these species of Oak are likely to do well on the hills, and would be an important addition to our supply of timber. There is a fine tree at Whitfield Hall, the property of DeB. Spencer Heaven, Esq.

G.—SEEDS AND PLANTS IMPORTATION LAW.

(L.S.)

H. W. Norman.

By His Excellency Sir Henry Wylie Norman, General of Her Majesty's Forces, Knight Grand Cross of the Most Honorable Order of the Bath, Knight Grand Cross of the Most Distinguished Order of Saint Michael and Saint George, Companion of the Most Eminent Order of the Indian Empire, Captain-General and Governor-in-Chief in and over the Island of Jamaica and its Dependencies.

PROCLAMATION.

In virtue of the power vested in me in that behalf by the First Section of Law 4 of 1884, entitled "The Seeds and Plants Importation Law, 1884," I do hereby prohibit, until further Proclamation, the importation into this island of Seeds or Plants, or any description of earth or soil or any article packed therewith, that may have come either directly or indirectly from any of the following Countries: Natal, South India, Ceylon, Mauritius, Java, and Figi.

Given under my Hand and the Broad Seal of this Island, at King's House, this Second day of December, in the Fifty-first Year of Her Majesty's Reign, Annoque Domini, 1887.

By Command,

J. Allwood, Acting Colonial Secretary.

No. 6. March, 1888.

BULLETIN

OF THE

BOTANICAL DEPARTMENT,

JAMAICA.

CONTENTS:

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1888.

COFFEE.

A Short Treatise on Coffee Planting, by W. A. Sabonadière, (continued).

Buildings.

In Jamaica, Buildings, or *Works*, as they are called, appear to me too small in most instances for the proper carrying out of the work to be accomplished within them. On some old properties they are most substantially built, and are all closed in with windows like a house. In Ceylon, except at the first when very large, massive, expensive Buildings were put up, the style is very different and less costly. My idea of a store and pulping house is as follows for a property of 150 to 200 acres.

Store.

About 120 to 150 feet long, 25 feet broad, built on stone pillars about 10 feet apart, with three floors, the lowest cemented, the two upper to be laid on strong beams and joists, with a flooring of laths laid down about $2\frac{1}{2}$ inches apart, to be carpeted over with coir matting, so that the air can pass through the coffee and permit of its being heaped two or three feet deep; cleanliness is also another item in favor of coir matting, as compared to ordinary boards. The lower story should be well enclosed and have plenty of windows for light, so that it may be used as a picking room for preparation for market; and also for keeping the trash coffee bags, baskets, and other articles required in a coffee store. Between the pillars weather boarding should be used, with here and there a jalousie to admit the air; and at the ends of each floor there should be large windows to admit plenty of light. A free current of air cannot be injurious to parchment coffee that is sufficiently dried, as long as wet is excluded, and by turning over the coffee morning and evening it can be kept quite sweet and cool even when heaped two or three feet deep.

Pulping House.

A pulping house should have a solid paved platform on which to stand the pulper, below it there should be three long cisterns (or tanks) longer than they are broad, so that the coffee can not only be pulped into them, but also be used for washing. Below these again there should be a smaller narrow cistern with a perforated iron, or strong wire flooring to catch the skins and trash, so that no bean or berry worth keeping should escape; the tanks should be on a gentle slope downwards. The floor above the pulping house, should rest on very strong supports, and have suitable beams and joists, so as to bear a very heavy weight, cherry being always very heavy. For smaller estates these arrangements could be made on a moderate scale. My work on Coffee Planting enters more fully into details.

Machinery.

As to Machinery, there is no doubt that Messrs. John Walker & Co.'s Cylinder Pulpers, with self-feeding buckets and circular siene, are as yet the very best and most simple improvement on the old "rattle trap" pulper of Laborie's time still so universally used in Jamaica. There are also smaller hand cylinder pulpers made suitable for settlers. Another of Walker's inventions is the "Disc" Pulper, and there is also "Gordon's" Breast Pulper, these act and work splendidly so long as the coffee is medium size, even and fully ripe, but like most patented articles the least thing that goes wrong with them upsets the whole affair, and they do no end of damage. Now, settlers are not noted for picking their coffee *well* ripe, so it would certainly be better for them to stick to the old machine, as improved upon in Ceylon.

Curing Machinery.

A wheel to drive the pulper, the mill and the sizing machine, where plenty of water is available, or a *large* tank can be frequently replenished, is far preferable to mule, or manual power, the wheel should be so placed as to serve both the pulping house and the milling room. As to winnowers, the old kind answer very well, and as regards sizing machines, I am told by old planters, they prefer the original ones to any new kind lately imported.

Gathering Crop.

It is always best to pick the coffee when it is *fully* ripe, but in Jamaica this does not seem to prevail: it may be that planters and settlers are anxious to save as much of their coffee as possible from the attacks of birds and rats, which I begin to believe, do much more to reduce our in-gatherings than is supposed. The mongoose has without doubt been a good friend to the planters, but he is getting dainty, and does not consume as many rats as of yore, if he would but kill them we should be content. The pickers on a well ordered estate should pick in rows, and begin at the top of each field and work downwards, so that any coffee dropped would roll forward, and be more easily picked up. Picking gangs should be well supervised, the trick in planter parlance termed "fly picking" should be entirely interdicted, any defaulters should be severely punished. When practicable there should be a galvanized iron shoot (five inches in diameter) erected from the top fields, to shoot the coffee direct into the pulping house, so as to save the labourers the long and heavy carriage.

Pulping and Curing.

Walker's Pulpers will accomplish a tierce, (say 40 tubs) an hour when properly set and driven and the coffee is in good condition; there should be a suitably deep box, or iron tank, resting on the pulper, called the "feeding box," to receive the coffee from the cherry loft, before it flows over between the chops; this is meant to catch stones, nails, or any injurious articles that might either maliciously or accidentally find their way amongst the cherries. After the coffee is pulped, the water must be allowed to run off, and it should be left two nights in the cistern to ferment off the gummy matter; coffee pulped on Monday is usually fit to be washed on Wednesday morning. In washing as much as possible of the skins and trash as have passed through the sieve should be taken out, so that the parchment when washed should have a white, and milky appearance, then it should be removed and dried on coir matting, or well polished barbacues, until it becomes as hard as horn, and brittle when broken by the teeth.

Milling and Curing for Market.

The process of "milling" is the next operation to be gone through; after that is completed next comes "winnowing," which blows away the parchment skin; then it is passed through the sizer, and by it divided into three classes or sizes, Nos. 1, 2 and 3, then it is handed over to the women to be "picked for market," they take out all cut, and in any way bad or injured beans, known in commerce as *triage*. A final putting back into the mill for polishing is generally done, which much improves the look of the coffee. The women get one shilling a day for picking 112lbs, or one cwt. Plantation coffee is usually shipped in tierces or barrels, many planters sell the triage in Kingston in preference to sending it home, unless there happens to be a very good market. Settlers' coffee is usually shipped in bags, often in the American fruit, and sugar carrying steamers, a system believed by coffee planters to be not likely to enhance its quality.

Transport.

Transport is one of the greatest difficulties in the Blue Mountain Districts. The coffee has to be sent on mules' back to the nearest cart road, and thence in drays to Kingston, where it is usually casked preparatory for final shipment to Liverpool or London, the former market is considered best for the highest qualities, and London for the lowest.

HOME AND COLONIAL TOBACCO CULTURE.

Offer of Prizes.

Two prizes of 50 guineas each are offered by the Tobacco Trade Section of the London Chamber of Commerce, to be awarded respectively for the best specimen of tobacco grown in the United Kingdom, and for that produced in India, or in any of the British colonies and possessions.

These prizes are given as a means of definitely ascertaining how far the above sources of production can add to the supply of tobacco suitable for the English market, and to what extent, if any, these growths can compete in quality and price with those of foreign countries, from which the consumption of the world has hitherto been chiefly drawn.

It is with this object that the following conditions have been formulated, as applicable to the competition which is invited, and they are such as are thought the most expedient for the purpose in view.

Conditions.

1. The Tobacco Trade Section of the London Chamber of Commerce shall, for the purpose of deciding on the merit of the specimens competing for the prizes, appoint a jury of experts, who will be assisted by recognised scientific authorities.

2. Each specimen submitted for the competition shall consist of a minimum quantity of tobacco, grown on a commercial scale, and therefore not less than 400lbs. in weight.

3. Each sample shall embrace an average of the growth, and not consist alone of leaf picked from a larger quantity than that which is submitted to the jurors. It is nevertheless desirable that the leaf should be assorted in the usual way into sizes or colours, separately packed, each sort being left in its natural proportion to the bulk.

4. The name of the grower and the locality and total quantity of the growth to be stated. In the case of British grown tobacco, it is requisite that the approximate quantity per acre, the cost of production and similar particulars be given on the demand of the jurors. These details may be required as a means of their making a report on the yet doubtful question as to the possibility of growing tobacco in Great Britain, such as in quality relatively to price can compete with that of other countries.

5. The specimens not grown in the United Kingdom shall be submitted for competition in London, and in the bonded warehouses of either the Victoria, the London and St. Katherine's, the East and West India Docks, or other bonded warehouse. Specimens of British grown tobacco will only be admitted under bond at the Haydon Square bonded warehouse.

6. The tobacco grown in the United Kingdom shall be sent for inspection on or before the 1st March, 1888, and that of other places on or before the 1st of December of the same year.

7. The jury shall reserve the right to require an independent verification of the locality and total quantity of growth in all cases where they think it desirable, and in awarding the prizes shall be at liberty to take into consideration the care bestowed on the handling, sorting and packing the tobacco for commercial purposes.

Note.—In order to ensure its keeping qualities, and for reasons connected with the duty, it cannot be too strongly recommended to growers that the moisture of the tobacco submitted for competition should not exceed 15 *per cent.* as ascertained by the usual scientific test.

All communications to be addressed to the Secretary, London Chamber of Commerce (Incorporated), 84 & 85, King William Street, London, E.C.

AMERICAN FRUIT EVAPORATOR.

Coffee.—Mr. John MacLean, Cold Spring, and Mr. Marshall, Chester Vale, imported one of these Machines (N°0), for the purpose of testing its value in drying Coffee. They cured a certain amount with this small machine in a single day, but were of the opinion that the berries were "over cured," on account of the temperature being kept too high. A small sample of this Coffee was sent to England just as it was, without picking or sizing, and the following Report was sent back by the Brokers :—

"We have carefully examined the sample of Jamaica Coffee cured by the hot air, and report that the size of the berries is good, but that the Coffee appears soft and watery in character. The colour is dull, approaching that known in Central America as cloudy, and it is mixed with pale bleached berries which detract from the value. It would be more easy to say how far the process is answerable for these defects, if we knew the Estate's marks so as to compare it with Coffee cured on the Barbecues. The market value to-day is 92/ to 93/ per cwt."

Mr. MacLean mentions that the same Coffee, sun-dried, realised 123/, but that the machine-dried Coffee sent was not a fair sample, as it had not been picked. He says, "there can be no doubt about the curing of Coffee, for what we did, being over-cured proves the success beyond a doubt."

Mr. James Francis, Cedar Valley, has tried this same Machine, and has sent the following Report of his experience :—

"The O machine with its eight tray capacity, will only hold a quarter of a tub of parchment Coffee.

"Coffee from the washing tank, which has been drained upon a barbacue, will, with a temperature of 140° to 180° F. dry coffee sufficiently in six hours to place it out of danger, another six hours will almost cure the berries; two hours longer, and the Coffee will be cured as for shipment.

"It can be readily understood that as it would take 160 days, of 14 hours each, to cure one tierce of Coffee, I had to confine myself to limited experiments, and though I would be rendering greater service to the Coffee growing community, if I cured a certain quantity in the first stage only by the Machine, completing the process in the sun and testing the market with it.

"The silver skin comes away more readily from machine-cured Coffee than from sun-cured ; this is an advantage.

"The colour is changed, and it may prove not so pleasing to the eye as sun-cured.

"Coffee cured in the Machine yields, or goes back, much more quickly than sun-cured ; this defect would, I think, be obviated by allowing a certain time between each of the three or four stages of curing.

"Curing in the Machine needs constant and careful attention, or one set of trays will give Coffee cured irregularly, and in the last stage, much might be spoiled for the market, by over-curing ; the Coffee then takes on the appearance of semi-parched berries.

"The question will naturally be asked, is the Machine good for anything? Yes. I consider it a valuable addition to any Coffee works, particularly in districts where there is rain during the early picking of Coffee. With a Machine of sufficient capacity, Coffee could be put out of danger, bagged in coarse bags, and piled up so as to let air pass through. Its use in this way would save many Coffee growers from much loss.

"I would willingly, and with much interest, have carried on further experiments, had the Machine been larger.

"I have tasted really good Coffee from berries cured in the Machine."

Tea.—The evaporator has been tried in the manufacture of Tea at Cinchona. Three samples were sent to Kew with the view of testing whether the machine-dried Tea was superior to that cured on iron over a fire. A sample of the latter was labelled No. 1, the samples of the machine Tea were called Nos. 2 & 3. These samples were sent to England, unfortunately, in mustard tins, which impaired their value considerably, and this is what the Brokers refer to in their letter and report subjoined :—

A. G. Stanton, Esq., to Royal Gardens, Kew.

3, Rood Lane, London, E.C., 21st December, 1887.

Dear Mr. Morris,

I duly received your letter of the 29th instant, together with the three samples of Jamaica Tea, two being marked Nos. 1 and 2 and the third having no number ; this latter I have called No. 3.

As I have given in the enclosed Report a pretty full statement of the various characteristics of the samples, I will only here add that the liquors of all are very serviceable for the London market ; the samples are all slightly impaired, No. 1 being especially so.

I shall always be happy to report upon any samples and to do whatever I may be able in the way of assisting intending Planters with any information or suggestions which they may require.

Believe me, &c.,

(Signed) A. G. Stanton.

Messrs. Wilson and Stanton to Royal Gardens, Kew.

13 Rood Lane, London, E.C., 31st December, 1887.

Dear Sir,

We beg to hand you our characters and valuations of Musters Packages of Tea per mail from Jamaica :—

Sample.	Species and Character.	Value per lb.
No. 1	Unassorted Tea ... ... The dry leaf is well rolled but is much too grey in colour, and wanting in tip ; somewhat uneven and inclined to be dusty. The liquor is fairly dark and full with some flavour. The infused leaf is regular and of a fairly bright colour.	£0 1 1
No. 2	Unassorted Tea ... ... The dry leaf is good colour but is too crinkley, and has not been properly rolled. The liquor is dark and full, and of a nice flavour. The infused leaf is regular and of a fairly bright colour.	0 1 2

Sample.	Species and Character.	Value per lb.
No. 3	BROKEN ORANGE PEKOE ... ... Dry leaf is good colour, and with a few tips ; but is rather open ragged and too uneven. The liquor is dark, full, and of good flavour. The infused leaf is bright and regular.	£0 1 8
General	The above Teas are chiefly valuable in the London Market on account of their liquors, the manipulation of the dry leaf being faulty. We prefer the samples marked Nos. 2 and 3, the leaf being better in colour ; and liquors of finer quality and flavour. No. 1 is too soft in liquor and resembles China Tea, Nos. 2 and 3 being more like Ceylon Tea. All the samples have a peculiar smell, and taste of some substance quite foreign to Tea ; for this defect we have made due allowance in our Report. The leaf of No. 1 is quite *limp* instead of being crisp, the sample has probably been damaged in transit.	

(Sgd.) GOW. WILSON AND STANTON.

D. Morris, Esq., Royal Gardens, Kew.

Mr. Morris writes : "We want now some good samples of Jamaica Tea sent over in chests, and grown and manufactured by private planters. This would be a decided step in advance."

CINCHONA BARK.—One lot of Bark has been dried in the Machine at Cinchona with very fair results. It was evident at the time that the temperature was too high, and that the bark would consequently suffer by dissipation of a portion of the alkaloids. It was however submitted to the Island Chemist, together with a sample of the same bark dried on a barbecue. He reports that from the barbecue dried bark, he extracted 3.55 per cent of alkaloids, whilst from the machine dried he obtained 3.38 per cent. and that the latter was harder and more difficult to grind This experiment is quite sufficient to show that the Machine would be useful to Cinchona Planters in drying their bark in plantations high up on the mountains, and distant from any barbecues.

CORN.—(Maize) Although there has been no opportunity here of drying Corn in the Machine, it is certain that either by kiln-drying or by the use of this Machine, sufficient corn could be grown and dried in the island for all our needs without having to import any.

PIMENTO.—The preliminary drying might well be done in the Machine, and it would probable much improve its appearance. It would be generally advantageous if those who have tried the Machine with the curing of Cacao or in any other way would communicate with the Director, Cinchona, Gordon Town P. O.

SACCHARINE.

The following information is taken from the Kew Bulletin for January, 1888. (It may be mentioned that the Kew Bulletin can be obtained through any Bookseller, or direct from the Publishers, Messrs. Eyre and Spottiswoode, East Harding Street, Fleet Street, London, E.C. Price twopence per copy, exclusive of postage.)

"In the inaugural address of Sir Henry E. Roscoe, M P., F.R.S., to the British Association at Manchester on the 27th August, 1886, he drew attention to the chemical principles upon which organic synthesis have been effected. He stated that as soon as the chemical structure of some organic substance has been ascertained or, in other words, as soon as chemists have carefully analysed and determined the exact constituents of a given organic substance, and the mode in which they are arranged within its molecule, there is open to them by a synthetic process or a building up of such constituents on a definite plan, to produce artificially a substance which hitherto may have only been known as naturally occurring in plants or animals. As instances he cited the well known synthesis of the coloring matter of madder by Graebe and Liebermann, and of indigo by Baeyer. Such artificial substances have been rendered possible by an intimate acquaintance with the successive steps by which these substances can be chemically broken up or decomposed. Hence, in a theoretical sense, a Chemist should be able to produce artificially almost any substance for which, at present, we are entirely dependent upon certain plants. By a purely synthetic process, Chemists may ultimately be able to produce artificial quinine, artificial theine, artificial theobromine, and artificial caffeine. If most artificial substances possessed all the therapeutic or elementary properties of the natural product, and they could be produced in such quantities and at such prices as would compete successfully with them, there is no doubt the growers of cinchona, tea, cacao and coffee, would have some reason to be alarmed for the welfare of their particular industries. But while we may admit that theoretically it will, in most cases, be possible to produce artificial substances having the same chemical constitution as the natural products, it is very doubtful whether the Chemist will, in many cases, find it a remunerative enterprise to compete with the Planter. The list of naturally occurring substances which have been already displaced by these artificially produced by Chemists is not a large one. But from time to time we are made acquainted with some new substances which have been discovered by chemical research, possessing properties singularly similar to those which have been hitherto obtained only from certain plants. Of those as mentioned by Sir Henry Roscoe "the most remarkable instance is the production of an artificial sweetening agent, termed saccharine, 250 times sweeter than sugar, prepared by a complicated series of re-actions from coal tar." The discoverer of saccharine is Dr. Constantine Fahlberg.

When the announcement of this discovery was first made, followed soon after by the appearance of saccharine as an article of commerce, there naturally arose a well-grounded anxiety among sugar-planters to learn how far this new substance was likely to constitute a competitor with cane-sugar. It is admitted that saccharine is now an article of commerce, and that it is anticipated that it will be largely employed for dietetic purposes. It appears to be agreed that saccharine does not undergo assimilation when taken as an article of food, and hence it may be used in cases where cane or beet-sugar is forbidden. It may be safely employed, for instance, by diabetic patients and by persons suffering from gouty affections and liver complaints. Further, it is said, that one grain of saccharine is sufficient to sweeten a cup of tea or coffee, and that it is very difficult if not impossible, to distinguish whether a beverage is sweetened with saccharine or cane sugar. And lastly, further it is claimed, that saccharine used in sweetmeats does not "create acidity" and in pharmacy its use will afford a wide field of usefulness.

The manufacture of saccharine on the other hand, is said to be a costly process, and it cannot at present nor is it even likely, to be sold as cheap as sugar.

Having thus briefly summarized what is known of saccharine, it may interest those who are engaged directly or indirectly in the production of cane sugar, to learn that the views of so eminent an authority as Sir Henry Roscoe, as to the probable influence of the discovery of saccharine on their particular industry. In reply to a letter addressed to him from this establishment in which it was stated that correspondents in the Colonies were anxious to learn the opinion of those best able to judge as to the future of saccharine, Sir Henry Roscoe expressed himself as follows :--

SIR HENRY E. ROSCOE, M.P., F.R.S., TO ROYAL GARDENS, KEW.

10, Bramham Gardens, Wetherby Road, S. W., December 3rd, 1887.

MY DEAR SIR,

In reply to yours of November 28, as to the probable influence of the discovery of saccharine, on the growers and makers of sugar cane and cane sugar, I have to say that I do not belicieve that saccharine is ever likely to become an article of common use like sugar.

In the first place, saccharine is not a food, while sugar is ; and in the second place, I doubt whether saccharine can be prepared at a price likely to compete with sugar.

I think that this artificial sweetening agent will, however, become a useful material in cases in which sugar cannot be employed, as in diabetes and other diseases.

It seems to me beyond the bounds of possibility that the price or production of cane-sugar can be materially affected by the introduction of saccharine.

I am, &c.,

(Signed) HENRY E. ROSCOE.

D. Morris, Esq.

DISEASE OF COCOANUT PALMS IN THE WEST INDIES.

The following article appeared in the *European Mail*, 1st July, 1886, and as it sums up what had been done to that date, may be usefully reproduced.

The growing of cocoanuts is fast becoming a large industry in the West Indies, and we find that Jamaica exports about three millions annually, while the exports of Trinidad are about ten millions. The export value of the cocoanut industry in these two islands is. therefore, about 50,000*l.* annually. The other British West India Islands do little or nothing in cocoanuts. Tobago, so depressed in every industry, has, however, made some progress in the planting of cocoanut palms, and before long she may show a respectable item in her export list for these commercial nuts. Her present export is about 800,000 nuts, of the value of 2,500*l.* At Grenada, St. Vincent, St. Lucia, Dominica, Antigua, and other islands of the Leeward group, cocoanuts are grown more or less successfully, but the greater number of the nuts are consumed locally. Indeed, as contributing to the food supply of the inhabitants, and as entering into almost every item of their daily life, the cocoanut palm is invaluable. Hence it may be safely estimated that for the whole of the West India Islands the annual value of the produce of the cocoanut palm is double of that exported, and may be placed at about 100,000*l.*

It is somewhat remarkable, and a strange anomaly in West Indian economies, that the tropical and fertile island of Barbados should be unable to grow cocoanuts sufficient for its own wants This, however, is the fact. To begin with, Barbados has a teeming population of about 140,000 souls, and nearly every foot of its beautifully-kept and productive soil is devoted to the growth of sugar cane and sweet potato. A few cocoanut palms are seen to fringe the coast, but they do not provide a morning drink of the delicious "cocoanut water" to a tithe of the inhabitants. Hence cocoanuts are imported to Barbados from any of the neighbouring islands that can spare them, and they provide at once meat and drink to the densely-packed black population, that would otherwise have to subsist on flying fish and sweet potatoes or American corn meal It is not, however, a matter of choice as regards growing cocoanuts at Barbados. For many years the few trees attempted to be grown there have presented more or less diseased conditions, and the produce in nuts has been very small In 1880 Mr. D. Morris, Director of Public Gardens and Plantations at Jamaica, investigated the condition of the cocoanut palms at Barbados, and found they were attacked by a small scale insect, which, covering the underside of the fronds, destroyed them as soon as they attained maturity. The disease was general, and affected every palm alike. As long as this disease is present in force it is hopeless to attempt to grow cocoanuts at Barbados Since 1880 Mr. Morris' attention has been given to the condition of cocoanut palms in other parts of the West Indies, and naturally those in Jamaica have come under particular notice

In 1882, a disease very similar to that at Barbados was found in certain portions of Jamaica, but it is evidently not confined either to Barbados or Jamaica, but is more or less prevalent everywhere in the West Indies. In a recent report on the subject, from which we are privileged to make a few extracts, Mr. Morris classes the diseases to which cocoanuts in the West Indies are liable under two heads, viz., the cocoanut beetle and the scale insect. As regards the cocoanut beetle, the attacks of this insect are confined to the trunk of the cocoanut palm or to the terminal bud, sometimes called the "cabbage." If a tree is suffering from the attacks of the beetle the first signs will appear among the young leaves in the centre of the crown of fronds. These will have a withered, drooping aspect, becoming more and more pronounced as time goes on, until at last the whole head will turn brown and withered. With the occurrence of the first strong breeze the head falls off, leaving nothing but the bare stem remaining. The best cure for the beetle, if noticed in time, is a handful of salt or unslacked lime dusted into the centre of the palm, which will gradually dissolve and find its way into the leaf-bud, where the beetle is at work, and destroy it. This, however, can only be conveniently done when the palm is young and within easy reach. Fortunately, however, although many cocoanut tree are destroyed by the palm beetle, its ravages are not serious at present, and it is quite possible they may never become so.

With the scale insect, however, it is different. During the last five years this insect has become more and more prevalent on cocoanut estates in Jamaica, and Mr. Morris appears to have corresponded with planters in different parts of the Island, and kept the disease under observation during the whole time. The result of his investigations, as detailed in the report above mentioned, are briefly as follows ; - The scale insect, in appearance like a minute oyster or limpet, attaches itself to the under side of the fronds of the cocoanut palm, and covers them with a thin silvery coating, which rubs off when scraped with a knife. Underneath the scale, one of which is only about the twelfth part of an inch in length, there lies an insect armed with a proboscis, by means of which it penetrates into the tissue of the frond and sucks up its juices. Generally, when lifting up one of the scales, there is found, not only the female scale-insect, but also a large number of eggs, which, when hatched give rise to a colony of small scale insects. These ultimately escape by a small hole in the scale, or general covering. It will be noticed that the cocoanut palm suffers from the scale insect by the loss of its juices, absorbed from the leaves by the myriad colonies of insects clustered beneath them. The disease spreads by the colonies of scale insects being carried from tree to tree, or from estate to estate, by the wind. It was first noticed in force in the Parish of St. Mary's, Jamaica. Like the aphis blight which appeared on sugar canes some years ago, the scale insect has spread in the direction of the trade winds, and affected estates to the south and west. The first appearance of the scale disease is shown by the outer frond turning brown and withered, and ultimately becoming quite dead and dry. In this respect it differs from the beetle, where the head is first affected and the outer leaves only at the last. If the scale disease is persistent it gradually spreads from the outer to the inner leaves, but, so far as Mr. Morris' observations are concerned, the scale disease does not destroy the trees, although it weakens them to such an extent as to spoil their bearing. To planters the most important considerations, however, are,—(1) How has the disease arisen? and (2) How may it be checked or removed ? Quoting a very valuable little book, by Miss Ormerod called "A Manual of Injurious Insects," lately reviewed in these columns Mr. Morris expresses his opinion that this disease has spread owing to the unprecedented prevalence of dry weather, in the West Indies, and he finds that the severer the drought the worse the disease. " Insects of this class multiply most quickly in dry weather, and on plants which are sickly from drought, exhaustion by insect attack or other causes ; so that all measures of cultivation tending to produce vigorous healthy growth are serviceable in counteracting attack ; and where circumstances allow of the application of liquid manure, or of water to an extent to make the plant food in the soil invaluable, and push on growth that otherwise was being checked by drought, such treatment would be desirable." Several other points are touched upon, such as that cocoanut palms grown inland, where there is an absence of salt in the soil, being less able to resist the disease, suffer more than those near the sea ; that where practicable cocoanuts should have a good dressing of manure applied to their roots as soon as the disease appears, and that irrigation be applied whenever practicable. As regards other treatment, Mr. Morris mentions that the fronds affected by the scale insects should be cut down and that they should be heaped up and gradually burned under the trees to give off as much smoke as possible, without, however injuring the foliage by heat. In fact, it is believed that by thoroughly smoking the insects in the first stages they may be destroyed, but beyond that it is hopeless to cope with a disease so widespread in its habit or so difficult to bring under careful treatment. It is somewhat consolatory to learn that in Mr. Morris' opinion the disease is likely to be greatly reduced on the return of regular rains and that it cannot ultimately affect the value of cocoanut properties in Jamaica. Planters in the meantime are, however, specially urged to take the simple steps noted above, and reduce the effects of the disease on their plantations as much as possible.

Mr. Hart also noticed the disease in his Report for the year ending September, 1886, and mentioned various remedies.

The following letter has already appeared in the Jamaica Gazette :—

Botanical Department, Gordon Town P.O.,
16th January, 1888.

Sir,

In continuation of my letter dated 7th September, 1887, No. 2424, on the Cocoanut disease in the neighbourhood of Bath, I beg to report that on a recent visit to Port Antonio I found that the same disease was attacking the Cocoanut Palms there, and especially the young plants.

2. Mr. Watson, who has charge of Captain Baker's plantations, appears to have been successful in getting rid of the disease on the young plants by a simple and inexpensive method. He placed a heap of dry leaves, &c., round the base of each stem and allowed it to burn for some time. The flames scorched and burnt the outer leaves of the Palm, at the same time killing the scale-insects, and new leaves are putting forth, which look healthy and free from the disease. I am inclined to think that the smoke caused by the burning had a greater effect than the heat, for it could penetrate to inner parts where the flames could not act. If so, a similar plan might be tried with even the tallest Palms, by packing the bases of the outer leaves with dry bush, rotten wood, or some material which would give dense smoke without flame. Sulphur might also be tried. The application of this or any other remedy should be tried at different times of the year, for a remedy which would have no effect on the eggs migh completely extirpate the disease if applied when the young insects are hatched out—probably about May or June.

3. A Correspondent from the Grand Cayman informs me that the Cocoanut Palms have been infested with apparently the same disease for forty years, and that " tens of thousands" of trees have been destroyed.

4. The subject is of great importance as a Cocoanut Palm in bearing is calculated to be worth Five Pounds, and if the disease spreads much in Jamaica the total loss will be very considerable.

5. It is to be hoped that the results of any experiments made for the extirpation of the disease will be communicated to me, in order that they may be published for the benefit of others.

I have, &c.,

W. Fawcett,
Director Public Gardens and Plantations.

Note.—A subscription of 2/ will insure the delivery at any Post Office in Jamaica of 12 numbers of the " Bulletin." Application may be made at any of the Gardens, or by post to the Director of Public Gardens and Plantations, Gordon Town, P. O., Jamaica.

The Secretary
"Torrey" Botanical Club
Columbia College
49th St Madison Square
New York

No. 7. JUNE, 1888.

BULLETIN

OF THE

BOTANICAL DEPARTMENT,

JAMAICA.

CONTENTS:

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JAMAICA:
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1888.

LIST OF ORNAMENTAL PLANTS IN THE GARDENS.

Scientific Name.	Common Name.	Habitat.	Price of Single Plants.
Dilleniaceæ—			
Dillenia indica, L.	Dillenia	E. Indies	2d.
(Dillenia speciosa, Thunb.) ...			
Wormia Burbidgei, Hk. f. ...	...	Borneo	...
Calycanthaceæ—			
Chimonanthus fragrans, Lindl. ..	Japan Allspice	China	...
Magnoliaceæ—			
Talauma Candollei, Blum. ...	...	Amboyna	...
Michelia fuscata, Blum ..	...	China	...
(Magnolia fuscata, Andr.) ...	...	...	...
Magnolia grandiflora, L. ...	Great Laurel Magnolia	S. United States	...
Michelia Champaca, L. ..	Champaca	India, Java	2d.
Drimys Winteri, Forst. ...	Winter's bark	Straits of Magellan	...
Anonaceæ—			
Cananga odorata, Hf. & Th. ...	Kananga	Burma, Java and Philippines	2d.
Asimina parviflora, Dunal ...	North American Papaw	Southern United States	...
Artabotrys odoratissimus, R. Br.	Ylang-Ylang	India, Ceylon, Java, China	...
Berberideæ—			
Berberis vulgaris, L ..	Barberry	Europe and temperate Asia	...
Nymphæaceæ—			
Nymphæa alba, L. ...	White Water Lily	Europe, Siberia, Kashmir	...
Nymphæa alba, L. v. biradiata ...	...	...	...
Nymphæa stellata, Willd. ...	...	India, Africa	...
Nymphæa Lotus L. ..	White Lotus	Hungary, Africa, E. Indies	...
Nymphæa Lotus L. v. rubra. ...	...	...	...
Nymphæa Lotus L. v. dentata ...	...	...	...
Nymphæa hybrida, (Hort. Kew.)	...	...	...
Nymphæa flava ...	...	...	..
Euryale ferox, Salisb. ...	...	India, China	...
Nelumbium speciosum, Willd. ...	...	Persia, E. Indies, China Japan, Trop. Australia	...
Nelumbium speciosum, Willd. var. album ...	...	...	...
Victoria regia, Schomb. ...	...	Northern S. America	...
Violaceæ—			
Viola tricolor, L. ...	Wild Pansy, Heartsease	Europe, W. Asia, N. Africa	2d. doz.
" (cultivated varieties) ...	Pansy	..	2d.
Viola odorata, L. ...	Sweet Violet	Europe, N. & W. Asia, N. Africa	1d.
Bixineæ—			
Scolopia crenata, Clos. ...	...	S. India, Ceylon, China, Philippines	2d.
Pittosporeæ—			
Pittosporum tenuifolium, Banks & Sol ...	Hedge Laurel	New Zealand	1d.
Pittosporum undulatum, Vent. ...	Victorian Laurel	Victoria & N.S. Wales	1d.
Sollya heterophylla, Lindl. ...	Blue Bell creeper	Western Australia	...
Guttiferæ—			
Garcinia Morella, Desr. ...	Gamboge Tree	E. Indies	2d.
(Garcinia pictoria, Roxb.)	...	...	...
Mesua ferrea, L. ...	Iron wood Tree	India, Ceylon	...

LIST OF ORNAMENTAL PLANTS, (continued.)

Scientific Name.	Common Name.	Habitat.	Price of Single Plants.
Ternstrœmiaceæ—			
Camellia japonica, Thunb. ...	Camellia	China and Japan	2d.
Gordonia anomala, Spreng. ...	Gordonia	Hong Kong	
Gordonia Lasianthus, L. ...	Loblolly Bay	S. United States	2d.
Malvaceæ—			
Pachira aquatica, Aubl. ... (Carolinea princeps L. fil.)	...	Central & Northern S America, St. Lucia, Guadeloupe	2d.
Pachira Barrigon, Seem. ...	...	Panama	2d.
Pavonia Wrightii, A. Gray ...	...	Texas, Mexico	...
Goethea strictiflora, Hk. ...	...	Brazil	...
Sterculiaceæ—			
Sterculia diversifolia, G. Don ... (Brachychiton populneum, R. Br.)	Victorian Bottle Brush Tree	Australia	
Sterculia heterophylla, G Don. ...	...	Australia	...
Sterculia alata, Roxb. ... (Pterygota alata, R. Br.)	...	India	...
Dombeya natalensis, Sonders ...	Cape Wedding flower	Natal	...
Dombeya Wallichii, B. & H. ... (Astrapæa Wallichii, Lindl.)	...	Madagascar	...
Reevesia thyrsoidea, Lindl. ...	...	China	...
Lasiopetalum dasyphyllum, Sieb.	...	N.S. Wales, Victoria, Tasmania	...
Pterospermum acerifolium, Willd.	...	India	...
Pterospermum lanceæfolium, Roxb	...	India	2d.
Pterospermum Heyneanum, Wall.	...	India	...
Pterosperum semisagittatum, Ham.	...	Assam and Burma	...
Lineæ—			
Reinwardtia trigyna, Planch. ... (Linum trigynum, Roxb.)	...	Himalayas	2d.
Geraniaceæ—			
Tropæolum majus, L. ...	Indian Cress, Garden Nasturtium.	Peru	1d.
Rutaceæ			
Ravenia spectabilis, Planch. ... (Lemonia spectabilis, Lindl.)	...	Jamaica and Cuba	2d.
Toddalia lanceolata, Lam. ...	...	The Cape, Mozambique and Mauritius	...
Atalantia monophylla, Correa ...	...	India, Ceylon	2d.
Simarubeæ—			
Samadera indica, Gærtn. ...	...	India, Ceylon	...
Ilicineæ—			
Ilex insignis, Hook. fil. ...	...	Himalayas	...
Rhamneæ—			
Pomaderris ligustrina, Sieb. ...	...	New South Wales	...
Ampelideæ—			
Leea sambucina, Willd ...	...	East Indies, China, Australia	2d.

NOTE—The prices in this List are quoted only for cultivators in Jamaica and in those West Indian Islands which have established Botanical Stations in connection with Jamaica. The Department cannot undertake to supply shippers.

The Lists are, in the first instance, catalogues of plants growing in the Gardens, and it is only those that have prices attached which are available for distribution. Some of these plants are not in stock throughout the year, but it is impossible to publish complete monthly lists.

Statement of Freight Charges allowed by the Royal Mail Company to the Botanical Department for conveying Plants to the West Indian Islands :—

Wardian Case ...	42″ × 20″ × 18″ more or less	...	£0 10 6
Box or Barrel or Package of similar capacity	...	...	0 6 0

NUTMEGS.

Nutmegs are principally propagated by seed, and care should be taken that well-ripened, selected nuts are chosen for planting. The nuts must be sown as soon as they are picked, or placed in soil until it is convenient to plant them. They should be planted a foot apart in rows, and ought only to be lightly covered with soil. Shade and protection are necessary till they have germinated, which takes from 30 to 60 days. When from 3 to 4 feet high they can then be transplanted, and may be set from 25 to 30 feet apart, and in dry weather it is advisable to water them.

A strong rich and rather moist loamy soil is best suited for the Nutmeg. Shade trees are essentially necessary.

The trees begin to bear when about 10 years old, and continue productive for 70 or 80 years; the fruit takes 9 months to mature.

The fruit as it splits is gathered by means of a hook attached to a long stick, the pericarp is then removed, and the mace carefully stripped off. The nuts are then taken to the drying house. The drying operation lasts for about two months, during which time the Nutmegs are turned every second or third day. At the end of this period the kernels are found to rattle in the shell, an indication that the drying is complete. The shells are then broken, the Nutmegs picked out and sorted, and finally rubbed over with dry sifted lime.

ANNATTO.

(Bixa Orellana, L.)

Several enquiries have been made respecting the note in the Annual Report concerning Annatto. There is no doubt that Agriculturists in the Tropics will find it indispensable to procure the Kew Bulletin, but occasionally it may be useful to quote from its pages in the local Bulletin. The following communication was received at Kew from Messrs. Fulwood & Bland, Annatto Manufacturers, of 31 Bevenden St., Hoxton, London :—

"The great bulk of Flag Annatto comes from Cayenne and Guadaloupe in the form of a paste made into cakes of about 8 or 10 lbs., which are wrapped up in banana leaves and packed in casks weighing about 5 cwt. each. The best kind is that from Cayenne, but it varies very much in quality, so much so that its value at the present time ranges from 5d. to 1s. 8d. per lb.; it also fluctuates very much in price according to the seasons. The Guadaloupe Annatto is very inferior, being very sour, but bright in colour in consequence of the acid that the natives put into it; it is, however, of very little value for manufacturing purposes, and therefore never realises such a high price as Cayenne Annatto; moreover, it does not contain anything like the amount of colouring matter present in the Cayenne kind. Annatto seeds principally come from the West Indies and Ceylon. We have never heard of any being imported into this country from Cayenne or Guadaloupe; the best that we have seen have been from Jamaica; they vary very much indeed in quality in consequence of insufficient care in collecting, curing and drying them before exportation. Large quantities came into the London Market last year very much deteriorated in value in consequence of having been packed when damp and getting heated and mouldy; the colouring matter was seriously damaged, and a good deal arrived shrivelled up and broken into small particles (evidently gathered before quite ripe) which is very objectionable for manufacturing purposes. We bought seeds last year in London at 1½d., 2d., 2½d., 3d., 4d and 6d. per lb., and those at 6d. were much the cheapest for our purpose, since the labour and expense with bad seed is just the same as with the best quality.

"The supply of seeds on the London market always has been very intermittent, so that we cannot rely upon a constant and regular supply every season, and last year we ordered two tons of some Kingston Merchants which they could not supply. We are, therefore, decidedly of opinion that good sound, hard, whole Annatto seed, properly collected and dried, free from mould, would meet with a ready sale in this country at such a price as would pay the growers well. If, however, they would only prepare the Annatto in the same way as they do in Cayenne, by washing the colouring matter off the freshly gathered seeds, and send it over here in cakes or in a semi-fluid form, it would be better. We are quite sure that it would pay them well to do so, as it would fetch a very much higher price than the Guadeloupe kind realises, and we should be securing an industry for our own Colonies that is now entirely in the hands of the French. This is the reason why nearly all the Flag Annatto is sent to France, to encourage their own shipping, and the French Merchants make a good profit out of it before it reaches us. If, therefore, it answers the French Colonists' purpose to prepare the Flag Annatto and export it to France, surely it would pay the growers of Jamaica and Ceylon to do likewise and export it direct to us; they would then get a better price for it than the Cayenne growers do, because they would save the intermediate profits of the Merchants in Cayenne and France. They ought to be able to prepare the Flag Annatto in Jamaica and Ceylon quite as well and as cheaply as the natives do in Cayenne; but it would not do for us to attempt it in this country from imported seed, because there is first the cost of freightage over here, and labour is too dear to attempt to compete with the natives of Cayenne in washing the colouring matter off the seeds. You will therefore, understand that we can buy the Flag or Paste Annatto very much cheaper than it would be possible for us to prepare it ourselves in this Country. Annatto seeds of best quality will consequently never fetch more than about 5d. or 6d. per lb., because of the competition with the Flag Annatto. Lisbon Roll Annatto is another kind that comes from Para; it is in a paste packed in baskets weighing about ¾ cwt. each. It is wrapped up in dried leaves, and is principally used for colouring butter, being of no use whatever for colouring cheese; this also varies very considerably in quality. We bought it last year from 2d. to 1s. 9d. per lb. according to quality.

"It has long been evident to us that sufficient care is not taken in washing the colouring matter off the seeds, and in preparing the Flag Annatto for the market we often find that it is very much adulterated with farinaceous and other substances to increase the bulk, which frequently causes a large amount of trouble to the manufacturer. We, in fact, seldom find two casks alike in quality or colour, and it is frequently kept until fermentation and decomposition set in, which of course destroy the colour; some that we had from the Polynesian Islands consisted simply of the colouring matter washed from the seed without admixture of any foreign substance. It was in a semi-fluid state and very pure, but a little dearer than Cayenne Annatto, and we cannot see any reason why the growers in Jamaica and Ceylon should not be able to teach the natives how to prepare it in this way, and we could then take large quantities of this kind of Annatto annually, and probably all that they could make. We would suggest that some of the growers should make the experiment and send us samples, and we would let them know how much we could give for it and the quantity we would take annually.

"The consumption of Annatto throughout the world is of course limited. Our business has been established over 100 years, and for the last 50 years our importation of Annatto has not varied very much. Last year our imports of Annatto of the various kinds amounted to over 50,000 lbs., the great bulk of which was Cayenne Flag Annatto. Had we used the seeds only we should have required at least 200,000 lbs. for our business alone.

"Annatto is principally used for colouring cheese and butter, for which purpose it has to be specially prepared so as to be perfectly pure and harmless when it reaches the consumer.

"The following are among the many preparations of Annatto manufactured by us, specimens of which have been presented to the Kew Museum :—

Imperial Black Cake Annatto.
Treble Strength " "
Extra Superfine " "
Superfine Orange " "
Fluid Extract of Annatto.
Butter Colouring.
Butter Colouring prepared in oil.
Roll Annatto, Spanish.
Cayenne Flag Annatto.
Lisbon Roll Annatto.

"These are used for a variety of purposes, viz., for colouring jellies, hair, soap, candles, scent, spirits, confectionery, leather, pomades, chocolate, and in making lacquer for brass work, and dyeing calico, silk, wool, skin, rugs, straw-plait, feathers, wood, ivory, bone, &c , and also as an auxiliary in giving a deeper shade to the simple yellows.

"Dyers also use the raw Flag Annatto very extensively for a reddish colour. It is not generally known that two colours can be obtained from Annatto, yellow and red."

The following information is gleaned from the Kew Bulletin, published in July, 1887 :—

"Annatto plants are readily raised from seed, and are of a hardy character. They prefer cool, moist situations, such as the banks of streams, and luxuriate in shaded places in and around dwellings. They are, however, readily established on comparatively poor soils, and although the growth under such circumstances is necessarily less robust, the yield in seeds is fairly large. If a plantation of Annatto is proposed to be established, plants may first be raised in seed beds in nurseries, and transplanted during the rainy season when about 6 or 8 inches high. The distance apart of permanent plants may vary from 10 to 15, or 20 feet, according to the character of the soil, and the nature of any subsidiary cultivation that may be carried on. In many cases seeds may be sown at once in the places where the permanent plants are desired, and of the seedlings grown, the strongest only is ultimately retained. As cattle, horses, and goats do not eat the leaves of Annatto, planters in the West Indies often utilize hilly pasture lands by planting Annatto upon them. In this way very little expense is incurred for maintenance, and should the price of the produce prove of an unremunerative character, no steps are taken to gather the crop. The range of cultivation for Annatto is a wide one. In the West Indies it grows readily from sea-level up to an altitude of 2,000 feet. In Ceylon it is known to grow up to 3,000 feet, but it is particularly flourishing in the lowlands. It appears to be well adapted for moist warm situations, with a mean annual temperature of 75° to 80° Fah. It requires an abundant rainfall, and hence is not suitable for arid situations, or those subject to prolonged droughts. Under favorable circumstances Annatto plants begin to yield seed in about two years, and remain fruitful for a long period.

"The manufacture in French Guiana is as follows :—Pick the small red seeds from the husk, put them in fresh and clear water to soak, for not less than 2 days, then pass them through a mill or crusher. When crushed let them remain 24 hours in fresh water ; after this pass them through a sieve ; the residue is again passed through the mill until nothing remains of the seed. The produce of the seeds as prepared is put in water until it has precipitated ; the surface water is then made to run out. After the surface water has become perfectly clear, the paste is boiled during 4 or 5 hours' time. After this process has been gone through, the paste is placed in cases with curing holes, with a weight placed on it, and a cloth at the bottom to prevent the finely crushed powder from passing through. When the above process has been gone through the paste should be in a fit state for shipment. It is then packed in layers, with plantain leaves between each layer to retain the necessary amount of moisture and to check acidity.

"A method recommended by the Director of the Botanic Gardens at Ceylon for preparing Annatto, and which, no doubt, has been followed in the manufacture of some fine samples of Annatto lately exported from that Island, is as follows : The seeds, with their pulpy envelopes are pounded in a wooden mortar, and, after adding hot water, the mixture is left in the mortar for several days, after which it is passed through a sieve. The liquid is then left to ferment for 8 days, when the water is decanted off, and the deposited pulp left to become concentrated by evaporation in the shade. When it has acquired the consistency of firm putty, it is made up into cakes of 1½—2 kilos. weight. These are packed with plantain leaves, and have a lively orange-yellow colour ; the value is about 4 fr. the kilo. In Cayenne it would appear that the pulp is sometimes boiled for 4 or 5 hours, and afterwards put under weights to squeeze out the water. It is also sometimes made into rolls instead of cakes, in which state it appears to fetch an inferior price.

"Messrs. S. G. Clements & Co., of Bristol, writing on 11th June, 1887, state :—The value of Annatto *Seed* at market is to-day unusually low, good quality having been done at 2½d. lately, so that growers cannot be doing well with it. Now, in Ceylon, an extraordinarily fine bright *paste* is made, and we think we purchased the first lots of it brought over, through London brokers, at a much higher price than any Paste or Flag Annatto then offered in London or Liverpool. It was followed by other lots not quite up to the first grade, and the disparity in values between 'Cayenne' best, and this 'Ceylon' was too great to induce us to go on buying, except in small lots occasionally for mixing and improving. On lately enquiring the value, our brokers tell us the bulk of it is going to the United States of America, and there fetching 3s. 6d. per lb.!"

Mr. J. J. Bowrey, F.C.S., F.I.C., Island Chemist, has kindly forwarded to the Director, Botanical Department, Jamaica, the following information about a method of preparing Annatto invented by himself :—

A METHOD FOR THE SEPARATION OF THE COLOUR FROM ANNATTO SEEDS IN A CONCENTRATED AND MARKETABLE FORM.

This method is quite different from any in actual use ; it simply separates the colouring matter, which exists as a pellicle upon the seeds in an unaltered state. All the processes now employed involve the use of water, either alone or in conjunction with alkalies and acids. When water is used for the separation of the colour, much, and, I believe, the best of the colour is lost. This is due to the fact that the finer particles of colour will not settle in a practicable time and cannot be recovered by filtration as they immediately clog the filter and prevent its action. Hence only the portions which subside quickly can be utilized, and even these are deprived of the water they retain with difficulty, the only method practicable being to expose the wet colour to the air until the water has evaporated. During this long contact with water and air the colour is greatly deteriorated.

My process is entirely mechanical, consisting in the separation of the coloured pellicle by agitating the seeds in the presence of any of the lighter rock oils, such as kerosine or gasolene. Only a small quantity of the colour dissolves in the oil, the rest remaining suspended in the solid form. As the oil becomes saturated in the first operation, it has no solvent action in succeeding ones. After agitation the seeds are separated from the colour–laden oil by a strainer ; the colour quickly subsides and the clear, red-coloured oil is decanted and run back on the seeds until they are completely cleaned of colour. When a quantity of colour has accumulated, it must be thrown on a filter when most of the oil will drain off and the remainder can be got rid of by exposing the colour to the air so as to allow the oil to evaporate. If the oil used is of good quality, it will leave no odour behind it. I find good Annatto seeds yield by this process an ounce of dry solid colour for each pound operated on. I have not tried the process on fresh gathered seeds, but I think it will work equally well with them.

The plant necessary to carry out the process is a vessel with an agitator, a subsiding vessel, an oil-store vessel, and some calico filters on wooden frames. But if the process were carried out on anything like a large scale the calico filters should be replaced by a filter press which will give the colour in compact cakes requiring but little exposure to deprive them of all oil. Of course, power of some kind, manual or other, would be required to agitate the seeds with the oil, and a pump to elevate the clear oil on to fresh seeds would greatly facilitate operations. With well constructed apparatus and filter press there would be very little loss of oil, even if the more volatile varieties were used ; and these are the best, being cheaper to begin with, having to pay less duty than kerosine in the second place, and thirdly more rapidly and completely evaporating from the colour.

Some Annatto colour prepared by this method has been tested by a practical dyer in the States, and was found to be from twelve to twenty times stronger than the ordinary Paste Annatto of commerce, and to be also more brilliant.

(Mr. Bowrey writes that he is unable to give an estimate of the cost of apparatus, but that he will be glad to give all the aid in his power to any one who thinks of trying the process, and communicates with him.)

NOTES ON SUGAR BOILING.

From the Planters' Monthly, Honolulu.

There is nothing in the Sugar industry so important as the Sugar-boiling, and I was going to say, there is nothing so imperfectly understood. I will not say that, however, but I will say that there is more diversity of opinion in regard to how this work should be done, than there is in any other business with which I am acquainted. One would suppose that there would be one fixed rule established, and the work done exactly the same in every mill, but such is not found to be the case. Indeed, it is impossible to find two Sugar-boilers who do the work exactly alike, and it is just as impossible to find two men who quite agree as to the proper treatment of the juice, or the proper amount of lime which should be used per clarifier. All of these men, however, have rules or guides of their own to go by, but they differ greatly, both in the treatment of the juice and in the results.

For instance, some men depend entirely upon their sense of sight, others partly upon their senses of taste and smell Some use the test tubes, some litmus paper, and some use nothing at all. They depend upon the look of the juice, the way it boils, the colour of the foam and the smell of the vapour. But by far the greater number use the proof-glass. When this is done the juice is limed and skimmed and then the glass is filled with the liquid and if it is seen that the foreign matter ascends in small particles like dust, then the juice needs more lime; if it ascends in flakes it needs less; if it is of medium size and perfectly clear between, then it is considered about right, provided it all settles and the juice is perfectly clear.

The liming of the juice is one of the most important things a Sugar-boiler has to do, and at times, when the Cane varies to any great extent it is quite difficult.

This liming of the juice is something which cannot apparently be taught to any one, for the more information one gets about it the less he seems to know. There evidently is but one way to learn this business, and that is by actual experience, and even then there seems to be a great deal of guess-work about it.

Great as these difficulties are, however, some men have greater success in surmounting them than others. The improvement is seen everywhere in clarifying, cleaning and boiling. When the juice is limed right, it cleans easily, boils rapidly, and grains up quickly in the pan, and the Sugar-boiler will always be ahead of his work. If this is imperfectly done there will be trouble all round.

Some persons believe that although there are different ways of doing this work, there is in reality but one test after all. But it is the perfection of this test, or the thoroughness with which it is understood, and the work done, which characterizes the difference between mediocrity and superiority. Some men are apparently especially adapted to this kind of work, and do everything with ease and despatch. Their perceptions are quick and always on the alert, and they seem to have a perfect intuition as to the proper amount of lime needed for a certain kind of juice, as they will often get the right quantity at the first attempt, if not at the second The ability of catching quickly the proper amount of lime is a great advantage, particularly if the Cane changes to any great extent.

Liming the Juice.

As there are different ways of testing the juice, so there are different ways of preparing the lime, and also different ways of applying it. In fact, there are almost as many ways of doing this work as there are mills; and each one claims some advantage for their own particular method.

In clarifying the juice, there are but three different methods of treating it; the first, and undoubtedly the best, is to first ascertain the quantity needed by the test mentioned above, then weigh the same amount for each succeeding clarifier, put it in a bucket, slake it with water, then fill the bucket with juice, and apply the whole of this solution to the liquid in the clarifier, and mix it well together. In some cases, instead of putting the whole amount of this lime in at once, half is put in when the clarifier is about one-third full, and the balance when the clarifier is two-thirds full.

By weighing the lime for each clarifier, one knows to a certainty the exact quantity to put in each one and knows also that unless the juice changes to any extent the clarifying will be done right.

The second method is to take a barrel of lime, slake it in a large quantity of water, reduce the mixture to about ten degrees B., and apply a certain number of gallons to each clarifier; but the trouble with this method is, to get the men to keep it at the proper density; little do they care whether it stands at two degrees B., or twenty degrees B., as long as they give it the right number of gallons; and in consequence, by adopting this method the work is rarely done well.

The third method is to run the lime water into the clarifiers in a continual stream, and also clarify the juice continuously. Neither method is thought much of, and they are rarely used in modern mills.

Liming the Juice in the Cleaning Pans.

Quite a number of Sugar-boilers lime their juice in the cleaning pans. This method under certain circumstances and with certain kinds of Cane, is undoubtedly a great advantage to the perfect cleaning of the juice. Indeed, in some cases, the lime is no sooner put in than the colour of the juice is changed as if by magic. The foam, which is of a dark colour is instantly changed to a bright yellow, and sparkling all over with bubbles about the size of a ten cent piece, while the juice looks as clear as crystal.

Liming the Juice in the Juice-tanks.

This is also, undoubtedly, a great advantage, especially when the juice stands all night. Indeed I have been informed by one of the best managers on this Island, that at his mill they gained as much as one degree polarization by this simple method.

Liming the first Juice in the Vacuum Pan.

There are quite a number of persons, and even many Sugar-boilers, who have never heard of this practice, yet it has been in constant use in some of the mills for the last two years. In using lime in the vacuum pan, it is claimed the first sugar is of a better *colour* and *harder grain* besides keeping better, the polarization being nearly as good at the Coast, as when it left the mill.

What particular advantage this method has, I know not, but I do know that they have got the highest polarization of any mill on this Island. These mills use four pounds of lime for each strike of sugar.

In the manufacture of sugar, there seems to be a growing disposition to use more lime. Lime high is now the watch-word, and the aim and object of most of the manufacturers.

But this is a matter which may be carried too far, and instead of it effecting a saving may entail a loss. I have been watching this matter with great interest for a great many years. I have watched it also, under almost all kinds of circumstances and conditions, and in various places, and have come to certain conclusions which do not coincide with this growing demand for more lime. I do believe, however, that lime can be used to advantage (at times) in the cleaning-pans, and always in the juice-tanks, and also in the vacuum pans. But I protest against this overliming business, as far as the clarifiers are concerned, because any excess of lime in clarifying effects an evil which cannot be remedied at any future stage of the work. If such juice were to pass through a process of "saturation," then it might be an advantage, but when this is not done, then it is a positive injury.

In the first place it greatly retards the boiling and cleaning of the juice; it also takes more steam to do the work, and costs more both for labour and fuel. In the second place it discolours the juice and darkens the sugar, and effects innumerable evils besides. And further than this, I have noticed that the best juice to boil, to clean and to grain, and that which made the cleanest and best coloured sugar, was juice which had been treated with a minimum quantity of lime in clarifying, and that juice which was hardest to boil, to clean and to grain, and which made the darkest and worst sugar, was juice which had been treated with an excess of lime in clarifying.

Making No. 1 Sugar.

Next to the importance of defecting the juice, is that of boiling it in the vacuum pan. This is by far the finest, best, and most interesting part of a Sugar-boiler's duty, and it is doubtful if there is anything more beautiful in the science of crystallization than in this process of taking the liquid, and by slow and almost imperceptible degrees, transforming it into a solid, into perfect crystals that are as symmetrical, if not as beautiful, as the crystals of a snow-flake.

There are Sugar-boilers who have got this down to a science. The improvement is seen not only in the perfect shape, equal size and hardness of the crystal, but actually in the colour of the sugar. There are two methods in general use in doing this. First, there is one which commences at the top of the pan; and second, another which commences at the bottom. The advantage of commencing at the top (that is, filling the pan more than half full to start with and boiling it down) is to get the use of all the coils from the start, so that they can "whoop her up," as they call it, and get away with the work.

The second way is to commence at the bottom of the pan; that is, to take just enough juice to cover the bottom coil, and commence the grain at this point. The advantage of commencing at the bottom of the pan is, to give one more time and space to build the grain.

There are also those who take in a large charge at short intervals, those who take a proof every minute, those who take one every hour, and some who take none at all; they go by the look of the grain as it splashes on the lights of the pan.

Of the various ways of doing this work there seems to be none better than to commence the grain as low as possible in the pan, and to take small charges of juice, and watch it with untiring vigilance, as any little slip here by inattention means a loss hardly to be estimated or believed possible.

Boiling No. 2 Sugar.

There is a great diversity of opinion in regard to boiling this sugar. In some mills it is nearly boiled to proof, the same as No. 3. In others it is grained up in the pan and run into coolers, where it is left long enough to become quite hard A third way is to grain it in the vacuum-pan the last thing at night, and run it into the mixer and dry the first thing in the morning. The last method is in more general use than the other two, and is thought by many to be a good practice. Still, if one speaks in favour of it to some persons, they look at you in a compassionate sort of way, and evidently think you belong to mediæval times, or have just come from the backwoods. They claim that to secure the best results one should grain in the pan and run it into the coolers, so as to have it grain up better and harder. Evidently this is the best way.

No 3 Sugar.

There is but one method in general use in boiling this sugar, and that is to boil it to proof and run it into the coolers and let it grain up there. In some places this sugar is returned to the cleaning pans and mixed with the first juice; in other mills it is returned to the clarifiers. In other places the number two molasses is returned to the cleaning pan, or is blown up, skimmed, and taken into the pan with first juice. It is questionable if any gain is derived from any of these methods, as it retards the work, and costs more both for fuel and labour, besides introducing an element into the juice which is usually very hard to deal with and eliminate.

No. 4 Sugar.

Quite a number of mills are now making number four sugar, but not all of them have met with success. Usually this sugar is boiled to proof, run into large tanks or cisterns and centrifugaled after the crop is off. One objection to this method is the large size of the tanks: and another objection is in placing them out of doors, where the rain and cold air can too quickly reduce the temperature. These tanks should be kept dry and warm, certainly not out in the rain; neither should they be too large, or the molasses will cool off too quickly. But taking everything into consideration it is doubtful if this practice pays, because there are certain substances left in the molasses over which the Sugar-boiler has no control whatever, and these substances increase with superior quality of cane. They are also known to be obstacles to the regular crystallization of the sugar even in the first boiling, and their destructive power seems to increase in every successive boiling, until they are so great that it becomes impossible to do anything whatever with them at the fourth boiling, and at times even at the third. Some persons are of opinion that something will eventually be discovered to counteract the evil of these obnoxious substances and acids that are found in this molasses: but it is doubtful, or if it is done at all, it will be done in the first stage of the process of defection.

SUGAR CANES FOR AUTUMN PLANTING.

Application should be made at once for Canes wanted for Autumn planting, stating varieties required, and number of tops. Price, in Jamaica, 5s. per barrel of about 50 or 60 tops, delivered free at any railway station, or port touched at by Coastal Steamer.

NOTE.—A subscription of 2s. will insure the delivery at any Post Office in Jamaica of 12 numbers of the "Bulletin." Application may be made at any of the Gardens, or by Post to the Director of Public Gardens and Plantations, Gordon Town P.O., Jamaica. Postage must be added for delivery out of Jamaica.

No 8. October, 1888.

BULLETIN

OF THE

BOTANICAL DEPARTMENT,

JAMAICA.

CONTENTS:

PRICE—Two-pence.

JAMAICA:
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1888.

LIST OF ORNAMENTAL PLANTS (continued from No. 7).

Scientific Name.	Common Name.	Habitat	Price of single Plants.
Sapindaceæ—			
Acer rubrum L. ...	Red Maple	North America	1d.
Bersama lucens, B. & H. (Natalia lucens, Hochst.)	...	Natal	...
Anacardiaceæ—			
Rhus succedanea L. ...	Red Lac or Japanese Wax Tree	N. India, China, Japan and Java	...
Rhus Cotinus L. ...	Venetian Sumach	South of France, Syria to N. India, China and N. America	1d.
Schinus terebinthifolius, Raddi. ...	...	Brazil	2d.
Leguminosæ—			
Acacia armata, R. Br.	Prickly Acacia	Australia	...
Acacia brachybotrya, Benth. (Acacia argyrophylla, Hook.)	...	S. E. Australia	...
Acacia cyanophylla, Lindl. ...	Blue Acacia	West Australia	...
Acacia dealbata, Link. ...	Silver Wattle	S. E. Australia and Tasmania	...
Acacia decurrens, Willd. v. mollis (Acacia mollissima, Willd.)	Black or Green Wattle	S. E. Australia and Tasmania	...
Acacia farnesiana, Willd. ...	Sponge Tree	Tropics	...
Acacia longifolia, Willd. v. Sophoræ (Acacia Sophoræ, R. Br.)	...	S. E Australia and Tasmania	...
Acacia verticillata, Willd. ...	...	Southern Australia and Tasmania	...
Adenanthera pavonina, L. ...	Red Bead Tree Red Sandal Wood	E. Indies and China	2d.
Amherstia nobilis, Wall. ...	Amherstia	Further India and Malacca	...
Andira inermis, H. B. K. ...	Cabbage Bark Tree Bastard Cabbage	W. Indies Trop. S. America and Trop. W. Africa	...
Bauhinia megalandra, Griseb. ...	...	W. Indies	2d.
Bauhinia picta, D. C. ...	...	Colombia	2d.
Bauhinia variegata, Benth. ...	Mountain Ebony	India, Birma, China	2d.
Brownea coccinea, Jacq. ...	...	Venezuela	4d.
Brownea latifolia, Jacq. ...	...	Trinidad, Venezuela	4d.
Brownea Rosa, Berg. ...	...	St. Vincent, Venezuela	...
Cæsalpinia pulcherrima, Sw. (Poinciana pulcherrima, L.)	Barbados Pride	Tropics	2d.
Cæsalpinia Sappan, L. ...	...	E. Indies	2d.
Calliandra Guildingii, Benth. ...	...	Trop. America and W. Indies	...
Caragana arborescens, Lam. ...	Siberian Pea Tree	Siberia	...
Cassia alata, L. ...	...	Tropics	2d.
Cassia Fistula, L. ...	Purging Cassia Indian Laburnum	E. Indies, China	2d.
Cassia glauca, Lam. ...	...	E. Indies, Australia and Polynesia	2d.
Cassia grandis, Linn. f. ...	...	W. Indies, Panama, Northern S. America	2d.
Cassia marginata. Roxb. (Cassia Roxburghii, D. C.)	...	India, Ceylon	...
Cassia siamea, Lam. (Cassia florida, Vahl.)	...	E. Indies	2d.
Castanospermum australe, A. Cunn.	Moreton Bay Chestnut	N. S. Wales, Queensland	...
Chorizema cordatum, Lindl. ...	...	W. Australia	...
Chorizema diversifolium, A. D. C.	...	W. Australia	...
Cladrastis amurensis, B. & H. ...	...	Mantchuria	...
Cladrastis tinctoria, Raf. ...	Yellow Wood	East United States	...
Cytisus alpinus, Mill. v. pendulus.	...	Mts. of S. Europe	1d.

LIST OF ORNAMENTAL PLANTS (continued).

Scientific Name.	Common Name.	Habitat.	Price of single Plants.
Leguminosæ, contd —			
Cytisus Laburnum, L. v. Alschingerii	Laburnum (variety)	Alps	1d.
Cytisus Laburnum, L. v quercifolius	Oak-leaved Laburnum	Alps	...
Cytisus scoparius, Link. ...	Broom	Europe N. Asia, Canaries, Azores	1d.
Cytisus serotinus, Kit. ...	...	Hungary	...
Cytisus sessilifolius, L. ...	...	S. France, N Italy	...
Dalbergia Sissoo, Roxb. ...	Sissoo	India, Beloochistan, Afghanistan	2d.
Erythrina Caffra, Thunb. ...	...	Natal	...
Erythrina corallodendrum, L. ...	Coral Bean Tree	W. Indies, Central and Northern S. America	2d.
Erythrina Crista-galli, L. ...	...	Brazil	2d.
Erythrina indica, Lam. ...	Indian Coral Tree	E. Indies, Polynesia	2d.
Erythrina umbrosa, Humb. ...	...	W. Indies, Venezuela	2d.
Gleditschia sinensis, L. ...	Chinese Locust Tree	China	...
Hardenbergia monophylla, Benth.	Victorian Lilac	S E. Australia, Tasmania	...
Poinciana regia, Bojer. ...	Flamboyante	Madagascar	2d.
Saraca indica, L. ...	...	E. Indies	...
Spartium junceum, L. ...	Spanish Broom	Mediterranean Region and Canaries	1d.
Rosaceæ—			
Quillaja saponaria, Mol. ...	Chilian Soap Bark Tree	Chili	...
Prunus Chicasa, Mich. ...	Chickasaw Plum	N. States	1d.

NOTE—The prices in this List are quoted only for cultivators in Jamaica and in those West Indian Islands which have established Botanical Stations in connection with Jamaica. The Department cannot undertake to supply shippers.
The Lists are, in the first instance, catalogues of plants growing in the Gardens, and it is only those that have prices attached which are available for distribution. Some of these plants are not in stock throughout the year, but it is impossible to publish complete monthly lists.

Statement of Freight Charges allowed by the Royal Mail Company to the Botanical Department for conveying Plants to the West Indian Islands :—

Wardian Case ...	42″ × 20″ × 18″ more or less	...	£0 10 6
Box or Barrel or Package of similar capacity	...	...	0 6 0

PARCHMENT COFFEE FOR EXPORT.

The Hon. the Colonial Secretary has directed that the following letters, forwarded by the Secretary of State for the Colonies, shall be printed in this number of the BULLETIN. Inquiries are being made in England and Ceylon as to the price of pulping machinery but good machines for settlers are made in Jamaica for about £4. When settlers live in the neighbourhood of a mill, it will probably be better to have the Coffee finally prepared in Jamaica, but there are many Districts well suited for the growth of Coffee at a considerable distance from any mill. It is in these Districts that settlers will benefit by being able to send home their Coffee in parchment. It is hoped that the Agricultural Society will offer prizes for Parchment Coffee, and for pulping machines, and thus encourage a wider cultivation.

KEW GARDENS TO COLONIAL OFFICE.

Royal Gardens, Kew, 23rd April, 1888.

SIR,

In continuation of my letter of the 11th instant, I am desired by Mr Thiselton Dyer to forward to you, for the information of the Government of Trinidad, the enclosed copy of a letter received from Messrs. Lewis & Peat, of Mincing Lane, on the subject of cleaning "parchment coffee".

It would appear from this letter than an entirely new aspect has been given to the preparation of coffee for the English market by the establishment of a factory, in London, to clean parchment coffee in a cheap and expeditious manner.

3. It is proposed to treat this subject, as regards its bearing upon West Indian Coffee, in the *Kew Bulletin* for the month of May next. Owing to the falling-off of coffee production in the East Indies to the extent of a million and a quarter cwts. annually, coffee cultivation in the West Indies should be largely augmented. The difficulties hitherto encountered by small settlers in the preparation of coffee are likely to be entirely overcome by the cleaning of parchment coffee in London, and this, in the opinion of Mr. Thiselton Dyer, cannot be too widely known in every West Indian Island.

I am, &c.,

(Signed) D. MORRIS.

EDWARD WINGFIELD, Esquire, Colonial Office, S.W.

MESSRS. LEWIS & PEAT TO ROYAL GARDENS, KEW.

6 Mincing Lane, London E. C., 17th April, 1888.

DEAR SIR,

In reply to your favor of the 16th instant, 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 attained. We have recently sold large parcels from America which were "milled" here; and against 70s. per cwt. obtained last year for the same coffee cleaned on the plantation, we obtained 86s. 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 invariably been in favor of cleaning here. The process is quite simple, and the cost is 2s. 6d. 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 must be perfectly dried and kept from moisture afterwards—insufficient drying is most damaging to after-results—and must have the greatest care. There is no advantage in selling the coffee in parchment, as much better prices are obtained by cleaning it here. The grower is more than compensated for extra freight paid, loss in weight. &c, by the extra good out-turn of his coffee, if properly cleaned here. Any further information we can furnish we shall be most happy to give you. We enclose a sample of parchment, which is worth 35s per cwt. in parchment and when cleaned 80s. per cwt. The probable loss in weight is about 15 or 16 per cent. There would always be a market for coffee cleaned here, and as much as the West India Islands could produce would easily find a market here.

We remain, &c.,

D. MORRIS, Esquire. (Signed) LEWIS & PEAT.

PRIZE FOR TOBACCO GROWN IN BRITISH COLONIES.

This prize was announced in the March number (6) of the Bulletin. The following are the Forms of Entry which must be filled up and forwarded to the Secretary of the London Chamber of Commerce. Copies of these Forms will be supplied on application to the Director Public Gardens and Plantations, Gordon Town P.O.

FORM A.

THE LONDON CHAMBER OF COMMERCE (INCORPORATED).

BOTOLPH HOUSE, EASTCHEAP, E.C.

TOBACCO TRADE SECTION.

TOBACCO PRIZE COMPETITION.
FORM OF ENTRY.

To the Secretary, London Chamber of Commerce :

I desire to be entered as a competitor for the Prize of Fifty Guineas offered for the best specimen of Colonial grown tobacco, and hereby undertake to warehouse at the W. India Docks and submit for competition by the 1st December, 1888, a sample of 400 lbs., prepared and labelled in accordance with the understated conditions.

Signature
Address
Date 188

CONDITIONS.

1. The Tobacco Trade Section of the London Chamber of Commerce shall, for the purpose of deciding on the merit of the specimens competing for the prizes, appoint a jury of experts, who will be assisted by recognised scientific authorities.

2. Each specimen submitted for the competition shall consist of a minimum quantity of tobacco, grown on a commercial scale, and therefore not less than 400 lbs. in weight.

3. Each sample shall embrace an average of the growth, and not consist alone of leaf picked from a larger quantity than that which is submitted to the jurors. It is nevertheless desirable that the leaf should be assorted in the usual way into sizes or colours, separately packed, each sort being left in its natural proportion to the bulk.

4. The name of the grower and the locality and total quantity of the growth to be stated.

5. The specimens shall be submitted for competition in London, and in the bonded warehouses of either the Victoria, the London and St. Katherine's, the East and West India Docks, or other bonded warehouse.

6. The tobacco grown in the Colonies shall be sent for inspection on or before the 1st of December, 1888.

7. The jury shall reserve the right to require an independent verification of the locality and total quantity of growth in all cases where they think desirable, and in awarding the prizes shall be at liberty to take into consideration the care bestowed on the handling, sorting and packing the tobacco for commercial purposes.

Note.—In order to ensure its keeping qualities, and for reasons connected with the duty, it cannot be too strongly recommended to growers that the moisture of the tobacco submitted for competition should not exceed 15 per cent. as ascertained by the usual scientific test.

All communications to be addressed to the Secretary, London Chamber of Commerce (Incorporated), Botolph House Eastcheap, London E.C.

FORM B.

THE LONDON CHAMBER OF COMMERCE (INCORPORATED)

BOTOLPH HOUSE, EASTCHEAP, E. C.

TOBACCO PRIZE COMPETITION.

PARTICULARS OF SAMPLE.

1. Name of grower
2. Address in full
3. Weight of sample (minimum 400 lbs.)
4. Kind of seed sown
5. Is the sample an average of the growth in accordance with Condition 3 on Form A?
6. Where was the sample grown?
7. What was the total quantity grown?
8. What was the approximate yield per acre?
9. What was the cost of production for total crop?
10. Any further observations likely to forward the objects of the Competition:—

P.S.—This form to be returned to "The Secretary London Chamber of Commerce (Incorporated), Botalph House, Eastcheap, London, E. C." and a duplicate to be attached to sample. Any Competitor who has no regular correspondent in London may consign his sample, in the Bill of Lading, to Mr. Kenric B. Murray, Secretary of the Chamber.

The Agent for the Clyde Line of Steamers, E. A. H. Haggart, Esq., has very kindly consented to forward these samples of Tobacco of 400lbs. weight at the very low rate of seven shillings and sixpence each. This concession should make it possible for growers on a small scale to join in the competition. The samples should be sent to Mr. Haggart, Kingston, not later than 15th October. According to the following letter received from Mr. Kenric B. Murray, there is no doubt that after competition, the Tobacco can be readily sold.

30th April, '88, Botolph House, Eastcheap, London E. C.

W. Fawcett, Esq., Director Public Gardens and Plantations Jamaica, West Indies.

Sir,

I beg to thank you for your letter of the 9th instant and for the assistance you have so kindly given in making known the offer of the Tobacco Trade Section of this Chamber to give a prize of £50 for the best specimens of colonial grown tobacco.

In case you have not seen them, I send you a set of the latest circulars which we have issued on the subject.

With respect to the sale of the tobacco in England, after the prizes have been awarded, I am authorised to say that, subject to complying with the conditions of the competition, the Committee will do their best to put the tobacco on the market when the competition is over if required to do so by the exhibitor. This will only involve payment of ordinary charges, including freight to England, brokerage, &c. by the latter. The duty, of course, will be payable by the purchaser, as the tobacco will be warehoused in bond while the competition proceeds.

As regards the best mode of packing, it is desirable that the tobacco should be put up in "heads" of not less than 80 lbs. weight, a mode which is well known to tobacco growers.

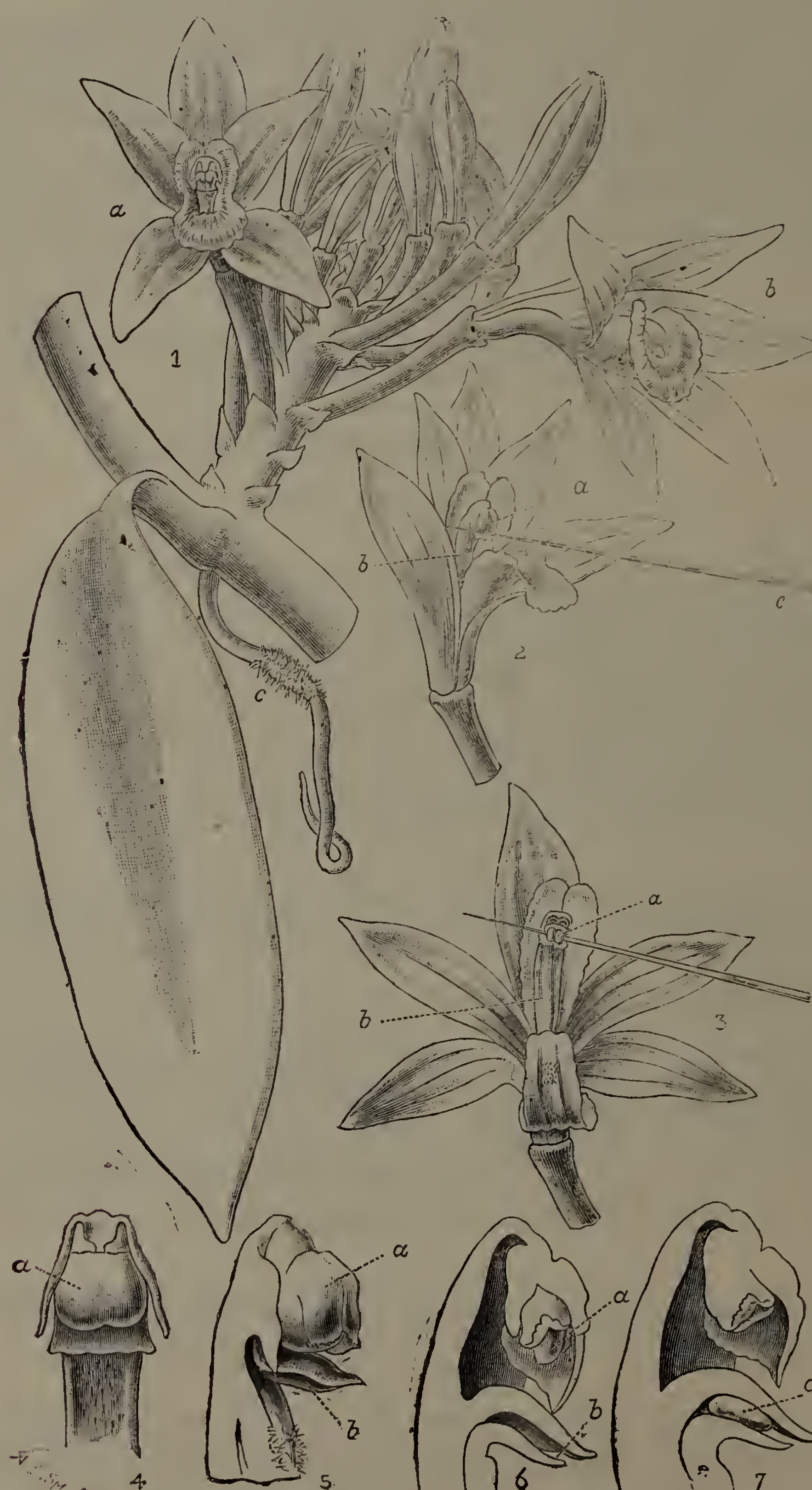
If what is sent is at all similar to specimens already received in this market, competitors may be certain of commanding a good price for their exhibits, after the competition is over.

Yours faithfully,

(Signed) Kenric B. Murray, Secretary.

VANILLA.

As many persons in Jamaica are now taking up the cultivation of Vanilla, it is with great pleasure that we are enabled through the kindness of the authorities at Kew to reproduce a plate, explaining, the method of fertilization, which was published in the March number of the Kew Bulletin. The very important article, published at the same time, dealing with the cultivation and curing of Vanilla, is also herewith reprinted.



Fertilization of Vanilla Flower (Delteil).

EXPLANATION OF PLATE.

Fig. 1.—Portion of stem of Vanilla plant, with leaf, aerial root, and cluster of flowers; *a*, front view of Vanilla flower; *b*, side view; *c*, aerial root, with root hairs.

Fig. 2.—Single flower of Vanilla, exhibiting the first stage in the process of artificial fertilization. The operator, provided with a finely-pointed piece of bamboo, divides the lip or labellum medially, so that the central lobe is separated from the two side lobes. This exposes the column and organs of fecundation. The instrument is represented as placed against the column, ready to press upwards the anther *a*, and bring the pollinia in contact with the stigma *b*.

Fig. 3.—Single flower of Vanilla, exhibiting the second stage in the process of artificial fertilization; *b* shows position of column exposed by division of the lip [the middle lobe of lip is pulled forward and curled upon itself to show the position of the column; the side lobes of lip, separated as shown in Fig, 2, are represented at back of the column]; *a*, the position of pollen masses, taken from the anther and placed on the stigma.

Fig. 4.—Enlarged front view of top of the column; *a*, the anther.

Fig. 5.—Enlarged side view of top of the column; *a*, the anther; *b*, the stigma, or viscid surface on which the pollen masses must be placed to ensure fertilization.

Fig. 6.—Enlarged section through top of the column; *a*, one of the pollen masses *in situ*; *b*, the stigmatic cavity.

Fig. 7.—Enlarged section through top of the column; *a*, the pollen masses, having been transferred from *a*, Fig. 6, are now represented in contact with the stigmatic surface. [Although diagramatically shown, these figures give a tolerably good idea of what is actually necessary in order to produce fertilization in a Vanilla flower.]

The cultivation of Vanilla has been attempted in numerous tropical Colonies, but, with the sole exception of Mauritius and the Seychelles, it does not appear to have assumed an important position in any British Colony. This is due to a variety of circumstances. In some Colonies the climate may be unsuited to the successful growth of the plant, owing to seasons of extreme severity in droughts or heavy rains. In others, the soil may be too retentive. In most of them, the need which exists for artificially fertilizing the flowers of Vanilla, and the care necesssary to properly cure the pods have, no doubt, contributed to retard the cultivation. There are, however, no valid reasons why the cultivation of Vanilla in certain portions, at least, of the West Indian Colonies, of British Honduras, of the West African Settlements, of India, Ceylon, and the Straits Settlements should not be successfully pursued. With that view plants of Vanilla have been forwarded from Kew to certain Colonies where they did not previously exist, and it is proposed now to give very briefly the chief points bearing upon the industry.

The Vanilla plant is an orchid of climbing habit, of which there are probably several species under cultivation. The more common plant appears to be *Vanilla planifolia*, Andr. (*V. claviculata*, Sw.) Other species under cultivation are *V. aromatica*, Sw. and *V. grandiflora*, Eich. The botany of the plants yielding Vanilla requires to be carefully investigated. The specimens in the herbarium of this establishment in their present state throw little light on the subject. Hence a good series of leaves, flowers and fruits of plants yielding Vanilla, carefully dried, or preserved in spirit, would be a valuable addition to the collections.

It appears that *Selenipedium Chica*, Rchb. f. (Xenia Orchidacea, Vol. I., p. 3, t. 2) yields Vanilla on the Isthmus of Panama, which is described by Seeman (Botany of Herald, p 215) as follows :—

"The fruit of this plant is highly esteemed as an aromatic by the inhabitants of the Isthmus [Panama], "and used for all purposes for which real Vanilla is commonly used It is termed 'Vanilla Chica,' or 'Little "Vanilla,' because its fruit is very much smaller than that of any of the genus Vanilla found in the Isthmus."

Cultivation.—As regards starting a Vanilla plantation, it is important to bear in mind that the plants being climbers, it is necessary to provide them with support of some kind, and generally, for this purpose, rough-barked trees, trellis-work, stone pillars, or stone walls are utilized. Living stems of rough-bark trees are probably the best support for Vanilla. In Mauritius, the Seychelles, and Réunion, the stems of *Jatropha Curcas* are largely used. In addition to support, the Vanilla plants require a certain amount of shade. This however, should not exceed what is called half-shade (*demi jour*). A certain amount of sun is, however, essential to the proper ripening of the pods. Whatever the support or nature of the shade may be, it is important to bear in mind that the Vanilla plants should be kept within easy reach of the cultivator, and not allowed to climb high up amongst the branches.

The ground around the support should be prepared by deep trenching to the depth of a foot or 18 inches. The drainage of the bed should be perfect. The most favourable soil consists of fine rich loam, mixed with equal parts of sand and leaf mould. Rich animal manure, or manure of any kind, is not a desirable addition. To renovate the soil at the end of the season, add some well-rotted vegetable mould or humus mixed with sand. Raise the bed about six inches above the surrounding surface, and support by means of stones or rockwork. Where obtainable, the cutting should consist of portions of stems about two or three feet long, but all the better if four or five feet long. The leaves are first removed from the lower part, and three joints are laid under the soil and covered to a depth of two or three inches. The upper part of the stem is trained against the support in the position in which it is intended to grow. A single tree will carry several Vanilla plants, depending upon its size. The surface of the bed should be kept moist by being covered with leaves or "mulching" and, in very dry weather, it should be regularly watered.

Thus started, Vanilla cuttings readily take root, and the stem will grow and flourish. Depending upon the size of the cuttings, the plants begin to flower in the second year after planting. They do not, however, flower freely until the third and fourth years.

Fertilization of the flowers.—The first duty of the cultivator when the plants are in flower is to attend to the duty of fertilization which, in countries where the Vanilla is not a native, will require to be done artificially. The flower of the Vanilla, as in most orchids, is a very highly differentiated organ, the parts of which can be best studied by a reference to the engraving given on page 6. In the wild state, the pollen is carried to the stigma of the Vanilla flower by means of the agency of insects. Where these particular insects are absent, their work must be performed by the cultivator, or no Vanilla pods will be produced.

It is recommended that the work of fertilization should take place in the morning. It is advisable that all the flowers in a cluster be fertilized as they open; but of those that are successfully fertilized, only a certain number, depending on the age and strength of the vine, should be allowed to remain. If too many pods are retained at first, the vine is apt to be weakened, and the quality of the produce lowered.

The process of fertilization will be better understood by a reference to the engraving given herewith. The only instrument necessary is a small piece of bamboo or sharpened stick the thickness of a lead pencil, about four or five inches long

When the flower is opened, it will be noticed that there are three outer and three inner floral parts, which are sometimes designated the sepals and the petals respectively. One of the latter is so much altered and so distinct in form and colour, that it is usually spoken of as the *lip*. Inside, and immediately hanging over the free part of the lip, is a process which is a continuation of the axis of the flower This is called the column (*see b*, fig 2). The end of the column enlarged, front view, is shown at fig. 4. At *a*,, fig. 5 is represented the anther, containing the pollen masses, and at *b*, the stigma or viscid surface, on which the pollen must be placed in order to ensure the act of fertilization. At Fig. 6 is represented a section through the top of the column showing the position of the pollen masses *a*, and the stigma *b*. It will be noticed that the stigma is separated from the pollen masses by an upper lip projecting over the stigma. In the work of fertilization it is necessary to lift up or tear away this lip, and transfer the pollen masses from the anther at *a* to the stigma at *b*, as shown in fig. 7. The mode of using the instrument is shown at figs. 2 and 3.

The work of fertilization, when once understood, may be carried on with great rapidity. An expert person will, it is said, fertilize as many as a thousand flowers in one forenoon. The simplest mode is to seize the flower with the left hand between the thumb and middle finger, and support the column at the back with the forefinger. Then, with the sharpened instrument in the right hand, the hood at the top of the column is removed, so as to expose the anther and stigma. The upper lip of the stigma is then pressed upwards, and the anthers brought down and placed in contact with stigmatic surface, as shown in figs. 3 and 7. The explanations given to the figures in the engraving will clearly show the operations here described. When the flowers have been fertilized they will begin to wither about the third day. By the end of the first month the fruit attains nearly its full size, although it is not fully developed until it is six or seven months old.

Curing the pods.—The pods are left on the vine until they begin to show a slight yellow tinge at one end. They are then gathered from day to day, care being taken not to injure those not yet fit to gather. When the day's gathering is completed, the pods are placed in a basket, and, according to one method of preparation, they are plunged for about half a minute in very hot but not actually boiling, water. Directly after this operation the pods are spread out on mats to drain. For the next six or eight days they are exposed on woolen cloths or blankets in the sun, while each night they are kept in a closed box, where they undergo a certain amount of fermentation. When they have become soft and brown, the pods are placed to dry in the shade, they are carefully and regularly pressed between the fingers slightly anointed with oil, and rendered supple and lustrous. When quite cured, the pods are of a rich dark chocolate colour, pliable in texture and perfectly free from moisture. The whole process of curing extends over several weeks.

In packing for the market, the pods are sorted according to length, and put up in packets of 50 pods each; they are tied in the middle, and also near each end. These packets are then carefully put up in closely fitting tin boxes When Vanilla pods are in good condition, they become covered with an efflorescence of needle-like crystals of Vanillic acid The interior of the bean is then soft, unctious, and balsamic.

Those who wish to carefully study the various modes of growing and curing Vanilla cannot do better than consult *Vanilla, its cultivation in India*, by J E. O'Connor, Calcutta, 1881; and *La Vanilla. sa Culture et sa Préparation* par A. Delteil, Paris. Challamel Aîné, 2, Rue Jacob, 1884.

Vanilla plants have been frequently grown and fruited in this country at Kew, at Sion House, and other establishments. In 1878, some bunches at Sion House contained as many as fifteen pods, each of which measured nine inches in length.

Mr. Piesse gives the following interesting information respecting the use of Vanilla pods for perfumery purposes:—

"In order to obtain the perfume or essence, ½ lb. of such pods are cut up small, and put into one gallon "of pure alcohol, of a strength known as 60° over proof, giving the whole a shake up daily. The ingre- "dients must remain together for, say, four weeks, at which time all that is worth extracting will be found "in the spirit, which may then be strained off quite clear and bright. It is then suitable as a flavouring "agent. or when blended with other scents, it makes delicious perfumery. Those sold under the titles of "clematis, heliotrope, wall-flower, &c.. mostly contain about one-half in bulk of Vanilla extract. About two "centuries ago, Vanilla may be said to have been unknown in this country; it is, however, stated that Mor- "gan, an apothecary, showed to Queen Elizabeth a sample, but he knew nothing more about it than that 'it "was brought from abroad by some Spanish merchants.' At the present time the total annual average crop "of all the varieties of Vanilla from the several countries which produce it may be estimated at 80,000 lbs., "representing a value of not less than £150,000."

NOTE.—A subscription of 2s. will insure the delivery at any Post Office in Jamaica of 12 numbers of the "Bulletin." Application may be made at any of the Gardens, or by Post to the Director of Public Gardens and Plantations, Gordon Town P. O., Jamaica. Postage may be added for delivery out of Jamaica.

No. 9. NOVEMBER, 1888.

BULLETIN

OF THE

BOTANICAL DEPARTMENT, JAMAICA.

CONTENTS:

PRICE—Two-pence.

JAMAICA:
GOVERNMENT PRINTING ESTABLISHMENT, 79 DUKE STREET, KINGSTON

1888.

AGRICULTURAL SHOW.

We beg to call the attention of every one interested in the agricultural progress of the country to the great importance of heartily supporting the Agricultural Show, to be held at Cumberland Pen, on 6th December. A very great difficulty has hitherto been experienced in inducing small settlers to exhibit, and there is no doubt that they would benefit materially if a healthy competition could be aroused amongst them. If the Clergy, or Schoolmasters, in the several country districts would interest themselves in the matter, much good might be done. It is suggested that Local Committees should be started, and arrangements made for sending up exhibits. The indefatigable Secretary, G. N Cox, Esq., has kindly promised to receive any exhibits sent up before the day of the Show, and will also be glad to give every information and assistance. The Committee will grant free tickets of admission to all those who will undertake to bring in exhibits of coffee, cacao, or minor products. The Prize List has been considerably increased, and amongst the Special Prizes are £2 for Small Settlers' Sugar, 25lbs.; £5 for Coffee, 100lbs; £5 for Cured Cacao, 100lbs.; £5 for Tobacco, 25lbs.; £2 for Irish Potatoes, 1 bushel. The complete list of prizes for Sugar Rum, Coffee, &c., and minor Products is subjoined:—

Class.		Prizes. 1st. £ s. d.	Prizes. 2nd. £ s. d.
	SUGAR AND RUM.		
104	Best Sample of Sugar—1 barrel	5 0 0	...
105	Vaccuum Pan Sugar, white 25lbs.	1 0 0	...
106	Ditto ditto ditto Yellow 25lbs.	1 0 0	...
107	Centrifugal ditto 25lbs.	1 0 0	...
108	Muscovado ditto 25lbs.	1 0 0	...
109	Small Settlers 25lbs.	2 0 0	...
	Note—The Polariscope test to be used in judging Sugars, in case of dispute.		
110	Best Sample of Rum, 1887-88, 2 quarts	2 0 0	...
	COFFEE, PIMENTO, CACAO, TEA, &c.		
111	Best Sample of Jamaica Coffee, 100lbs.	5 0 0	...
112	Coffee grown and prepared at an elevation of 2,000 to 4,000 feet, 10 quarts	1 0 0	0 10 0
113	Ditto at an elevation of 1,000 to 2,000 feet, 10 quarts ...	1 0 0	0 10 0
114	Ditto grown and prepared by small settlers, 10 quarts ...	1 0 0	0 10 0
115	Cured Pimento, 2 quarts	0 10 0	0 5 0
116	Cacao pods, not less than 12	0 10 0	0 5 0
117	Best Sample of Cured Cacao, Jamaica grown, 100lbs. ...	5 0 0	...
117a	Cacao, grown and prepared by small settlers, 25lbs. ...	2 0 0	0 10 0
	Note—All samples of above exhibits must have been grown and manufactured by the Exhibitor		
118	Chocolate prepared for use, 2lbs.	0 5 0	0 2 6
119	Sample Tea, 1lb.	0 10 0	...
120	Cinchona, best sample of Bark	0 10 0	...
	MINOR PRODUCTS OF NATIVE GROWTH OR MANUFACTURE.		
121	Maize or Indian Corn, not less than 50 ears ...	0 10 0	0 5 0
122	Cornmeal (Native grown and prepared) six quarts ...	0 10 0	0 5 0
123	Essential Oils—Best complete Exhibit of not less than two of any of the following, viz: 1. Pimento Seed Oil; 2. Pimento Leaf Oil; 3. Lemon Grass Oil; 4. Seville Orange Oil; 5. Lemon Oil; 6. Sweet Orange Oil; 7. Juniper Cedar Oil; 8. Blue Gum Oil; 9. Moringa Oil; 10. Cashew Nut Oil	1 0 0	...
124	Prepared Dry Ginger, not less than 10lbs.	0 10 0	0 5 0
125	Nutmegs cured and ready for market, not less than 3lbs ...	0 10 0	...
126	Sarsaparilla, not less than 5lbs.	0 10 0	0 5 0
127	Cocoanut Oil, not less than 2 quarts	0 5 0	0 2 6
128	Castor Oil ditto ditto	0 5 0	0 2 6
129	Pindar Nut Oil, not less than 1 pint	0 5 0	0 2 6
130	Cacao Oil, ditto ditto	0 5 0	0 2 6
131	Meals—Complete Exhibit of not less than two of any of the following, viz: 1. Cassava Meal, not less than 10lbs; 2. Arrowroot ditto ditto; 3. Banana Meal ditto ditto; 4. Plantain Meal ditto ditto; 5. Breadfruit Meal ditto ditto	0 10 0	...

Class.		Prizes. 1st. £	s.	d.	2nd. £	s.	d.
132	Starches, Cassava—complete exhibit of not less than two of any of the following samples, to be not less than 10lbs: Cassava, Negro Yam, White Yam, Coco, or Sweet Potato ...	0	10	0	...		
133	Tapioca, not less than 10lbs	0	10	0	...		
134	Brl. or box of Oranges packed for exportation ...	0	16	0	0	8	0
135	Bananas, not less than 5 bunches	1	0	0	0	10	0
136	Oranges—Exhibit not less than 100	0	10	0	0	5	0
137	Limes—Exhibit not less than 200	0	5	0	0	2	6
138	Lemons—Exhibit not less than 100	0	5	0	0	2	6
139	Citrons—Exhibit not less than 50	0	5	0	...		
140	Pine Apples—Collection not less than 6	1	0	0	0	10	0
141	Collection of any Fruits, 6 varieties	0	10	0	...		
142	General collection of Vegetables, 6 varieties ...	0	10	0	0	5	0
143	Yam, 10lbs.	0	10	0	0	5	0
143a	Sweet Potatoes, 10lbs.	0	10	0	0	5	0
143b	Irish Potatoes, 1 bushel	2	0	0	...		
144	Best sample of Jamaica Tobacco. cured, 25lbs. ...	5	0	0	...		
145	Cigars, made of Jamaica Tobacco, 3lbs.	1	0	0	0	10	0
146	Best Basket 12 Fowls' Eggs	0	5	0	...		
147	Fresh Butter, 1lb.	0	10	0	...		
148	Mountain Butter, 2lbs.	0	10	0	...		
149	Salted Butter. 2lbs.	0	10	0	...		
150	Preserved Fish, 15lbs.	0	10	0	0	5	0
151	Salted Beef, 10lbs.	0	10	0	0	5	0
152	Bacon, 6lbs.	0	10	0	0	5	0
153	Honey, 1 gallon	0	10	0	0	5	0
154	Wax, 10lbs	0	10	0	0	5	0
155	Vinegar, 1 gallon	0	5	0	0	2	6
156	Lime Juce, 1 gallon, *prepared for export*	0	7	6	...		
157	Lime Robe, 2lbs.	0	5	0	...		
158	Cayenne Pepper, 1 pint	0	5	0	0	2	6
159	Cassareep, 2 quarts	0	5	0	...		
160	Annatto, 10lbs.	0	5	0	...		
161	Pickles, not less than four varieties	0	5	0	...		
162	Syrups, from native fruits, 2 varieties	0	10	0	0	5	0
163	Jellies and preserved Jamaica Fruits, not less than 2 varieties, 2lbs. each	0	10	0	0	5	0
164	Fibre Plants, 6 varieties	1	0	0	...		
165	Commercial samples of manufactured Fibre, not less than 60lbs., 6 samples	1	0	0	...		
166	Mule Cart	1	10	0	1	0	0
167	Wain	1	10	0	1	0	0
168	Dray	1	10	0	1	0	0
169	Wheel barrow	0	10	0	0	5	0
170	Hogshead	0	10	0	0	5	0
171	Puncheon	0	10	0	0	5	0
172	Barrel	0	5	0	0	2	6
173	Tub	0	5	0	0	2	6
174	Ox-Bows, half dozen	0	10	0	0	5	0
175	Yoke	0	10	0	0	5	0
176	Field Gate	0	15	0	0	10	0
177	Open Baskets, 3 sizes	0	6	0	0	3	0
178	Dozen Walking Sticks, 6 varieties	0	6	0	0	3	0
179	Hats, Jipijapa Straw, 3 samples	0	10	0	0	5	0
180	Hats, any other description	0	5	0	0	2	6
181	Hampers, pair	0	5	0	0	2	6

Note.—No prize will be awarded in any class unless there are at least two exhibits in same.

Note.—The sum of one shilling will be allowed to unsuccessful exhibitors in the Minor Product Class towards defraying expenses.

MANGOSTEEN.

It may be of interest to place on record in the Bulletin of the Botanical Department the fact that the Mangosteen (Garcinia Mangostana, L.) has been successfully grafted on the Gamboge tree (Garcinia pictoria, Roxb.) at the Castleton Botanic Gardens. The Mangosteen fruited at Castleton for the first time in the latter part of 1885. Only a few fruits were then produced, and none of them contained any seeds. Another tree is now bearing half-a-dozen fruits. It will be seen that the lookout for propagating the plant by seeds at Castleton is a very poor one indeed, and as a large number of plants sent in a wardian case from the Singapore Botanic Gardens were all dead on arrival it seemed as if the chances of the Mangosteen becoming a naturalised Jamaica fruit tree were very remote. About a yeas ago it occurred to me that it might be possible to graft the Mangosteen on the Gamboge tree. I may here remark that the Gamboge tree (Garcinia pictoria, Roxb.) fruits regularly and abundantly at Castleton. By way of experiment these plants were grafted by the process known as inarching, or approach grafting. When the plants had been grafted a month we began to sever them from the parent tree; this was done very gradually, the cut being deepened a little each week, and at the end of three months the plants were taken from the tree and it was found that union had perfectly taken place. It may be interesting to those who have not seen the tree to have a short description of it. The following is taken from the "Treasury of Botany:"—"The Mangosteen (Garcinia Mangostana) so well known for its luscious fruit, is found in the Malay Islands, where it grows to a tree of middling stature with a conical head, the branches furnished with glossy leathery elliptical oblong pointed leaves, and the flowers single and nearly sessile at the ends of the twigs, of a dull red colour, and as large as dog-roses. Dr. Abel, writing of the fruits of Batavia, says: 'First in beauty and flavour was the celebrated Mangosteen. This, so often eulogised by travellers, certainly deserves much of the praise bestowed upon it. It is of a spherical form, of the size of a small orange, when ripe reddish-brown, and when old of a chestnut-brown colour. Its succulent rind is nearly the fourth of an inch in thickness. It contains a very powerful astringent juice, and in wet weather exudes a yellow gum which is a variety of Gamboge. On removing the rind, its esculent substance appears in the form of a juicy pulp having the whiteness and solubility of snow, and of a refreshing, delicate, delicious flavour. We were all anxious to carry away with us some precise expression of its qualities; but after satisfying ourselves that it partook of the compound taste of pine-apple and peach, we were obliged to confess it had many other equally good but utterly inexpressible qualities.' Any amount of the fruit may be eaten without injury, and it is said to be given to those afflicted with fever along with the sweet Orange."

The tree has not proved fruitful at Castleton, but I think that is due mainly to the poorness of the soil, and when a little manure can be scraped together there are so many things in need of it that the larger plants like the Mangosteen, &c., are generally overlooked. The Mangosteen undoubtedly requires good treatment. The tree which fruited in 1885 received a heavy dressing of manure about nine months previously, and it had several applications of liquid manure. The tree which is now fruiting had also a heavy dressing of rich manure mixed with fresh soil about seven or eight months ago.

The "Jew Plum" (Spondias dulcis, Forst.) is called Mangosteen in some parts of Jamaica, but this is an entirely different tree from Garcinia Mangostana. W. Harris.

SILKY OAK. *(Grevillea robusta.)*

The natural order Proteaceæ includes a number of genera of very handsome plants, presenting great diversity of appearance. Grevillea is considered the handsomest genus of the order and it contains a large number of species, but the only one grown in Jamaica is Grevillea robusta, Cunn. It is a native of Australia, where it attains a height of 100 feet, with a girth of 8 feet, and is called the "Silky Oak" by the colonists. It is well known in Jamaica as an ornamental foliage plant, and as such is highly prized. Its finely cut foliage resembles some of our ferns and, indeed, it is an excellent substitute for ferns for decorating churches, &c. The trees of Grevillea which we are accustomed to see seldom exceed 15 or 20 feet in height, and until quite recently, as far as I am aware, it had not produced its light clusters of handsome flowers in Jamaica, so that we have not been able to form an adequate idea of the beauty of the tree. Now, however, thanks to the care of the Revd. H. H. Isaacs, M.A., a tree 40 feet in height, with a girth of 3 feet 1 inch at 6 inches from the ground, has flowered at St. Andrew's Rectory. Mr. Isaacs informs me that he obtained the plant from the Castleton Botanic Gardens seven years ago. It was then, of course, little more than a seedling in a bamboo pot, and if we take into consideration the fact that the Rectory is an exposed situation, at an elevation of only 380 feet above the sea, with an annual mean temperature of 78°.7 Fah. it must be admitted that the plant has made good progress. The soil at the Rectory is of a poor gravelly nature, and to enable plants to thrive in it thorough and deep cultivation is necessary, with frequent additions of rotten stable manure and a liberal supply of water. That this treatment has agreed with the Grevillea is proved by the splendid specimen in Mr. Isaacs' garden. W. Harris.

OCCASIONAL NOTES.

On a late visit to the Parish of St. Elizabeth there were two subjects that especially interested me—the question of hay-making and the attention now devoted to the care of young logwood.

Very little hay is made in Jamaica. Freshly cut Guinea grass (*Panicum jumentorum*) is given to horses and stock, or the cattle are put out into pastures. The remark was made to me that dry grass in the field was just as good as hay in the stable. But the very object of hay-making is not so much to get rid of the water which the grass contains (about two-thirds of its weight), but, more important still, to preserve as far as possible all the nutritious qualities of the grass, and that in the largest possible quantity. If grass dries up, while growing in the fields, almost the whole of the nutritious materials have been allowed to disappear. While a plant is growing, it is at the same time collecting a store of materials to be used eventually in the formation of seed, and when the store has accumulated, the plant flowers, the young seed-germs are formed, and the stored material begins to pass from the plant, both for the purpose of completing the seed, and also into the seed as a new store-house for the future growth of the young seedling. This is the reason why so many seeds, such as peas and corn, are so highly nutritious. In hay-making it is extremely important to cut the grass just when it has taken up from soil and air all the nutritious material it can, and just before any of this has passed away to form seed. After flowering, the old leaves of grass lose their power of assimilation, and it is, generally speaking, just at the period of flowering, before the seed is formed, that we get the maximum quantity of nutritious material, and it follows that it is at that time that grass should be cut for hay. When the grass has been cut, it ought not to be allowed to scorch, but should be kept constantly turned during the day. At night it is important to collect it into small heaps in order to keep off as much dew as possible, and as soon as the hay is finally made, it should be stacked.

Probably ensilage would, in Jamaica, be even a more important matter than hay-making By this process, grass, &c., may be stored in the green state, and made use of at any subsequent period On seeing fields of corn in St Elizabeth which, on account of the dry weather, would never produce cobs, and therefore represented so much waste of labour and material, the thought naturally occurred that if ensilage were practised, all this green stuff might be converted into food material for use when grass was scarce. Sugar planters, too, could utilize tops which at present very often go to waste. In Barbados the method is being employed with great success

It was very remarkable to see commons where formerly log-wood was carefully exterminated, now becoming covered with young growth, and woods which at one time received no attention, now being cleaned and looked after for a prospective crop of logwood. It will repay cultivators to consider the principles upon which the formation of wood depends, and to guide their cultivation by those principles. Wood is formed by materials which have been elaborated in the leaves, and therefore the amount of wood formed is in direct proportion to the area of the leaf-surface. If the trees are too close together, the branches cannot have full scope, there will be a deficiency of leaves, and a slender stem. Much more will this be the case, if half a dozen stems are allowed to spring up from one spot. On a given area the actual weight of wood may be the same, whether the trees are thinned or left to grow by chance, but in individual stems the difference will at once be seen after careful thinning out and lopping of lower branches, for the greater the diameter of the stems the less waste there will be in chipping.

W. F.

BOTANICAL NOTES ON COMMON PLANTS GROWING IN JAMAICA.

The Inspector of Schools requires that Students in Training Colleges should prepare for examination in Botany, the chapters referring to this subject in Paul Bert's First Year of Scientific Knowledge, and should be able to describe 30 plants found commonly in Jamaica. It is proposed in this and following numbers of the Bulletin to give notes on plants suitable for the purpose, not by way of complete description, but to call attention to special points in the structure of the plants, and so illustrate from living examples botanical terms which are the foundation of botanical language. Those who wish to use these notes should first make themselves familiar with the book mentioned, and also with Hooker's Primer of Botany (MacMillan, price one shilling.)

(1). Custard Apple, Sweet Sop, Sour Sop, Cherimoya.

All these belong to one genus,—Anona, and all agree in certain particulars as follow:—

The calyx consists of 3 *distinct sepals* (*poly-sepalous*) slightly united at the base, and the edges *meeting* in the bud (*valvate*); it is inserted *below* the pistil (*inferior*). The corolla consists of 6 *distinct petals* (*poly-petalous*, arranged in two series. The three petals of the outer series are alternate with the sepals, and those of the inner series are alternate with the outer petals. The outer petals are broad and concave; the inner are smaller, and in the Sweet Sop, Custard Apple and Cherimoya, they are minute. They are valvate before expansion, and are inserted *below the pistil* (*hypo-gynous*). The stamens are numerous, covering the hemispherical receptacle, they are *distinct* (*poly-androus*); and hypogynous; the connective is produced above the anthers; the filaments are short. The pistil is *free from the calyx* (*superior*), and is composed of numerous carpels, each of which contains a single, erect, *reversed* ovule (*anatropous*). The ripe carpels are *united* (*syn-carpous*) into a pulpy fruit. The seeds *contain endosperm* (*albuminous*), in which is a minute embryo. The inner seed-coat projects into the substance of the endosperm, giving a characteristic appearance when cut (*ruminate*).

The species mentioned are trees; the leaves are alternate, entire, without stipules. The flowers are solitary or clustered, terminal or opposite a leaf.

The following are distinctions amongst themselves:—

Sour-Sop (*Anona muricata*, L.) Leaves oblong, at length glabrous; outer petals subcordate, acute, inner rounded; fruit with recurved spines.

Sweet-Sop (*Anona squamosa, L.*). Leaves oblong or lanceolate; sub-glabrous, glaucous on the under surface; outer petals lanceolate, inner minute; fruit tubercled.

Cherimoya (*Anoma Cherimo'ia, Mill.*). Leaves oblong, pubescent above, velvety beneath, outer petals nearly closed, velvety outside, inner minute; fruit netted, slightly tubercled.

Custard Apple (*Anona reticulata, L.*). Leaves oblong-lanceolate, glabrous; fruit netted.

The family or order to which these plants belong is known as Anonaceæ. The chief characteristics of the order are as follow:—There are 3 sepals. The petals are distinct, hypogynous, and usually in 2 series. There are numerous stamens, generally crowded on the receptacle. The carpels are usually numerous, and apocarpous. The embryo is small in copious ruminate endosperm. The species are trees or shrubs with alternate leaves without stipules.

To this same order belong Lancewood (*Bocagea virgata*), and the ornamental trees Artabotrys and Cananga.

(2) Cacao or Chocolate (*Theobroma Cacao, L.*).

The calyx is *divided nearly to the base into 5 parts* (5-partite), the edges of which just *touch* in the bud (*valvate*). There are 5 petals, hood-shaped at the base, and produced above the hood into a sort of spoon-shaped process. The stamens are *united (mon-adelphous)* at the base into a cup; there are 5 opposite the sepals without anthers, and opposite each petal there are 2 anthers with united filaments. The ovary is 5-celled, each cell containing numerous ovules. There is one style, and 5 stigmas. The seeds are enveloped in pulp, and are *without endosperm* (*ex-albuminous*); the cotyledons are thick and corrugated; the radicle is very short. This species is a large shrub or tree; the leaves are entire, oblong, glabrous; the flowers are small, and are scattered over the truuk and branches.

Cacao belongs to the order Sterculiaceæ, of which the more important characters are the following :—The calyx is in 5 (rarely 4 or 3) parts, valvate. The petals are wanting or are as many as the calyx-divisions, and hypogynous. The stamens are numerous, and are united in *one bundle* (*mon-adelphous*) or *several* (*poly-adelphous*); the anthers are 2-celled. The carpels are distinct or more or less united. The ovules are affixed at the inner angle of the cells, and are ascending or horizontal. The species are herbs, shrubs, or trees. The leaves are simple or compound, usually alternate, with stipules. The Byssi-Nut (*Cola acuminata*) belongs to this order.

(3) Akee. (*Cupania edulis*, Schum. and Thonn.)

The calyx is formed of 5 sepals arranged in 2 series, which slightly *overlap in the bud* (*imbricate*). It is inserted *below* the pistil (inferior). The corolla is composed of 5 petals, each with a large scale at the base, and is inserted on a *fleshy ring* (*disc*), which is *below the pistil* (*hypogynous*). The disc completely surrounds the floral axis; it is regular in form, with small projections. There are from 7 to 10 stamens, exceeding the corolla in length, and inserted within the disc at the base of the ovary; the filaments are downy. The ovary is three-celled (sometimes 4 or 5), and is shortly stalked; the style is simple; there is one ovule in each cell, affixed to the axis. The fruit is a capsule, fleshy, 3-celled, opening by 3 valves, which separate from the top. There is a single hard black seed in each cell, partially covered with an aril (which is edible); the seed is *without endosperm* (*exalbuminous*); the embryo is thick and curved.

This species is a tree; the leaves are alternate, compound, with the leaflets arranged along each side of a common leaf-stalk (*pinnate*), and ending with a pair of leaflets (*abruptly pinnate*). The flowers are arranged single along a common stalk (*raceme*); they occur occasionally without perfect stamens or a perfect ovary.

The Akee belongs to the order Sapindaceæ, of which the following are the chief characteristics :—

The flowers are often irregular. The petals are 4 or 5 in number (or are wanting); they are imbricate, inserted outside a disk. The disk is swollen, adnate to the base of the calyx, or lining its tube. The stamens are usually inserted within the disk, and in number are double, equal, or fewer than the sepals. The ovary is usually 3-celled, entire or lobed, often excentric. The ovules are generally 1 or 2 in each cell, affixed to the axis and ascending. The seed is exalbuminous, with the embryo usually curved or spiral. The species are shrubs or trees. The leaves are usually alternate and compound.

(4) Papaw. (Carica Papaya, L.)

There are two kinds of flowers, the one kind is without a pistil, and the other without stamens. In the staminate (or male) flowers, the calyx is very small, and is 5-lobed; the corolla is salver-shaped with the lobes twisted in the bud; there are 10 stamens, inserted at the throat of the corolla in 2 series, 5 of which are alternate with the corolla-lobes and have short filaments, and 5 are opposite to the lobes almost without filaments, the 2-celled anthers discharge their pollen inwards. In the pistillate (or female) flowers, the calyx is of the same kind as in the male, but the corolla is composed of 5 distinct petals, which soon drop away (*deciduous*); the pistil is composed of 5 *united carpels* (*syn-carpous*); the ovary is free from the calyx (*superior*), and is one-celled with numerous ovules; the style is very short, there are 5 stigmas which are dilated and lobed; the fruit is fleshy with numerous seeds; the seeds have an aril and contain endosperm (*albuminous*) which is fleshy; the embryo is in the axis of the seed. The species is a small tree with milky juice; the leaves are alternate, with long stalks, and the veins of the leaf come from a common point (*palmate*). The flowers are arranged singly along a common flower-stalk (*raceme*). The Papaw belongs together with the Granadilla, Sweet Cup and other Passion-Flowers to the order Passifloreæ. The following are its principal characters :—The flowers are regular, sometimes unisexual. The corona, inserted at the base of the petals, is sometimes altogether wanting. The stamens are definite in number. The ovary is free, and one-celled. The seeds have a fleshy endosperm. The species are herbs or shrubs, sometimes trees. The leaves are alternate, often lobed, and with or without lateral tendrils.

(5) Woman's Tongue, Sirissa Tree of India. (Albizzia Lebbek, Benth.)

The sepals are united (*gamo--sepalous*) to form a 5-toothed, funnel-shaped calyx, which is inserted below the pistil (*inferior*). The corolla is composed of 5 divisions (*gamo-petalous*), it is funnel-shaped, and inserted *below the pistil* (*hypo-gynous*). The stamens are numerous, united (*monadelphous*) at the base, inserted on the calyx *round the pistil* (*peri-gynous*); the filaments are much longer than the corolla with minute anthers. The pistil is composed of one carpel, and is *free from the calyx* (*superior*); the ovary contains several ovules, the stigma is capitate, minute; the fruit is a pod (*legume*), large, straight, thin, flat, strap-shaped, scarcely bursting; the seeds contain no endosperm (*exalbuminous*) they are compressed and rounded.

This species is a tree. The leaves are compound; the leaflets are arranged in pairs along each side of a stalk (*pinnately*), and these stalks again are arranged in pairs along a primary stalk, so that the leave are said to be twice-pinnate (*bi-pinnate*). The flowers are in globular heads.

Albizzia belongs together with Peas, Beans, Poinciana, &c., which have a pod-like fruit (legume) to the order Leguminosæ. The following are the chief characteristics of the order:—The flowers are regular or irregular. The calyx is gamo-sepalous. The corolla is peri-gynous or hypo-gynous. The stamens are inserted with the corolla, in number double that of the petals or indefinite; the anthers are 2-celled. The pistil is generally of 1 carpel, excentric and 1-celled, becoming a pod, or an indehiscent fruit, often jointed; the style is terminal. The ovules are numerous (or only one), affixed at the interior angle. The seeds are usually ex-albuminous. The species are herbs, shrubs, or trees. The leaves are usually alternate, compound, and stipulate.

(6). Star-apple. (*Chrysophyllum Cainito, L.*)

The calyx is composed of 5 sepals, united (*gamo-sepalous*), which overlap in the bud (*imbricate*); it is inserted *below the pistil* (inferior). The corolla is 5 lobed (*gamo-petalous*), inserted *below the pistil* (*hypogynous*); the lobes are imbricate. There are 5 very small stamens *quite free from one another*, (*polyandrous*), inserted *on the petals* (*epi-petalous*). The pistil is composed of 8 or 9 carpels united together (*syn-carpous*), and free from the calyx (*superior*); the ovary is 8 or 9 celled, each cell containing one ovule; the style is short the stigma is 8 or 9 toothed; the fruit is pulpy throughout (*a berry*); the seeds contain endosperm (*albuminous*), and have a long, broad, *scar* (*hilum*); the radicle of the embryo is directed towards the base of the ovary (*inferior*).

The species is a tree. The leaves are elliptical, tipped with a sharp point (*cuspidate*), destitute of hairs (*glabrous*) on the upper surface, covered beneath with golden silky down. The flower stalks are clustered in the axils of the leaves.

(7) NASEBERRY. (Achras Sapota, L.)

The segments of the calyx are 6 in number, and are arranged in 2 series, the 3 outer sepals enclosing the 3 inner; they are inserted *below* the pistil (*inferior*). The cup-shaped corolla is composed of 6 *united petals* (*gamo petalous*), which overlap in the bud (*imbricate*), and are somewhat twisted. There are 6 stamens, affixed to the middle of the corolla (*epi petalous*), opposite to the corolla-lobes; the anthers open outwards to discharge the pollen; there are 6 imperfect stamens (*staminodes*) which do not produce pollen,—they are petal-like, and are inserted alternately with the perfect stamens. The ovary is free from the calyx (*superior*) hairy on the outside, and has 10 to 12 cells with one ovule in each; the style is without hairs (*glabrous*), and the stigma is small. The fruit is globular, fleshy. The seeds have a fleshy *endosperm* (*albuminous*); the cotyledons are flat and thick; the radicle is small, and is directed towards the base of the ovary (*inferior*).

This species is a large tree. The flowers are stalked, and are inserted in the axils of the leaves. The leaves are alternate, thick, with an *entire* margin; the venation is feather-veined (*penni-veined*).

The Star-Apple and the Naseberry belong to the order SAPOTACEÆ, which includes also the Mammee Sapota This Order has the following characters :—

The calyx is inferior, with 4 to 8 divisions, imbricate. The corolla is gamopetalous, hypogynous; there are 4 to 8 lobes in 1 or 2 series, imbricate. The stamens are inserted on the corolla, the fertile equalling in number the corolla- lobes and opposite to them, or more numerous in 2 or several series, sometimes with alternating staminodes. The ovary is superior, many-celled. The ovules are solitary in the cells, ascending from the base of the inner angle, anatropous. The fruit is a berry with 1 or several cells. The seeds are one or several in number, with a thick often hard shining testa, and long broad hilum; the fleshy endosperm is scanty or altogether wanting; the embryo is large, with broad, foliaceous cotyledons, and inferior radicle. The species are trees or shrub with milky juice, the leaves are alternate, entire, without stipules.

(8) YOKE-WOOD, FRENCH OAK. (Catalpa longissima, Sims).

The calyx is deeply 2-lipped, the lower lip *having an abrupt, short tip* (*mucronate*). The corolla is irregular, bell-shaped, with an oblique tube swollen above, the limb is 5-lobed, 2-lipped. There are 2 perfect stamens; the filaments are bent; the anthers are of 2 diverging cells, one above and one below; there are 3 *imperfect rudimentary stamens*, (*staminodes*). The ovary is *free from the calyx* (*superior*), 2-celled, the style long and slender, the stigma 2-lipped, the ovules are numerous. The fruit is a long slender capsule, cylindrical, 2-valved, the valves *separating between the partitions* (*loculicidal*); the seeds have wings which are cut into long threads they are *without endosperm* (*exalbuminous*). The French Oak is a tall tree; the leaves are simple, opposite or 3 or 4 together, oblong, and entire; the flowers are at the apex of the branches, they are arranged in a *branched raceme* (*panicle*).

This Tree belongs to the order BIGNONIACEÆ, which also includes the wild yellow flowering shrub of the plains (*Tecoma stans*), the ornamental climber, *Bignonia venusta*, the ornamental tree, *Spathodea*, and the Calabash (*Crescentia Cujete*). The following are the chief characters of the order :—The flowers are more or less irregular. The calyx is inferior, gamosepalous, with 2 to 5 divisions. The corolla is gamopetalous with 5 lobes, more or less arranged in 2 lips. The stamens are alternate with the lobes of the corolla, but only 4, and sometimes only 2, are perfect. The disk is hypogynous or wanting. The ovary is sometimes 2-celled with numerous ovules inserted on 2 placentas along the edges of the partition in each cell, or it is one-celled with numerous ovules on 2 placentas running along the walls of the ovary. The seeds are exalbuminous.

(9) SANDBOX. (Hura crepitans, L.)

The flowers have either stamens without a pistil (male), or a pistil without stamens (female); both kinds occur on the same tree (*monœcious*); they have *no petals* (*a-petalous*).

In the male flowers, the calyx is short, cup shaped, with an irregular margin. The stamens are numerous, combined with the connectives into a thick column; the cells of the anthers are distinct, disposed below the apex of the column in 2 rings. The ovary is wanting.

In the female flowers, the calyx is cup-shaped, with an entire margin The ovary contains 5 to 20 *united cells* (*syn-carpous*); the styles are combined into a long, fleshy column, spreading in a radiate form at the apex: the ovules are solitary in the cells. The fruit is a large depressed capsule; the carpels are *arranged in a ring* (*verticillate*), and at length separate from the axis. The seeds have a fleshy endosperm (*albuminous*); the cotyledons are broad and flat.

This species is a tree. The leaves are alternate, stalked (*petiolate*), feather veined (*penni-veined*), with transverse veins. The male flowers grow in spikes which are stalked, and are situated at the apex of the branches The female flowers occur single under the male spike.

The Sandbox tree belongs, together with the Castor Oil Plant, and Cassava, to the order EUPHORBIACEŒ. The characteristics are as follow :—The flowers are unisexual, and generally apetalous. The ovary is syncarpous, with 3 (rarely 1 or several) cells. The ovules are solitary, or 2 side by side, in each cell; they are pendulous from the inner angle. The fruit splits up into as many cells as there are in the ovary. The embryo is straight in the axis of abundant endosperm. The species are herbs, shrubs or trees. The leaves are usually alternate with 2 stipules.

(10) BANANA OR PLANTAIN. (Musa paradasiaca, L.)

The stem is composed of the lower portions of the leaf-stalks, rolled round one another.

The flower-stalk is protruded from the centre of the leaves which gradually lengthens and hangs down. The irregularly-shaped flowers are arranged in clusters, which in fruit are called "hands". These clusters are arranged spirally on the stalk, and there are three in each revolution, so that commencing at any one cluster, the fourth is above or below it. The flowers that appear first, at the base of the stalk, have a pistil, but no stamens (pistillate or female flowers); there are from 5 to 12 or more of these clusters, and these produce fruit Then come clusters of flowers which have both pistil and stamens (bisexual); and finally clusters of flowers which have stamens and no pistil (staminate or male flowers). Each cluster is covered by a coloured leaf (bract).

The calyx is long, tubular but split from the base; and three-lobed. The corolla is included in the calyx, shorter than it, and blunt at the apex with a long point. There are 5 perfect stamens; the filaments are thick, and *thread-shaped* (*filiform*); the anthers are linear, erect, 2-celled, with parallel contiguous cells. The pistil consists of 3 *united carpels* (*syn-carpous*); the ovary is inferior and 3 celled, with numerous ovules in each cell; the style is filiform from a thickened base; the stigma is rounded. The fruit is pulpy and *does not split* (*in-dehiscent*) it is technically therefore a berry (*baccate*); the ovules do not ripen into seeds in this cultivated fruit.

The true *stem* is *underground* (*rhizome*). The leaves are very large, *with an uncut margin* (*entire*) and parallel veins passing off from the midrib.

The Banana belongs to the order SCITAMINEÆ, which also includes Ginger (*Zingiber*), wild Ginger (*Hedychium*), Cardamom, Indian Shot (*Canna*), Arrowroot and Kæmpferia. The following are the chief characters of the order: the flowers are irregular. The perianth consists of 2 series, the outer being calyx-like, and the inner corolla-like. There are 1 or 5 perfect stamens, and 5 or 1 without anthers (*staminodes*) and variously altered, the ovary is inferior. The seed has the embryo embedded in the centre of the endosperm. The leaves have parallel veins passing from the midrib. The species are herbs generally with rhizomes.

(11) TAMARIND. (*Tamarindus indica, L.*)

In the calyx, the *sepals are united* (*gamo-sepalous*) into a short funnel-shaped tube; the *upper portion* (*limb*) is divided into 4 lobes, which *overlap in the bud* (are *imbricate*); one of the lobes (the largest) appears to be composed of 2 lobes combined,—it has 2 distinct veins. The corolla is composed of *distinct petals* (it is *poly-petalous*), which are inserted on the calyx *round the ovary* (*peri-gynous*), and are imbricate; 3 of the petals are about equal to the calyx-lobes, and 2 are minute. (There are thus a regular number of sepals and petals, 5 of each.) The stamens are peri gynous, 3 in number, with the filaments *all connected* below (*mon-adelphous*), *undeveloped stamens* (*staminodes*) alternate with the fertile stamens; the anthers are attached at a point near their centre (*versatile*), they are oblong, two-celled, and burst longitudinally. The pistil is composed of one carpel; the ovary is stalked, with the stalk united on one side to the calyx-tube; there are numerous ovules; the style is long with terminal stigma. The fruit is a pod (*legume*) incurved, thick, not splitting open (*in-dehiscent*), it is composed of 3 portions, the outer part (*epi-carp*) is brittle, the middle portion (*meso-carp*) is pulpy, and the inner portion enclosing the seeds (*endo-carp*) is leathery; there are partitions between the seeds. The seeds are roundish, compressed, with thick testa, *no endosperm* (*ex-albuminous*); the cotyledons are thick, and the radicle short and straight. This species is a tree without spines. The leaves are alternate, compound, with the leaflets arranged on opposite sides of a common stalk (*pinnate*) without an odd one at the top (*abruptly pinnate*); the leaflets are small, opposite in about 8 to 16 pairs. The flowers are yellowish, red-striped, arranged *singly along a common unbranched stalk* (*in a raceme*) at the tops of the branches; small leaves (*bracts*) cover the flower in the bud, which *soon fall* (*deciduous*).

Order: Leguminosæ. See No. 5.

(12) DIVI-DIVI. (*Cæsalpinia coriaria, W.*)

The calyx is composed of 5 *united sepals* (*gamo-sepalous*), the lowest one being the largest; it is quite free from and *below* the pistil (*inferior*); the lobes *overlap in the bud* (are *imbricate*) The corolla is composed of 5 *distinct petals* (*poly petalous*), which are imbricate and attached to the calyx *round the ovary* (*peri-gynous*); 4 of the petals are about equal in size and roundish, and the upper one is boat-shaped and situated within the rest. There are 10 *free stamens* (*dec-androus*), perigynous; the filaments are hairy at the base; the anthers are 2-celled, and burst longitudinally. The pistil is composed of 1 carpel; the ovary is free from the calyx (*superior*) with few ovules; the stigma is concave. The fruit is a pod (*legume*) curved sideways and compressed. The seed is compressed, and is *without endosperm* (*ex-albuminous*); the cotyledons are flat, and the radicle short and straight. The species is a tree, without spines. The leaves are compound, twice-pinnate (*bi-pinnate*) that is the primary leaflets are arranged along each side of a common stalk, and each primary leaflet is composed of small secondary leaflets along a common stalk; the secondary leaflets are numerous, with a row of dots inside the margin. The flowers are white and fragrant, arranged *along a branching stalk* (*in a panicle*).

Order: Leguminosæ. See No. 5.

(13) FLAMBOYANTE. (*Poinciana regia*, Boj.)

The calyx is composed of 5 *sepals united* (*gamo-sepalous*) below into a very short tube which is inserted on the stalk *below* the ovary (*inferior*); the 5 lobes are long and become detached easily from the tube, their edges just touch in the bud (*valvate*); there is an outgrowth (*disk*) on the top of the inside of the tube to which the petals and stamens are affixed. The corolla consists of 5 *distinct petals* (*poly-petalous*) inserted on the disk, which are wrinkled and *overlap* in the bud (*imbricate*); the 4 lower petals are scarlet, round, tapering into a kind of *stalk* (*claw*), the upper petal is wedge-shaped, and in colour is variegated with red and yellow. There are 10 stamens, all bending one way, distinct from one another, but attached to the disk; the filaments are hairy at the base. The pistil consists of one carpel; the ovary is shortly stalked, and is not adherent to the calyx (*superior*); there are numerous ovules; the style is long and *thread-like* (*filiform*); the stigma is terminal, and covered with very small hairs. The fruit is a pod (*legume*) very long, flat, hard, 2-valved, and filled up within except the spaces for the seeds. The seeds are oblong, with a small *scar* (*hilum*), and hard *skin* (*testa*) enclosing endosperm (*albuminous*); the endosperm is hard and horny and surrounds the embryo, which is of the same shape as the seed; the radicle is close to the hilum, straight and somewhat rounded; the cotyledons are flat, green, with plainly marked midrib, and *heart-shaped* (*cordate*) at the base; the plumule is small. This species is a tree. The leaves are compound, the component parts are arranged along a common stalk (*pinnate*) and are themselves pinnats, so that the whole leaf is twice pinnate (*bi-pinnate*). The flowers are in terminal racemes.

Order: Leguminosæ. See No. 5.

(14) Granadilla. (*Passiflora quadrangularis*, L.)

The calyx consists of 5 *sepals united* (*gamo-sepalous*) below into a short tube; the lobes are oblong, fleshy, and *overlap in the bud* (are *imbricate*). The corolla consists of 5 *distinct petals* (*poly-petalous*), which are a little longer than the calyx-lobes. The *corona* is a marked feature of the Passion Flowers: in the Granadilla 3 parts may be seen, the outer portion consists of numerous long threads, then follows a circle of smaller threads, and still nearer the centre there is a ring. There are five stamens; the filaments are attached to the long stalk on which the ovary grows (the *gyno-phore*) and are free above; the anthers are attached at a point near their centre (*versatile*). The pistil is composed of *united carpels* (*syn-carpous*); the ovary is stalked, free from the calyx (*superior*), 1-celled; there are 4 styles; there are numerous ovules; there are 3 *ovule-bearing surfaces* (*placentas*) which run down the *wall* of the ovary (this is called *parietal* placentation). The ovary-wall, as it has ripened (*peri-carp*), has remained fleshy, and the fruit is therefore a *berry*. The seeds are numerous, compressed, immersed in pulp, *with* fleshy *endosperm* (*albuminous*) which is marked on the outside with dots, due to the markings on the testa; these cotyledons are thin and flat, endorsed by the endosperm. The Granadilla plant is a climbing herb, with 4-angled branches. The leaves are alternate, simple, entire. The tendrils are axillary, and stipules leafy. The flowers are large, axillary, solitary. The flower stalks are jointed, and have 3 bracts below the flowers.

The Sweet-Cup, Pomme d'or, and other Passion Flowers, all belong to the same order, but differ in some details.

Order: Passifloreæ. See No. 4.

(15) Castor Oil. (*Ricinus communis, L.*)

The flowers have *no petals* (*a-petalous*); some have stamens only (male flowers), and some have pistil only (female flowers), and these 2 kinds grow *on the same plant* (*monœcious*). In the male flowers the calyx is 5-lobed, with the edges of the lobes just touching in the bud (*valvate*). The stamens are very numerous; the filaments branch repeatedly; the anthers are 2-celled, roundish, with the cells distinct. In the female flowers, the calyx is 5-lobed, valvate, inserted on the stalk *below* the ovary (*inferior*), and remaining attached while the ovary is ripening. The ovary is 3-celled; the style is very short; there are 3 stigmas, each divided into 2 branches covered with stigmatic lobes; there is one ovule in each cell, pendulous from the inner angle. The fruit is *dry and splitting up* (*a capsule*) into 3 portions, each of which splits again with 2 valves. The seeds have endosperm (*albuminous*) which is fleshy; the cotyledons are flat. The Castor Oil plant is a shrub. The leaves are alternate, large, with the stalk passing off from the back of the leaf (*peltate*), they have 7 or several lobes, so arranged that the spaces between (*sinuses*) approach the insertion of the stalk (palmately-lobed). The flowers are arranged along a common stalk (*raceme*) at the ends of the branches, the female flowers above, and the male below.

Order: Euphorbiaceæ. See No. 9.

(16) Bitter or Sweet Cassava. (*Manihot.*)

The flowers are *unisexual*, that is some have stamens only (male flowers) and others have a pistil only (female flowers). Both kinds of flowers grow on the same plant (*monœcious* flowers), and all are *without petals* (apetalous).

In the male flowers, which are small, the calyx consists of 5 *united sepals* (*gamo-sepalous*), which *overlap in the bud* (*imbricate*), and are inserted *below* the ovary (*inferior*). There are 10 distinct stamens, inserted below a yellow ring (*disk*), and between its knobs; the filaments are shorter than the calyx, and are of unequal length.

In the female flowers, which are larger than the male, the calyx consists of 5 sepals which are only slightly or not at all connected at the base, and are imbricate and inferior. The disk is a simple ring below the ovary. The pistil is composed of 3 *united carpels* (*syn-carpous*), as appears from the 3-celled ovary, and the 3 styles, which are shortly connected at the base and expand above into many lobed stigmas; there is one pendulous ovule in each cell. The 3-celled fruit is *dry and spliting up* (*a capsule*) through the partitions (*septicidal dehiscence*) into 3 portions, which also split down at the inner angle. There is one seed in each cell, with an *outgrowth round the hilum* (*caruncle*), fleshy endosperm, and leafy cotyledons.

These plants are half-shrubby perennials with large fleshy roots. The leaves are large, alternate, divided almost to the stalk into 3 to 7 lobes (*palmately lobed*). The flowers are attached along a common stalk at the ends of branches (*in terminal racemes*) with the male flowers above.

Order: Euphorbiaceæ. See No. 9.

(17) Common Tobacco. (*Nicotiana Tabacum, L.*)

The calyx consists of 5 *united sepals* (*gamo-sepalous*); it is inserted on the flower stalk *below* the ovary (*inferior*), it is tubular and somewhat inflated. The corolla is compound of *united petals* (*gamo-petalous*), it is funnel-shaped, with a long tube enlarged above, the limb is spreading and has 5 lobes which are folded in plaits in the bud (*plicate*), There are 5 stamens, *attached to the corolla* (*epi-petalous*) below the middle of the tube; the filaments reach to about the end of the corolla-tube. The pistil is composed of 2 *coherent carpels* (*syn-carpous*); the ovary is 2-celled; the ovules are numerous; the ovule-bearing surfaces (*placentas*) are on the partition (or *septum*) between the cells, and are so large as nearly to fill up the interior; the style is filiform, and about as long as the stamens; the stigma is 2-lobed. The fruit is *dry and splits up* (*a capsule*) through the septum (*septi-cidal dehiscence*) from the top into 2 valves, which again split on the inside; it is 2-celled and covered below by the dry persistent calyx. The seeds are very numerous, and small; the embryo is slightly curved in the axis of the endosperm. The Tobacco plant is a herb, covered with glutinous hairs. The leaves are alternate, entire. The flowers arc arranged along a branched stalk (*panicle*).

Order: Solanaceæ. W. F.

Note.—A subscription of 2s. will insure the delivery at any Post Office in Jamaica of 12 numbers of the "Bulletin." Application may be made at any of the Gardens, or by post to the Director of Public Gardens and Plantations, Gordon Town P.O., Jamaica.

No. 10. JANUARY, 1889.

BULLETIN

OF THE

BOTANICAL DEPARTMENT,

JAMAICA.

CONTENTS:

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1889.

JAMAICA INDIA RUBBER.

(Copy) *Kew Gardens to Colonial Office.*

Royal Gardens, Kew, 26th October, 1888.

Sir,

I have the honour to forward herewith the accompanying papers* relating to an important india rubber plant, (G. *Forsteronia floribunda* Don) native of Jamaica which has been in course of investigation by this Establishment.

2. The inquiry in regard to this plant was taken up in 1883 and 1884 (see the Reports of the Jamaica Botanical Department for those years) and recently at the request of Kew, theRev. E. Bassett Key, who throughout has taken a warm interest in the subject, forwarded here a bottle of latex for the purpose of determining the commercial value of the rubber.

3. The Report of the India Rubber, Gutta Percha and Telegraph Company of Silvertown, obtained through S. W. Silver, Esq., F.L.S., proves that this native rubber of Jamaica is of high industrial value and it might give rise to an important local industry if it were found possible to increase the plant by cultivation and to pursue the subject in a systematic manner.

4. On this latter point the Government of Jamaica will no doubt consult Mr. Fawcett, Director of the Botanical Department.

5. The supply of India Rubber as a forest product is destined to fall far short of the demand, and under these circumstances the Government of Jamaica might be glad to be put in possession of information as regards a native rubber plant which stands so high in intrinsic value. Samples of rubber manufactured from the Jamaica plant are enclosed.

I am &c.,

(Signed) D. Morris.

Edward Wingfield, Esq., Colonial Office.

(Copy) *Mr. Key to Mr Morris..*

Windsor Park, Balaclava, Jamaica, 4th June, 1888.

Dear Mr. Morris.

Some time ago I was asked by the Department here to put up for you for examination some of the "Milk Withe" juice.

As Mr. Pengelly is going home he has kindly consented to carry the parcel I should be glad to hear the result of the Analysis. I hope to send you the Coco leaves also asked for.

I am &c.,

(Signed) E. B. Key.

D. Morris, Esq., F.R.S., Assistant Director, Royal Gardens, Kew.

India Rubber, Gutta Percha and Telegraph Works Co. Limited.

Silvertown, 17th October, 1888.

The sample received with letter from Kew dated September 12th, 1888, consisted of a lactescent juice, partially coagulated, with a strongly acid reaction; fortunately it was contained in a stout glass bottle, about 10 ounces capacity.

The portion which had coagulated in the bottle could be removed only by fracturing the same. It was rinsed out so as to free it from adherent non-solidified milk &c., and treated subsequently by itself. It will be referred to hereafter as A.

The non-coagulated portion was mixed with about twice its volume of water, with about one ounce (fluid measure) ordinary acetic acid British Pharmacopœia strength, &c. After a few days, exposure the coagulum rose to the surface in a fairly coherent form, and was collected and squeezed. This portion will be referred to hereafter as B.

The residual liquid was evaporated to complete dryness, so as to ascertain whether the juice itself contained any principle likely to produce a detrimental effect on the product, by any subsequent process of coagulation or inspissation. So far as we can see, the portion of the juice or sap which is rendered insoluble by evaporation, would give the rubber a dark colour and render it short.

The finest Para rubber contains the entire juice or sap of the tree; the aqueous portion evaporates during the process of coagulating. It is doubtful whether the juice of the *Forsteronia florbunda* could with advantage be treated in this way.

The juices of India-rubber producing plants are alkaline or neutral, never acid. By a process of fermentation which soon sets in, the nitrogenous or other constituents of the juice produce sufficient acid to cause a separation of caoutchouc Whether the *Forsteronia floribunda* juice exposed in an open vessel would part with the whole of the caoutchouc in this way, would be worth trying, with the recently collected juice.

It is quite possible that it would be an advantage to recover the caoutchouc as it was coagulated, without using any artifical means; the mother liquor should not be thrown away but should be continually worked on with fresh juice.

The method recently given by Mr. Alvan Millson for the recovery of caoutchouc from the "Abba" tree is admirably adapted for the treatment of the juice of the *Forsteronia floribunda.*

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* Extract "Kew Bulletin" No. 15, March, 1888, p.p. 70, 71. Copy of letter from Rev. E. B. Key. Copy of Report from India Rubber, Gutta Percha & Co., Silvertown. Four samples of manufactured Rubber.

The rubber from this plant is so remarkably good that no time should be lost in submitting samples prepared on the spot. The rubber cannot seriously be deteriorated by any process likely to be used in its recovery.

There is no doubt but that the examination of the natural juice of a plant, will in most cases enable one to point out what precaution should be taken to ensure the best result; still the fact must not be lost sight of, that such an examination might lead one to suggest methods difficult of being carried out under surrounding circumstances.

The juice of the *Forsteronia floribunda*, yields roundly, one pound of dry and washed caoutchouc, or about twenty-two ounces of ordinary crude caoutchouc, as generally met with, per quart.

A. About two and a half ounces of this product was recovered, the weight being that of washed and dried article. In colour and strength it approaches more nearly to the better descriptions of Para-rubber. Mixed with sulphur and treated, it vulcanized perfectly, being solid, firm, and strong. It is a light colour when vulcanized.

B. About one and a half ounce of this product was recovered when washed and dried. It was much darker in colour than sample marked A. This remark applies also to the washed product, but it is not nearly so tough as A.

P.S.—I omitted to state in the proper place, that the residual juice from which the caoutchouc was recovered yielded less than half-an-ounce of solid, principally saline matter, gum &c.

Samples accompanying this Report :—
Sample A washed and dried.
" A vulcanized.
" B washed and dried.
" B vulcanized.

Note to samples. Small strips are enclosed for stretching &c. to ascertain strength, elasticity &c.

Botanical Department, Gordon Town, P.O., Jamaica, 18th December, 1888.

Sir,

I have the honor to acknowledge the receipt of your letter No. $\frac{6841}{\text{S.S. } 296}$ dated 7th inst., enclosing copies of correspondence relating to an indigenous India Rubber plant *(Forsteronia floribunda)*, called locally the "Milk Withe."

2. I have visited Manchester where the plant grows, and examined its habit of growth in its native woods. I have to thank the Rev. E. Bassett Key for his interest in the subject, and the assistance which he has given me.

3. The "Milk Withe" is a liane, generally about as thick as a man's wrist, sometimes much thicker. It grows in woods, climbing to the tops of the highest trees, and hanging in festoons from one tree to another. The geological formation is that described in Sawkin's "Geology of Jamaica" as "White limestone." The surface of the ground is exceedingly rough and difficult to traverse on account of the sharp and jagged edges of the hard crystalline limestone. The soil is lodged in hollows of varying extent and depth between the projecting limestone blocks.

4. When a cut is made through the bark of the "Milk Withe", a milky juice flows out for about two minutes, but a number of incisions are necessary before sufficient fluid is collected to fill a four-ounce bottle.

5. A little of the juice poured on the palm of the hand, and rubbed up with the finger soon coagulates. The addition of acetic acid to the juice does not hasten the coagulation, but a solution of alum at once coagulates the caoutchouc, leaving as a residuum a liquid of a slightly greenish tint. Coagulation takes place in the residual liquid after some time. Exposed in a shallow vessel to the heat of a lamp. a considerable amount of vapour passes off, and the caoutchouc gradually coagulates, the process being helped by stirring, until no residuum is left.

6. Mr. Bassett Key has propagated the plant by cuttings, one of which is growing vigorously in the Hope Gardens; and probably in the proper season a large quantity of seed could be obtained.

7. Experience alone can decide whether the collection of the caoutchouc would be a profitable undertaking, but Messrs. Silver's Report on the value of the India Rubber is so encouraging, that probably owners of woods where the "Milk Withe" grows, will make the experiment of exporting it in sufficient quantity to test the market.

8. As the juice flows freely, and for a short time only, a boy could soon collect a large quantity where the plants are abundant. An incision near the root appears to give the largest quantity, but several successive incisions might be made in the bark from the ground upwards as high as can be reached. The liane should not be pulled down, as the leaves would be deprived of the near sunlight the tops of the trees, and the plant would soon die. Care should be taken not to cut into the bark deeper than is necessary, so that the wound may soon be healed by the formation of new bark. What amount of cutting, the "Milk Withe" will endure can only be determined by observation. Collectors should therefore first be carefully chosen, until certain rules can be determined upon for the guidance of others. Exposure of the collected juice in a shallow vessel to the heat of the sun would perhaps be found sufficient to coagulate the caoutchouc.

9. If the export should prove to be a success, there ought to be no difficulty in propagating the plant in the woods in large quantities, so as to multiply the amount available, and to supply the place of plants which had become exhausted by constant incisions. A large area of land which is at present almost valueless would thus be utilised and be a source of profit.

10. It would be desirable to publish the correspondence for the information of owners of property,

I have &c., W. Fawcett,
Director of Public Gardens and Plantations.

The Hon. Neale Porter, C.M.G., Colonial Secretary.

Extract from Kew Bulletin.

Lagos Rubber, (*Ficus Vogelii*, Miq.)

The investigation of plants likely to yield the caoutchouc of commerce is being carried out in West Tropical Africa by numerous correspondents of Kew. Possibly in no other part of the world is there such a wide field for investigation of this kind, and in recent years a considerable trade in india-rubber has arisen through the exertions of officials and traders who have given attention to the subject.

A useful summary of information respecting West African rubbers is given by Captain Moloney in the *Forestry of West Africa*, pp. 78-95. At present the chief rubber-yielding plants on the west coast appear to belong to species of *Landolphia.* These are climbing shrubs with stems 4 to 6 inches in diameter near the ground, but dividing above into numerous branches which support themselves on the neighbouring trees. The rubber of the Gold Coast, known in commerce as Accra rubber, is the produce of *Landolphia owariensis*, Beauv. This is probably the best rubber plant in West Africa. The rubber is obtained by cutting off portions of the bark in strips varying in length from 3 to 10 inches. The cuts are made sufficiently deep to reach the latex canals, and soon the crude juice starts out in drops and gathers on the newly-cut surface. The rubber of the *Landolphia* coagulates on exposure to the air and requires no preparation other than rolling it up into ball. "A quantity of milk is first dabbed on the fore arm of " the operator, and being peeled off forms a nucleus of the balls. This nucleus is applied to one after " another of the fresh cuts, and being turned with a rotary motion the coagulated milk is wound off like " silk from a cocoon. The coagulation takes place so rapidly on exposure to the air that not only is every " particle cleanly removed from the cuttings, but also a large quantity of semi-coagulated milk is drawn " out from beneath the uncut bark, and during the process a break in the thread rarely occurs." [Kew Report, 1880, p. 40.]

Another method of collecting West African rubber is described as follows: The blacks wipe off the milk with their fingers and smear it on their arms, shoulders, and breasts, until a thick covering of rubber is formed. This is peeled off their bodies and cut into small squares, which are then said to be boiled in water. In European markets such rubber appears in more or less agglutinated masses of small cubes. Specimens of such rubber are shown in the Kew Museums under the name of Thimble rubber [*ib.*, p. 39].

The quantity of rubber exported annually from West Africa from British and other possessions is about 30,000 cwt. The value in 1885 was 265,017*l.*

It appears that in some districts, such as the Gaboon, owing to the reckless destruction of rubber vines the trade is becoming less and less every year. In the other districts the trade is gradually increasing. Attention has been specially directed to rubber plants in the colonies of Gold Coast and Lagos, and owing in a great measure to the interest taken in the subject by Captain Moloney, the exports from these British possessions have risen from nothing in the year 1882 to a value in 1885 of 69,911*l.*

There are doubtless other plants in West Africa from which commercial rubber might be obtained. The Mbungu rubber plant is *Landolphia florida*, Bth. This is distributed over the whole of Central Tropical Africa. There are also several species of Ficus, the original genus yielding commercial rubber, which deserve to be investigated.

We are glad to find that following the enterprising example of the Governor of the Colony of Lagos, Captain A. C. Moloney, C.M.G., Mr. Alvan Millson, Commissioner of the Western District residing at Badagry, has recently given attention to the preparation of commercial rubbers from the latex of the trees generally known there as "Abba" trees. Mr. Millson previous to taking up his duties at Lagos had served in British Honduras, where he had become acquainted with the preparation of what is known in commerce as Nicaragua or Central American rubber, the produce of *Castilloa elastica.* A contribution on this latter subject from Mr. Millson will be found in the *Kew Bulletin* for the month of December 1887, p. 14.

The investigations undertaken by Mr. Millson in the West Africa are described in the following notes which have been communicated to this establishment by the Secretary of State for the Colonies :—

Badagry, 15th April, 1888.

In nearly all the native villages in the western district of the colony of Lagos, and, I believe, throughout the colony and interior, are to be found large spreading trees, which have been planted for shade in the market places, streets, and compounds. These trees are of the fig family, and are called by the natives *Abba.*

I have measured a tree of this species of the age of 13 years, and found its girth, at 3 feet from the ground, to be 3 feet 4 inches, and its height to the branches 12 feet, while its total height could not be less than 50 or 60 feet, and its foliage area a quarter of an acre. A tree of this size ought to give large quantities of milk if tapped at the right time of the year. Although it was in fruit when I tapped it, and the season being very dry, was in every respect unsuitable, yet the milk exuded in large drops, and flowed for a considerable distance down the trunk. Three quarts of milk were extracted from this tree without injuring it in any way, and I have little doubt that at any time between the months of July and Febuary from four to five gallons could have been obtained with but little trouble. The trees, however, should only be tapped on alternate years, so as to leave time for fresh growth of bark to replace that which is removed. It is difficult to form an accurate estimate of the per centage of dry rubber that would be yielded by a gallon of milk, but I have reason to believe from previous experiments on Central American rubber trees (*Castilloa elastica*) of similar richness of milk, that each gallon should give about three pounds of india-rubber. The value of the rubber produced depends largely upon the care with which it is prepared, and I have reason to believe that the milk of this species, at least, of the "Abba" tree, can be made to give an excellent sample.

Should the above facts be established, it becomes evident that plantations of the "Abba" tree would be a highly profitable investment. It is planted by the simple method of cutting off a branch and pushing it into the ground, and on account of the facility and rapidity with which it is raised, the natives used it largely for fence posts. From the trees already in full growth in the bush and towns a considerable export trade could be readily established, and careful planting would develop this trade to almost an unlimited extent.

The rubber gatherer has no need of expensive implements or heavy baggage when he goes into the bush to collect and prepare the milk. He should take half a dozen or more well-cleansed kerosine-oil tins. With these tins, a sharp cutlass, a few yards of strong cotton cloth, and a sieve made of doubled muslin fastened like a jelly bag to a round hoop, he has all that he absolutely requires for his work.

On reaching the tree to be tapped, deep incisions are made on one side only of the stem and branches. The milk, as it flows from the incisions, is directed into the collector's vessel by a small piece of tin which is inserted into the bark so as to serve as a spout.

When the day's work is done, the milk should be mixed with an equal quantity of pure rain water, and strained through the sieve into clean kerosine-oil tins, which have been well scalded so as to remove all traces of grease. The mixture should be left to stand, without being moved or shaken, for 36 hours. The milk will then have risen to the surface, and the water and impurities which have sunk can be drawn away through a small hole near the bottom of the tin, which has been stopped by a plug of wood. As soon as white particles are seen to pass through the hole with the water, the plug should be inserted, and the washed milk poured into the prepared tin, with the cotton-cloth bag inside.

The milk, having been poured into the bag until the tin is half full, should be left with the mouth of the bag well tied, and a square piece of wood lying on the top of it for 12 hours. A bag of sand weighing about 10 pounds may then be put on to the top of the piece of wood for another 12 hours. Quantities of discoloured water will be seen to flow from the perforations in the sides and bottom of the tin during this process, and on touching the top of the bag it will be found to offer some resistance to pressure

A stout tree branch about 20 feet long should now be cut and trimmed, or if palm-leaf "bamboos" are obtainable, six or eight of them can be strongly lashed together. The poll thus obtained should have one end firmly fixed by thrusting it into a hole dug under a strong tree root, and a block of wood having been cut large enough to fit loosely into the tin, so as to rest on the square piece of wood which lies on the top of the bag of rubber, and to project above the mouth of the tin for about a foot; the tin and block should be thrust under the pole at the distance of perhaps a yard from the end which passes under the tree root. A large bag should now be filled with sand, and hung on to the pole. It is evident that the farther this bag is moved up the pole, the greater will be the pressure on the block of wood which acts as the fulcrum of the lever, and consequently upon the bag of rubber milk upon which it rests. Great pressure can be brought to bear by this simple means on the coagulating juice. Indeed, it will be found advisable to have the prepared tins replaced in their wooden case, and to press the milk in them side by side, by placing a flat board from block to block, and allowing the pole to rest upon that rather than directly upon the blocks. Unless some such precautions be taken, the tins will be apt to bulge, and perhaps burst outwards, when full pressure is applied.

The bag of sand should weigh about 100 pounds, and should be hung as near the tin as possible for 12 hours. It should then be moved along the pole gradually until it reaches the end farthest from the tin, where it should be left for two or three days.

On removing the weights and taking the bag out of the tin, which can be done by pressing the sides and lifting slowly, the mouth of the bag may be untied and the rubber removed, by turning the bag inside out. It will not be found to adhere to the cloth in the slightest degree, nor will there be any traces of viscosity in the rubber itself. It will appear as a white semi-elastic mass, which on exposure to the air will gradually turn black, and will gain in elasticity as it dries.

The samples when prepared should not be unnecessarily exposed to the sun, but will not be injured in any way by exposure to rain. They will, if anything, be improved by immersion in water.

The above method was followed when preparing the sample which I forward as Exhibit No. 1. At this season of the year it is difficult to obtain large enough quantities of milk for extensive experiments, and the specimens I am able to show are in consequence too small for commercial purposes. It is, however, my intention to continue the experiments on which these notes are based when the rains begin and the trees yield more sap. A further report will then be submitted should any new features present themselves.

Exhibits Nos. 2 and 3 are of unwashed milk coagulated by pressure, but as an insufficient weight was applied, they show a cellular structure, and are also not free from impurities.

Exhibits Nos. 4 and 5 are of shade-evaporated, unwashed milk, and are of fair quality. This method, however, cannot well be applied during the rainy season without the application of artificial heat, which I have proved to give unsatisfactory results.

Exhibits Nos. 2, 3, 4, and 5 are the results of preliminary experiments which were carried on with a view to proving the possibility of adopting, for the preparation of West African rubbers, the process described in notes already submitted to the Government of this Colony (see Government Gazette, Colony of Lagos, February, 1888.)

Exhibit No. 1 shows that the method indicated has been to a certain extent successful, even under extremely adverse circumstances. It will, however, be for experts in England in point out the good and bad qualities of the samples, and to declare the price that it ought to command in the English market.

These notes have been strictly limited to the consideration of certain attempts to apply the method above described to the preparation of india-rubber from the juice of the "Abba" tree. There is now on hand a series of experiments on the "Ibo" vine juice, which may be further reported on when complete, but at present no results have been arrived at of sufficient definiteness to warrant a detailed report.

It is important to remember that the results here noted have been obtained from one series of experiments only, and are not to be considered as in any way final. They serve to prove the possibility of applying a simple and inexpensive system of preparation to African rubbers which has already produced good results elsewhere. It will always be a sincere pleasure to me to show what little I know about the subject to anybody who may be sufficiently interested by these suggestions to wish to apply them to the preparation of india-rubber for the European market, and any question addressed to me in writing will also meet with attention, and will be answered as fully as my slight knowledge of the matter may permit.

ALVAN MILLSON.

As it was the desire of the Government of Lagos to obtain an authoritative opinion upon the specimens of rubber prepared by Mr. Millson, the good offices were sought of Mr. S. W. Silver, F.L.S., who already has most obligingly assisted this establishment in the investigation of specimens of rubbers obtained from various sources. Mr. Silver was kind enough to forward the samples of "Abba" rubber to the India Rubber, Gutta Percha and Telegraph Works Company, Limited, at Silvertown.

The report received on the specimens is as follows :—

Report on Five Samples of India-rubber, received from S. W. Silver, Esq., 6th July, 1888.

The samples are numbered in accordance with the report of Mr. Alvan Millson.

No. 1 internally was dark in colour, almost black, with a bluish fringe, tint gradually vanishing towards centre, which is nearly white. It was strongly alkaline in patches, evidently due to a little original moisture, other portions neutral.

No. 2, light (white) colour in centre, blackened about ½ inch in depth, reddish fringe, very faintly acid.

No. 3, pink colour, blackened about ½ inch in depth, contains much wood; slightly acid, especially in neighbourhood of woody particles.

Nos. 4 and 5. No. 5 is softer than No. 4, and lighter in colour; both samples have a pink tint and are distinctly alkaline.

Samples marked No. 1, No. 3, No. 4 were treated in detail; the quantity of the others being too small. Washing and drying, No. 1 lost 1·42 per cent. moisture, No. 3 lost 5 per cent., and No. 4 lost 7 per cent.

The temperature of the drying room was that used for the usual descriptions of rubber. If the samples had been hung up as usually adopted, the want of strength and firmness would have caused them to drop. Other means of drying would have to be devised. When dry No. 1 was very clammy, No. 3 was firmer than No. 1, but not nearly so good as No. 4. No. 4 might be more easily handled in drying.

They were all very short, with very little elasticity, this might have been expected from appearance of the original samples. They were kept in the drying room no longer than would be required if working on a practical scale.

Mixed with a suitable proportion of sulphur and vulcanised, they cured soft and short, but were not blistered. With pigments it may be made firmer and slightly tougher. It can evidently not be used by itself in any form. All the sample were troublesome to work in the mixing machines. It would not be right to assume that this behaviour is in any way a barrier to its usefulness.

When we take into account the great improvements which have been introduced in preparing certain African and Asiatic varieties of rubber, manufacturers must feel that the praiseworthy efforts of Mr. Alvan Millson to increase our sources of supply are in the right direction. Whether the recovery of the rubber from the "Abba" tree in the way these samples have been prepared is such as to ensure the best product in a commercial sense, is a most important matter. The sap of a tree may contain a large quantity of caoutchouc, but the same may be associated with other principles contained in the same or other plant tissues, which completely modify its character. It is this consideration which would lead one to ask how far the treatment of the juice of the *Castilloa elastica* can be applied to another plant, the juice of which, though containing caoutchouc, has very marked chemical differences.

I am not aware of any native india-rubber with an acid reaction; even the juice of the Para rubber tree *Hevea brasiliensis*, is distinctly alkaline when drawn, and exhales a strong smell of ammonia. The rubber from this source is strongly acid. In roasting the nuts of the Urucari palms, a large quantity of acetic acid is given off, which probably, by neutralizing the ammonia, brings about the coagulation of the caoutchouc, the excess of acid from the roasting of the nuts may help to explain the acid reaction of the Para rubber, but as the negrohead variety is obtained from the same source, and is *not* smoked although it is strongly acid, we must consider the generation of acid as due to fermentation, at least in a very great measure. The samples obtained from the "Abba" tree are not acid, but whether the product could be improved by precipitation with ordinary crude acetic acid, which at the same time would arrest those changes which are liable to go on afterwards, to the detriment, probably, of the rubber, is worth finding out. I thought it would be important to ascertain whether the soft clammy condition of the samples was due to oxidation, or to the presence of resinous matter. A white pulverulent resin was obtained from sample No. 4, amounting to 21·48 per cent. of its weight. The caoutchouc, by destructive distillation, yelded caoutchucene and the other products obtained from india-rubber. When resins exist in the juices of india-rubber yielding plants, as a rule they are combined with water, as hydrates, which is fatal to their use for vulcanizing, since such rubber blisters when cured. On boiling the resin with caustic potash, a large quantity of ammonia was given off. In the present case, although such a large quantity of resin is present, the rubber cures quite solid, but soft and short, this may be due to the resinous matter. The oxidation of the rubber itself will not account for it. The rubber may be hardened by pigments but its strength is still very low. It can be mixed with other low class rubbers with a corresponding improvement in toughness and strength.

In a locality so favourable for the growth of india-rubber producing plants, it would be interesting to know, whether any of the plants yielding good descriptions of rubber could be acclimatised successfully without invalidating the product. Common alum is sometimes found in the Para rubber, being used as a medium for coagulating, perhaps it may be useful in the present case.

I was informed by a friend who spent some time in Africa, that a very large quantity of crude acetic acid was shipped to different parts on the East Coast some years ago, and was evidently used in preparing india-rubber.

In smoking india-rubber, any plant may be used which yields acetic acid, but any plant yielding turpentine or similar products should be avoided.

The preservative action of the crude acid is enhanced by creosote and tarry matter present. Para rubber is flavoured with these.

While forming a favourable opinion of this gum, we cannot fix a value upon it, as everything will depend upon how far the experimental working can be verified in working on a larger quantity. As a supply of this is at present available, we would suggest that a larger quantity be sent over. say 100 pounds, so that we could test it in a practical manner, and thus give a better opinion as to its commercial value. We may observe that it is always more difficult to give a fair result on such small quantities, and it is therefore the more important that a supply sufficient for practical use should be sent.

India Rubber, Gutta Percha, and
Telegraph Works Co. (Limited), Silvertown.

The results of the inquiry and the suggestions offered by this establishment are contained in the following letter addressed to the Colonial Office for communication to the Government of Lagos :

Royal Gardens, Kew, to Colonial Office.

Royal Gardens, Kew, September 11, 1888.

Sir,

I am desired by Mr. Thiselton Dyer to acknowledge the receipt of your letter of the 16th June last forwarding papers and specimens from the Government of Lagos, relative to some experiments which had been made by Mr. A. Millson on the preparation of rubber from the Abba tree.

From the botanical specimens forwarded by Mr. Millson, Professor Oliver has arrived at the conclusion that this particular "Abba" tree is probably *Ficus Vogelii*, Miq , a West African rubber tree first collected by Vogel at Grand Bassa. This determination, however, owing to the character of the specimens, is not quite conclusive. It is very desirable that a full set of material be sent in all cases of this kind, which should contain young terminal shoots, as well as, portions of the branches, leaves, flowers, and fruits.

The various samples of rubber as received were forwarded, through S. W. Silver, Esq., F.L.S., to the India Rubber, Gutta Percha, and Telegraph Company (Limited) at Silvertown. The samples have received a very careful and exhaustive examination at their hands, and we have received from Mr. Silver a full report, a copy of which is herewith enclosed.

It is necessary in the first place to point out that rubber from the Abba tree similar to that under notice has already been investigated at this establishment. In the Kew Report for the year 1878, p. 39, a notice appears of Liberian rubber, which was identified with *Ficus* (Urostigma) *Vogelii*. This rubber, a sample of which is in the Kew Museums (from Mr. Thomas Christy) is made up into balls about the size of a large orange. It was valued (in 1873) at 1s. 6d. per pound, but it is added that "if sent home cleaner it would command a higher price."

It will be noticed that in the report furnished by the India Rubber, Gutta Percha, and Telegraph Works Company it is stated that the specimens received from Mr. Millson show an alkaline reaction and that on this and other grounds, such as the presence of resin and its soft clammy condition, "it can evidently not be used by itself in any form."

Mr. Millson's experiments are evidently based on his knowledge and experience of Central American rubber the produce of *Castilloa elastica*. It is probable, however, that the treatment suitable to the juice of this plant cannot be applied to another plant the juice of which, although containing caoutchouc, has very marked chemical differences.

The result of the inquiry so carefully conducted by the India Rubber Company would appear to show that the juice of *Ficus Vogelii* does not lend itself satisfactorily to such treatment. It is said that the rubber hitherto prepared from this tree has been treated with acetic acid, and if this is the case, possibly in this direction may be found a solution of the problems involved.

It is desirable in any future experiments carried on with india-rubber on the West Coast that larger samples be forwarded to this country for the purpose of testing the quality. In the report it is stated that about 100 pounds is necessary to test rubber in a thoroughly practical manner

In order to afford every information to the Government of Lagos in its praiseworthy efforts to develop the rubber industry of the colony there is forwarded herewith a parcel containing samples of "Abba" rubber in different stages of manufacture, together with specimens of commercial Para* and Accra rubbers now in large demand in this country.

If the experiments are continued, as it is hoped they will be, and if the valuable suggestions contained in the report are carefully carried out, it is pretty clear that Mr. Millson will be able to discover a practical and efficient method of preparing the juice of the Abba tree so as to produce commercial rubber.

There are few subjects at the present time of greater importance than a careful investigation of caoutchouc plants, and the extensive distribution of Abba trees in the West Africa indicates a wide and useful field of inquiry.

I am &c.,

(Signed) D. Morris.

Sir R. G. W. Herbert, K.C.B., Colonial Office.

Mr. Alvan Millson to Royal Gardens Kew.

Badagry, West Africa, August 16, 1888.

Your letter of the 4th ultimo reached me yesterday. I regret that the samples of rubber sent by me were—owing to the difficulty of obtaining pure milk—both small and of inferior quality to those which

* Para rubber is yielded by *Hevea brasiliensis* and Accra rubber by *Landolphia owariensis.*

have since been made. I was sorry also not to have had an opportunity of correcting the notes for the press, as I notice several misprints in them.

You were correct in your belief that the name "Abba" is applied to all arboreous fig-trees in this neighbourhood. Of these there is a remarkable variety. I will at a later date send specimens prepared as you so kindly direct me.

An enterprising firm of Lagos merchants, who have lately established a branch house in Badagry, have made a fair begining in the rubber business.

So far as I can at present see, West African rubber will never be reliable so long as the natives have the preparation in their own hands. The milk bears transport well, keeps well, and can easily be tested, by letting a sample (mixed with water) stand for twelve hours in a glass vessel. Unless merchants employ reliable men to buy and coagulate the milk, I fear that the trade will be of a very ephemeral nature. Yet on the other hand it seems clear, from the large numbers of rubber-giving fig-trees, that a properly conducted trade would be a considerable source of future prosperity to the whole coast. The present palm oil and kernel trade may be said to depend upon the continuance of slavery, and is indeed in many ways an injury to the people.

The Governor of the Colony, with is usual insight, is encouraging cocca-nut planting and other similar industries, which will do much to improve the general prosperity. He has already proved that the india-rubber industry is by no means the least important of these branches of commerce.

ALVAN MILLSON.

PLANT NOTES.

Beaumontia grandiflora, Wall. This handsome, strong-growing climber is now (November) flowering profusely in many gardens. It belongs to the Order Apocynaceæ and is a native of northern India.

The flowers are bell-shaped, 4 or 5 inches long and about 4 inches across, pure white in colour, and delicately scented. They are produced in cymes, and I have counted as many as 30 flower buds, and expanded flowers in a single cyme. The plant is seen to the best advantage when trained over a high fence, or allowed to grow naturally over a spreading tree. It is easily propogated by layers. Branches 20 or 30 feet long may be laid on the ground pegged down at intervals, and covered with soil just at the joints. The soil should be kept moist, and in a few weeks it will be found that roots have been thrown out from the under surface at almost every joint, while the buds, or young branches on the upper surface, receiving increased nourishment from the newly-made roots, quickly develop and make plants of a nice size.

When 8 or 9 inches high they may be severed from the parent plant or branch. This should be done by cutting the branch through with a sharp knife, leaving half an inch to an inch of the old branch on each side of the young plant.

It is just as well to allow the young plant to remain in the ground for a few days after being severed, then they should be taken up carefully and potted, or planted in a permanent position, as may be desired. A good sandy loam will be found to suit this plant best, and it should have a fair supply of water.

There is a plant of *Beaumontia Jerdoniana,* Wight, at Castleton. It has smaller leaves, and is not such a robust grower as *B. grandiflora.* Its flowers too, which are not produced in such profuseness, are funnel-shaped, white in colour, but slightly suffused with pink.

Barleria cristata, Linn. This is a very attractive, free-flowering shrub, native of the East Indies. It appears to thrive well in any ordinary garden soil, and requires little attention. Its funnel-shaped flowers, which vary in colour from light purple to pinkish-mauve, are produced in great profuseness nearly all the year round. The plant stands the sun well, and is easily propagated by cuttings.

Strobilanthes coloratus, T. Anders. This is also an East Indian plant but, unlike the preceding, it does not thrive in the sun. It has ovate, serrated leaves, dark green above and purplish-claret colour beneath. The flowers are tubular, about one and a half inches long, pale purple in colour, and are produced in panicles, several hundreds in each panicle. The plant should be grown in a shady situation, and it requires good rich soil, and should never be allowed to suffer for want of water. When carefully treated it produces its beautiful flowers in great abundance. This very desirable garden plant was sent to Jamaica from the Royal Gardens, Kew, about two years ago. Cuttings root readily.

Orchids. These magnificent plants have received so much attention at the hands of English and other cultivators for so many years that it is surprising in Jamaica, the home of many beautiful species, one seldom meets with them in plant collections. Our native orchids are not so gorgeous as the wonderful Cattleyas, Lælias, Dendrobiums, Vandas, &c., found in other parts of the world, but nevertheless we have several really pretty species that are well worth growing. It must be borne in mind that the showy orchids mentioned above are often valued at scores of guineas.

As a rule our native orchids require little or no cultivation; if fastened on a Calabash, Mango, or Ginep tree, and given a little water occasionally during dry weather till they throw out fresh roots, and take hold of the tree to which they are fastened, little more is required. Those that may be treated in this way are:—Epidendrum fragrans, with its sweet-scented flowers; E. cochleatum, E. polybulbon, Broughtonia sanguinea, with blood-red flowers; Oncidium luridum, O. tetrapetalum, O triquetrum, Schomburgkia Lyonsii, Brassavola cordata, Aeranthes funalis, Ionopsis utricularioides, a charming, profuse flowering species; Brassia maculata, B. caudata, Pleurothallis longissima, &c.

Species that grow in the woods at 4,000 to 5,000 feet elevation should be kept in cool, shady places, and the atmosphere should be kept moist. Those requiring this treatment are:—Oncidium pulchellum, without a doubt one of the most beautiful little orchids known; Lælia monophylla, a plant that has been much sought after of late years by connoisseurs in orchidology, it produces orange coloured flowers nearly an inch across; Epidendrum jamaicense, Ornithidium confertum, Maxillaria palmifolia, Comparettia falcata, another beautiful species, but seldom seen; Macradenia lutescens, &c.

Of terrestrial species, Phajus grandifolius is undoubtedly the best we have. This orchid is said to be a native of China, and is supposed to have been introduced to Jamaica, but I have found it at all elevations from 500 to 5,000 feet, growing in ravines, and in virgin forests, miles away from any habitation, so that I am inclined to regard it as a native plant. If not native, it certainly as become thoroughly naturalized, and is very plentiful. Bletia Shepherdii. B. purpurea, B. verecunda, and Cyrtopera Woodfordii. All these should be grown in pots in a good loam, and they should have plenty of water till they finish flowering, then they should be kept rather dry till they begin to make fresh growth.

W. Harris.

FREE GRANTS OF PLANTS.

Free grants are occasionally made from the surplus stock only to public institutions, but it will save some correspondence, if information in the following particulars are forwarded with the application :—

(1.) Are the plants required solely for the grounds of the public institution named?
(2.) Are these grounds fenced securely against the intrusion of goats, pigs and cattle?
(3.) Do you undertake to keep the fences in proper order?
(4.) Is there any provision for watering the plants, and tending them while young by keeping down weeds, &c?
(5.) Do you undertake to have holes dug for the plants before you send for them, and to have them planted at once when received?
(6.) What is the area of the ground?
(7.) Are there any trees or shrubs already growing?
(8.) Describe the situation and soil.

Carriage of the plants from the Gardens to Kingston must be paid for, before they are sent away.

THE IMPORTANCE OF SEED.

I imported a packet of seed of the "Telegraph" Cucumber which after paying duty and other expenses, cost me one shilling and three pence. It contained six seeds, all of which germinated, but one plant was accidentally destroyed. The remaining five plants were put in a bed about 7 feet long by 3 wide; the soil being a very sandy loam well manured with rotten horse dung. The vines were allowed to run on Lignum Vitæ branches, which being very twiggy give good hold for the tendrils; thus the fruits are kept off the ground and grow of a better shape. The plants were regularly and copiously watered by means of hose and rose. They grew luxuriantly and began to bear in about two months, yielding fruit from the end of January to the end of April. Many of the fruit were 22 inches long and weighed over three pounds each; frequently between two and three dozen fruit have been hanging on the vines at one time. Until the showers early in April these vines were free from caterpillars and aphides; but then they soon lost their healthy appearance, aphides having attacked them and also a few caterpillars of the moth Phakellura hyalinata.

At the same time that I imported the 'Telegraph' I also imported seed of a common field variety of cucumber, " White Spine," obtaining for one shilling an ounce, containing hundreds of seeds, which were treated in the same manner, and at the same time, as the more expensive kind. They germinated very fairly, and the plants were set out in beds of the same soil similarly prepared as that which received the 'Telegraph' plants; in fact all the plants were treated alike. The 'White Spine' plants occupied beds thirty or forty times as long as that in which the 'Telegraph' grew. They grew well, but by no means as luxuriantly as the finer kind; they fruited fairly, but were soon exhausted, and were all dead by the middle of March. The whole lot did not yield so great a weight of fruit as the five "Telegraph" plants, while the fruit of the latter were in every respect far finer.

I do not mention the above facts as condemning the 'White Spine', but as showing that under the given circumstances the 'Telegraph' is far superior. There may be circumstances in which the reverse would be the case, in which the more delicate variety would not be able to thrive, while the White Spine would do fairly well. But the facts do show the supreme importance of good seed, using the word "good" to signify "adapted to give the best results under the particular circumstances of the case." The six seeds cost 25 per cent more than the common seeds, but gave fully that excess of weight ot superior fruit, with but one thirtieth or fortieth of the labour in cultivation. Surely there is no subjecf better deserving the earnest attention of the Horticulturist and Agriculturist than the selection of 'Good Seed'; including in the term 'Seed' whatever is sown or planted.

J. J. Bowrey.

Note.—A subscription of 2s. will ensure the delivery at any Post Office in Jamaica of 12 numbers of the "Bulletin." Application may be made at any of the Gardens, or by post to the Director of Public Gardens and Pantations, Gordon Town, P.O., Jamaica.

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1889

REPORT

BY THE

DIRECTOR OF THE PUBLIC GARDENS AND PLANTATIONS ON THE CAYMAN ISLANDS.

Botanical Department, Gordon Town P.O., Jamaica, 22nd December, 1888.

SIR,

I have the honour to forward the following Report of a visit of a few days to the Cayman Islands, during last May.

2. The Cayman Islands, consisting of Grand Cayman, Little Cayman, and Cayman Brac are situated about 180 miles to the north-west of Jamaica, and perhaps the same distance south of the centre of Cuba, that is to say, between the meridians of 79° 44′ and 81° 26′ W. and the parallels of 19° 44′ and 19° 46′ N.

3. Grand Cayman is the largest of the group. Its greatest length, running east and west, is stated to be 17 miles, but the road which passes along the south coast must be twice as long. It is 4 or 5 miles broad at the eastern end, and 7 or 8 at the west end. A large bay, 6 miles across, called the "Sound," cuts into the land on the north side, so that the western portion of the island is a narrow slip from half to one mile broad. The island is low, and surrounded by coral reefs. The "Handbook of Jamaica" states that "the coast is in some parts bold and rock-bound, but with no elevation exceeding 150 feet;" but certainly in the western part of the island, the elevation is nothing like so much.

4. The beach in all the islands is composed of the *débris* of coral, the pieces ranging in size from large lumps to fine sand. Within the beach the coral is consolidated into a limestone rock, but the surface is very rough and uneven, due probably to the carbonic acid in rain-water acting with different degrees of intensity on the varying character of the rocks. The residue from this chemical action is the red clay which forms the soil. In Cayman Brac, along the west coast, there are cliffs at a short distance from the shore 40 or 50 feet high. The character of the islands from a geological point of view appears to be similar to that of the formation known as the "white limestone" in Jamaica.

5. In Grand Cayman, subterranean caves occur; one was pointed out to me not far from the road on the south coast. There is a gentle slope down to the level of the water at the mouth, so that it is very useful as a natural reservoir for watering cattle. The cave takes a sudden turn, so that I could not determine whether it is of large dimensions. There is another cave at Bodden Town, which I was told was very much larger, but there was no time to visit it; the "Jamaica Handbook" says that it "extends some hundreds of yards under the sea." Another curiosity mentioned in the Handbook is "a natural cistern of unknown depth, containing clear sweet spring water, at East End. This cistern measures about 50 feet across and is situated in the middle of a cliff of solid flint rock."

6. There are large phosphatic deposits in Grand Cayman and Cayman Brac. A Jamaican Firm is exporting from the former island, but the deposit on Cayman Brac is not at present worked. Phospates are so called, because they are combinations of phosphoric acid with other bodies such as calcium and aluminium. They are very important in agriculture from their use as manures to supply the amount extracted from the soil by growing crops; for instance, it is calculated that wheat removes from the soil 23℔s. of phsphoric acid per acre, and beans 29℔s. Most phosphates must be mixed with about two-thirds of their weight of sulphuric acid to render them soluble and capable of being absorbed by the roots of plants; but the great advantage of the Cayman phosphate is that this operation is not necessary, as it is already sufficiently soluble for use as manure. Some phosphatic deposits are accumulations of phosphatized fossil remains, but no fossils have been found in the Cayman phosphates. A tooth of an ox was given to me, found at a depth of 20 feet in the phosphate, but I have no doubt that its presence there was due to some accidental cause. Other deposits are the altered excrement of animals. Sawkins in the Appendix to the "Geology of Jamaica" refers to the phosphates of the island Sombrero as follows:—"From my observations on this island I feel fully convinced the deposit of phosphoric acid in the pores and cavities of this rock is due to a percolation of the sea water rather than from the guano of birds. The finer tissues of the corals are found saturated with phosphate, as are the bones of the turtle also without the slightest alteration in form. The casts of shells are covered with a thin film or coating of phosphate. The druses in the coralline portions are often crystallized with "Sombrerite," the nacreous part of the shells are dissolved out and partially filled with a thin coating of phosphate. Mr. Bowrey, Island Chemist, has analysed the Cayman phosphates, and has been kind enough to give me the following notes:—

"The Phosphate rock of the Cayman Islands varies much in the proportion of phosphate of lime it contains. Picked samples may be nearly pure phosphate of lime, on the commercial sale rock can be obtained with from 60 to 80 cent. of phosphate of lime. From these high percentages the proportion of phosphate varies down to vanishing point, as it decreases, the quantity of carbonate of lime, or red clay, or of both, increases.

"The following analyses will give an idea of the composition of good commercial samples of the Cayman Phosphate Rock :—

		a.	b.
Moisture	.. ...	4.34	3.66
Organic matter and loss on ignition	...	4.56	5.76
Sand &c. insoluble in Hydrochloric Acid	...	0.17	2.05
Alumina $Al_2 O_3$	... ...	1.41	6.20
Ferric Oxide $Fe_2 O_3$	... ...	0 67	3.43
Magnesia MgO	... ...	0.70	...
Lime CaO	... ...	48.30	43.85
† Carbonic Acid CO_2	... ...	2 89	3.03
* Phosphoric Acid $P_2 O_5$	... ...	36.96	32.16
		100.00	100.14
† Equivalent to Carbonate of Lime	...	6.57	6.90
* " " Phosphate of Lime	...	80.76	70.20

"The Cayman phosphate is evidently the result of the action of water; samples are frequently found with considerable resemblance to Agate showing a banded structure due to intermittent deposition from solution. Nor have these phosphates been exposed to much if any change since their formation, they therefore remain in a comparatively soft condition, rendering the phosphate more soluble in water, and especially in water charged with carbonic acid, than are apatite or other more changed and hardened phosphate of lime. Hence the special value of the Cayman phosphate as a manure, without further treatment than simple powdering.

"I have not seen the Cayman phosphate in situ but judging from the samples I have examined, and the accounts given by those who have visited the Islands in search of phosphates, I have no doubt they have been formed in the same manner as the phosphate of lime upon the Pedro Cays. These latter I have studied, having twice visited the Cays, on each occasion spending several days upon them. The mode of formation appears to be as follows:—The Cays are formed of coral limestone and much of their surface is covered with coral sand. Enormous numbers of terns resort to these Cays during the nesting season; their eggs are brought to Kingston and sold here as booby eggs. Other sea birds in smaller numbers live upon the Cays all the year round Crabs of various kinds swarm upon them at night spreading over every part of the islands; I have seen the ground in some places completely covered with their dung. Much rain falls upon the Cays, the rain water dissolves the soluble alkaline phosphates out of the more or less decomposed bird and crab dung. This solution percolates through the limestone or coral sand giving rise to a double decomposition, whereby the limestone parts with carbonic acid taking phosphoric acid from the solution in its stead. Thus carbonate of lime, i.e., limestone, coral sand, &c., is converted into phosphate of lime. No doubt the rain water also removes much carbonate of lime by direct solution thus aiding the accumulation of phosphate of lime.

"That this is the manner in which the phosphate of lime is formed is evident from the following facts. One portion of one of the Cays is free from coral sand, its surface consisting of bare rock, here the true booby habitually lives and breeds, and the surface of the rock, if not recently disturbed, will be found to be phosphate of lime mixed with a little organic matter but free, or nearly free, from carbonate of lime. The deeper one digs into the rock the smaller the proportion of phosphate and the larger the proportion of carbonate, hence in mining phosphate care must be taken not to remove too great a thickness of the rock. Again I found large surfaces of rock of paying quality to a depth of from 6 to 18 inches; the men employed in digging the phosphate assured me that that same area had been dug many years before and all paying phosphate removed. Plainly more had been formed in the interval preceding my visit. The same holds good for the portion of the Cays covered with coral sand, the upper layers are always the richest in phosphate; in digging, pure coral sand, without admixture of phosphate, is speedily met. Here again areas which have been exhausted of phosphate are found in time again to yield a surface layer of paying percentage.

"The similar action at the Caymans I think took place at a much earlier period, and possibly is now going on, but it was carried out to a much greater extent than on the Pedro Cays; as is evident from the amount of red clay on the Cayman Islands, this red clay being the residue from immense quantites of carbonate of lime removed in solution.

7. The plants which I collected, were sent to Kew, and I am indebted to the authorities there for their determination. The list of their names is added in an Appendix, and I have supplied notes of their geographical distribution. From this list it will be seen that about 20 per cent. of the species are found more or less throughout the Tropics. They are such as one might expect to find on any tropical island. It is interesting to note that one of the ferns *(Acrostichum aureum)* which is found growing to a height of 6 to 10 feet in swamps in Jamaica and throughout the Tropics, is one of the first plants to establish itself on the Island of Krakatao, where a terrible volcanic disturbance a short time ago completely destroyed every vestige of plant life. On its shore was also found the fruit of another plant occurring in the Cayman Islands, viz., the "Almond Tree" *(Terminalia Catappa.)* The gulf stream and equatorial current will to some extent account for a number of American and West Indian species. About 35 per cent. are found elsewhere in tropical America and the West Indies, more than half of which are found widespread over this region; others are more confined in their distribution, for instance *Cassia ligustrina*, is recorded only from Guiana besides the West Indies; others stretch beyond the region, one of the verveins *(Strachytarpheta jamaicensis)* being also found in Florida. About 16 per cent. also occur in parts of the West Indies and Central America, 14 per cent. in the West Indies, of

which 3 stretch north into Florida, and one into southern United States, 11 per cent. are found only in that region of the West Indies, comprising Jamaica, Cuba, Haiti, 4 of which are also found in the Bahamas and 2 in Florida. The two Orchids appear to be endemic, at any rate they are not known from any other locality. One of them *Schomburgkia Thomsoniana* was described for the first time last year, but its habitat was not known. It is a most beautiful plant in its native woods, the flowering stalk being 3 or 4 feet long, branching, and covered with a great number of gold and purple flowers. The first I found were growing in a small wood on the south coast of Grand Cayman on trees. Some miles further on, I discovered them growing on bushes on the sea shore far from any tree and almost on the ground. This same species was also abundant on Little Cayman and Cayman Brac. The other Orchid appears to have been hitherto quite unknown. It is nearly allied to the Jamaican *Dendrophylax (Aeranthes) funalis;* it resembles it in its white flowers, with long thin shoots, and want of leaves. It is fragrant, much larger than the Jamaica species and has a very long spur.

The following paragraph appeared, after this Report had been written, in the GARDENER'S CHRONICLE, November 10, 1888:—

Dendrophylax Fawcetti -Rolfe. n. sp.—This remarkable and not less beautiful Orchid is now flowering in the Kew collection, and for the first time. Imagine a tuft of roots, long, flexuose cylindrical, and greenish in colour, spreading in all directions from a very short tuft-like caudex, no leaves whatever, flowers 2 inches in diameter, the large bilobed lip pure white, the lanceolate acute segments of a most delicate greenish-white, and a slender pendulous spur 7 inches long, and you have the new plant; almost a counterpart of D. funalis, Benth— (the old Angræcum funale, Lindl., Bot Mag., t 4295), except some slight differences, and the gigantic spur, three times as long. It was found by Mr. W. Fawcett, F.L S., Director of the Jamaica Botanic Garden, in the Cayman Islands. Both living and dried specimens were transmitted to Kew during the past summer. Notwithstanding its leafless condition—for the green roots do the work of assimilating nutriment—the plant has thoroughly established itself on a block, and young shoots are pushing in all directions. The peduncle is but 2 inches long on this plant, but on a dried one sent home is at least 23 inches, or over ten times as long. It is hardly necessary to say that the plant is dedicated to its discoverer, with the hope that if other such novelties should be lingering in the West Indies, he will let us hear of them. Respecting this small genus there are, besides our novelty, D. hymenantha, Rchb. f, the original species, a native of Cuba, with flowers, including the spur, but half an inch long; D. Lindenii, Benth, with spur nearly as long as in our present species, but remarkably attenuated, acute lobes to the lip, a native of Cuba and Florida, in the latter locality said to grow on the stem of the Royal Palm; D. Sallei, Benth, a native of San Domingo, and D. funalis, Benth., a native of Jamaica. This latter rejoices in the following aliases—quite sufficient in all conscience—Limodorum funale, Sw; Epidendrum funale, Sw.; Aeceoclades funalis, Lindl.; Trichocentrum funale, Lindl.; and Aëranthus funalis, Rchb. f."

(Signed) R. A. ROLFE.

As I saw but a small portion of the Islands, and that chiefly on the sea shore, I feel little doubt that a complete collection of the plants would be of very great interest, and that perhaps other endemic species would be found.

8. With regard to cultivated plants, it may be gathered from the nature of the soil, and the wild plants that there would be a general resemblance to those of Jamaica. In Grand Cayman mangoes are not so plentifully distributed as here; they grow into fair-sized trees; fruit was not ripe, but was said to be inferior to some of the Jamaica mangoes. Oranges, both sweet and bitter, and a few lemons are produced, and great quantities of limes are exported pickled. Yams, cocoes, sweet potatoes, cassava, pine-apples, melons, sugar-canes, bananas, guinea-grass, all flourish. I took a few good pine-suckers with me and gave them to the Custos for trial. The sugar-cane looked poor but I was told that its indifferent appearance was due to long-continued drought, and that canes grow sometimes from 12 to 15 feet in height. There are a great number of papaw trees, some with thick trunk and several branches; the fruit is usually large and fine. There is a good deal of log-wood, fustic, mahogany, and hard-wood timbers. The logwood trees appear to be mostly young, all that was fit to cut having been exported. The mahogany and hardwoods are used in the construction of well built schooners up to 50 tons, the softer timbers for planking being imported from the United States. The good timber has been almost all cut down in the woods to the west and south; but I was told that there are great numbers growing still on the north side, where also the soil is depeer and richer, and more cultivation carried on than elsewhere. I was sorry not to have been able to go there, but as it was doubtful whether I could go and return in one day, I had to abandon a projected visit. It would be interesting to know what these timber trees are. The guava and the coco-plum grow wild. I saw two Coffee trees growing not far from the sea, and even in May after 6 months' drought, there was a fair quantity of berries on them. This is probably the first attempt to grow Coffee in these Islands, and the result appears to justify planting, where the soil is sufficiently deep.

9. In Little Cayman there is Mahogany but no Cedar *(Cedrela odorata);* and in Cayman Brac there is plenty of Cedar, but scarcely any Mahogany. In Little Cayman I was told that there is no logwood nor fustic, and that there was no logwood in Cayman Brac, but in the latter island I found fustic in the woods.

10. Coco-nut Palms grow on Grand Cayman, and Cayman Brac. Disease has for several years blighted the Palms in Grand Cayman, but no disease has appeared in the other island and I was informed that some 600,000 to 800,000 nuts are annually exported.

11. No accurate information could be obtained from the people as to the first appearance of the disease, some said it was 15 years ago, others again thought that it might have been 40 years. In a dispatch from the Marquis of Sligo in 1834, he mentions that all the Coco-nuts of the leeward side had been destroyed, but that the infection had not reached the windward side. It is probable that this was the same deadly disease. I saw a great number of these palms of different ages in various stages of the

disease, and at several localities. From George Town I went northwards about 7 miles to north-west point, and eastwards about 15 miles, some distance beyond Bodden Town. Seed is constantly brought from the mainland and the inhabitants have been most persevering in their efforts to re-establish their coco-nut walks, but it is of no avail. A grove may do well for a time, and produce a crop of fruit, but suddenly it is attacked, the disease often first seizing the tallest and finest palm. Or, again, the palms may all die off, when they are from 6 to 10 feet high, without producing any fruit. The disease is quite independent of the direction of the wind, travelling as often against it as with it. The outer leaves first show signs of the disease, gradually turning yellow, but I had several palms cut down, and invariably found that it was the bud leaves which were actually affected at the apex, and as the disease gained ground the outer leaves lost their green colour. Sometimes on cutting the stem right through just above the ground, it appeared perfectly untainted and smelt and tasted sweet. At other times when the disease had made more progress, though the stem section looked white, it smelt and tasted sour, and this occurred even when only the upper portion of the "cabbage" was discoloured. The discoloured portions were of a purplish black colour eventually becoming quite black. There was no sign of either the scale insect or the beetle which attack the Coco-nut Palm in Jamaica. In the early stages of the disease there is no appearance of an insect, but after decay has set in, various insects may be found, such as ants, a small beetle called the "coco-nut fly" and a white larva which may be that of the coco-nut fly. The only remedy that I can suggest is to take up each diseased coco-nut palm by the roots and burn the whole of it, root, stem and leaves on the spot where it was growing. To be effectual, it should be made compulsory by a local regulation, and some one should be appointed to see that the regulation is carried out. I cannot of course say that the disease will disappear, but I think that this plan is the only chance of getting rid of it,. And, I repeat, every single diseased palm without any exception, wherever it is found, must be exterminated. I suspect that the disease is due to the presence of a bacterium, and it is possible that it may gain access to the tissues through the stomata of the tender bud-leaves. Lime and phosphate probably encourage the disease, and it would be well to try the application of cattle-manure by digging it in round the roots, or, if this is not available, decaying weeds and other vegetable matter.

12 Increased attention might be given to various products, and a fair trial made of the cultivation of coffee. Common or Arabian Coffee appeared to do well, but it should be planted under shade trees. Liberian Coffee would no doubt succeed much better than Arabian and sell well in American Markets. In Johore Liberian Coffee from the 3rd to the 4th year yields about 3 cwts. per acre, and after that from 5 to 6 cwts. If any persons wish to start this cultivation, seed could be supplied from the Jamaica Gardens. Information as to planting, &c., is given in the Jamaica Bulletins Nos. 4, 5 and 6 ,and though these articles refer to Arabian Coffee grown on the mountains, the general method of cultivation can be easily ascertained and applied to Liberian Coffee grown at sea-level. Hand-pulping Machines are made by ordinary carpenters in Jamaica and could therefore be made also in the Cayman Islands from a pattern. It would probably be advisable to export common coffee in parchment, but Liberian Coffee should be thorougly cleaned. (See Kew Bulletin, No. 23, Nov. 1888.)

13. In cultivating products beyond the actual needs of the inhabitants, it will be well to give the first place to such as not only suit both soil and climate, but also are readily exported to foreign markets. For instance, probably no island in the West Indies is more suitable for the cultivation of pine-apples, if well drained, areas are chosen for planting, but the fruit does not last long, and the means of transport are both limited and uncertain. It is not advisable therefore to extend the cultivation of anything quickly perishable, unless it can be preserved by some means. Prepared articles like arrowroot, tapioca, guava jelly, can easily be stored until favourable opportunities occur for exporting them. Again, there is a good market for yams at Colon and Port Limon; the value of this export in Jamaica has risen from £48 4s. 3d. in 1881 to £15,978 18s. 3d. in 1887. Bananas, Oranges, and Mangoes would pay well, if there were schooners sailing regularly to New Orleans.

14. It appeared to me that in Grand Cayman the woods were being gradually cut down and no care taken to replant. This may seriously affect the future welfare of the islands, for if the woods disappear, the islands will become burnt up and barren; the rain which falls will not be retained in the soil, it will be impossible to keep cattle, and there will often be great hardship amongst the inhabitants for want of water. Care should be taken too that the growth of hardwoods used for shipbuilding be encouraged. The extermination of the hard timbers would lead to the extinction of ship building, for although even now planking is imported, it would scarcely pay to import the whole of the timber.

15 I have mentioned that I think that the flora of these islands would well repay the time spent on a complete collection, and a similar remark might also be made with regard to the fauna. A collector from the United States had just left when we arrived, and he is reported to have obtained new species of birds, insects, &c.

16. Such of the corals as were thrown up on the beach were of the usual West Indian types, and the shells were of common kinds. A collection of the mollusca which I brought back with me, was submitted to Mr. Henry Vendryes, who is well known in Jamaica and in England as an able conchologist, and I am indebted to him for the list given in the Appendix, and for the following observations :—"The shells were all dead shells, hastily gathered on the sea-level. The collector's time was too short to allow of the use of the dredge, or of the capture of living individuals *in situ* ; so as to ascertain peculiarities of station, depth of water, &c. The specimens, however, exhibit no signs of having been rolled in from afar; their condition varies gradually from fresh to faded, weather-worn, or bleached; and it is evident that they have been regularly thrown up from time to time, from the stations where they lived on the coral reefs, sloping sand-bottoms, and muddy flats of the adjoinining sea. They are not then, the mere " flotsam and jetsam" of the stormy Caribbean sea, cast up in strange

confusion with wracks and exuviae, on the beaches where they are found, but reliable examples of the living marine molluscan fauna of the Island.

"It is of course impossible to offer any safe generalizations, from such limited and imperfect material in connexion with the deep problems of origin, distribution, etc., but it may be useful to note, that the species are the same as occur at the Morant Cays, the Pedro Cays, and the shores of Jamaica, indicating a close principal alliance between the Grand Cayman and these places,—with, here and there, a species pointing to a wider sphere of derivation from the extreme eastern and southern limits of the Caribbean Province. Indeed, though but a small portion of the beach of Grand Cayman must necessarily have been explored in the collection which we are now examining, enough was got together, to show, what might have been predicated of the character of the marine fauna of the island, from its position within the province, and the currents which flow along and about it.

"Only one terrestrial Mollusk was obtained—namely, Pupa (*Strophia*) Martiniana Küster. It occurred in large numbers. The specimens collected are very fresh and well preserved, and one or two were alive when the parcel reached our hands. There can be no doubt, therefore, that the species is an inhabitant of the island. The species was first described, more than half a century ago, by Küster, but its habitat remained unknown, until a comparatively recent period, when Governor Rawson found specimens in one of the Bahamas, which were identified by Mr. Thomas Bland of New York. We now find it in Grand Cayman also. The sub-genus *Strophia* occurs in nearly all the West India Islands, except Jamaica or its outlying Cays. Its greatest development is in Cuba and the Bahamas. It is also found in Florida. *Strophia Martiniana*, however has not been discovered anywhere, but in a solitary island of the Bahamas group, and in the Grand Cayman. It seems difficult to account for the presence of this land-shell, in two such distant places, divided by what, to that class of creatures, must be formidable physical barriers, unless we appeal to the theory of separate creations, or plurality of origin, foreshadowed by Professor Agassiz, and advocated by Professor C. B. Adams, and many other eminent naturalists!

"From another source, I formerly received several very fresh specimens (though without animal or operculum) of *Helicina*, apparently an undescribed species; one specimen, dead but still fresh of *Tudora maritima* C. B. Adams; and also several much worn and bleached specimens of the group of *Helices*, to which *Helex chittyana* belongs, all collected inland, at the Grand Cayman. *Tudora maritima* is a Jamaica species inhabiting a rather limited area on the northside of the island, about midway; and *Helex chittyana*, inhabits the south-western Parish of Westmoreland.

"This collection, therefore, made under such very adverse circumstances, and imperfect as it is, must be accounted as a valuable example of the rich harvest which awaits future collectors at the Grand Cayman, and of the benefits to science which well directed and searching explorations of the molluscan fauna, marine as well as terrestrial are certain to afford to science. The minute marine shells alone, must present a vast and most productive field, in which much may be done."

(Signed) Henry Vendryes.

17. In conclusion I desire to express my sincere thanks to Capt. Mather Byles, R.N., and the other Officers of H.M.S. 'Tourmaline' for their courtesy and assistance in every possible way.

I have &c.,

W. Fawcett,

Director of Public Gardens and Plantations, Jamaica.

APPENDIX A.

Plants collected in the Cayman Islands by W. Fawcett

1. Argemone mexicana, L., George Town, *Mexico, Guatemala, C. Rica (throughout Tropics now).*
2. Cakile æqualis, L'Herit, Cayman Brac., *W. Ind. & S. U. States.*
3. Capparis cynophallophora, L. " *Trop. S. Amer. & W. Ind.*
4. Clusia sp. indeterminable " " " "
5. " " " " " "
6. Mammea americana, L. " " " "
7. Pavonia racemosa, Sw. " " " "
8. Sida carpinifolia, L., *Trop. Amer. (Tropics now).*
9. Hibiscus tiliaceus, L., George Town, *Amer. (Tropics).*
10. " clypeatus, L., Cayman Brac. *Jamaica, S. Domingo.*
11. Helicteres jamaicensis, Jacq. " *Panama, W. Ind.*
12. Melochia tomentosa, L. *Trop. S. Amer. & W. Ind.*
13. Malpighia setosa, Spreng. N. W. Point, Grand Cayman, *Bahamas, Haiti.*
14. Suriana maritima. L., Cayman Brac., *Tropics.*
15. Melia Azedarach, L. (M. sempervirens, Sw.) South Coast, also George Town, Grand Cayman, *India, &c. (cultivated in Tropics.)*
16. Trichilia terminalis. Jacq. (Acrilia Sloanci, Griseb.) Cayman Brac. "Bastard mahogany," *Jamaica.*
17. Swietenia Mahogani, L, *Central Amer., W. Indies, Peru.*
18. Colubrina ferruginea, Brong., George Town, *Bahamas, W. Ind.*
19. Vitis sicyoides, Bak., Cayman Brac., *Trop. Amer. W. Ind.*
20. " trifoliata, Jacq. " " " "
21. Cardiospermum Halicacabum, L., Cayman Brac., *Tropics.*
22. Spondias purpurea, L. "Yellow Plum" " Grand Cayman, *W. Ind., Colombia.*
23. Indigofera tinctoria. L., Nr. George Town, *cultivated in Tropics.*
24. Vigna luteola, Benth. *Tropics.*
25. Canavalia obtusifolia, D. C., Cayman Brac. and George Town, *Tropics.*
26. Cæsalpinia pulcherrima, Sw., George Town, *Trop. Amer. & W. Ind.*
27. Guilandina Bonducella, L., "Cock-spur," South Coast, Grand Cayman, *Tropics.*
28. Cassia ligustrina, L., near George Town, *W. Indies, Guiana.*
29. Bauhinia porrecta, Sw. (Casparea porrecta, Kunth) "Bull Hoof" Cayman Brac. and South Coast, Grand Cayman, *W. Ind., Mexico.*
30. Chrysobalanus Icaco, L., South Coast, Grand Cayman and Cayman Brac, *W. Ind. & Trop. Amer.*
31. Bryophyllum calycinum, Salisb, Cayman Brac. *Tropics.*
32. Terminalia Catappa, L, George Town, *Malaya (Planted in Tropics).*
33. Conocarpus erecta, L., Cayman Brac., *W. Ind. Trop. Amer., W. Trop. Afr.*
34. Psidium Guava, Raddi, N. W. Point, Grand Cayman, *W. Ind., Trop. Amer.*
35. Calyphanthes pallens, Griseb, Cayman Brac., *W. Ind.*
36. Eugenia sp.
37. Cascaria ramiflora, Vahl. Nr. George Town, *Panama, Guiana, W. Ind.*
38. Turnera ulmifolia, L. var. angustifolia Urban, S. Coast, Grand Cayman, *W. Ind. Trop. Amer.*
39. " " var. surinamensis Urban, Cayman Brac.
40. Opuntia sp.
41. Sesuvium portulacastrum, L., S. Coast, G. Cayman, *Tropics.*
42. Erithalis fruticosa, L. " " *Florida, Honduras, W. Ind.*
43. Morinda Royoc, L. " and George Town. *W. Ind., Honduras and Panama).*
44. Randia aculeata, L., var. mitis. L. S. Coast, G. Cayman, *Bahamas, W. Ind., Key West.*
45. Strumpfia maritima, Jacq., *Bahamas, Cuba, Guadeloupe.*
46. Chiococca racemosa, Jacq., Nr. George Town, *Trop. Amer & W. Ind.*
47. Psychotria lanceolata, Nutt. " *Florida, Bahamas, W. Ind.*
48. Ernodea littoralis, Sw. Cayman Brac. " " "
49. Vernonia arborescens, Sw. Nr. George Town, *Cent. Amer., Honduras & W. Ind.*
50. Eupatorium villosum, Sw. " and Cayman Brac., *Bahamas, Cuba, Jamaica.*
51. Wedelia carnosa, Rich. " " *Trop. Amer. & W. Ind.*
52. Borrichia arborescens, D. C., *Bermuda, Florida, Bahamas, W. Ind., Peru.*
53. Bidens leucantha, Willd., *Trop. Amer W. Ind.*
54. Ambrosia crithmifolia, D. C., *Florida, Cuba. Bahamas.*
55. Melanthera deltoidea, Rich, *Trop. Amer.. W. Ind.*
56. Achras Sapota, L., "Naseberry," Cayman Brac., *Trop. Amer. W. Ind.*
57. Plumieria alba, L., Cayman Brac., *W. Ind.*
58. Rhabdadenia Ehrenbergii, Muell. Arg. (Echites paludosa, Vahl.) nr. George Town, *Bahamas, Cuba, Haiti, Jamaica, Panama.*
59. Urechites suberecta, Muell. Arg. (Echites suberecta, Jacq.) nr. George Town, *Florida, Bahamas, W. Ind.*
60. Amphistelma filiforme, Griseb, *Cuba, Jamaica.*
61. Cordia globosa, Kunth. *Florida, W. Ind., Panama.*
62. Beurreria succulenta, Jacq.. N. W. Point, G. Cayman, *W. Ind.*
63. Tournefortia gnaphalodes, R. Br. "Lavender," George Town, *Florida, Bahamas.*
64. " cymosa, L. Nr George Town, *Florida, Bahamas, W. Ind.*
65. Heliotropium parviflorum, L. " *Cuba, Jamaica.*
66. Ipomœa pes-capræ, Sw. " *Tropics.*
66. " grandiflora, Lam. " "
67. " dissecta, Pursh. " "
68. " Jamaicensis, Don, *Mexico, Panama, Jamaica, Brazil.*
69. Solanum bahamense, L., George Town, *Mexico, W. Ind.*

70. Cestrum laurifolium, L'Herit, George Town, *W. Ind.*
71. Lantana Camara, L., George Town, *Trop. Amer.*, *W. Ind.*
72. " odorata, L. near George Town, *Honduras*, *W. Ind.*, *Galapagos.*
73. Stachytarpheta jamaicensis, Vahl. " *Florida*, *W. Ind.*, *Trop. Amer.*
74. Aegiphila elata, Sw., near George Town, *W. Ind.*, *Guiana*, *Brazil.*
75. Salvia occidentalis, L. " " *Florida*, *Trop. Amer.*, *W. Ind.*, *Galapagos.*
76. Boerhaavia erecta, L. " " *Georgia to Guatemala*, *W. Ind.*
77. Pisonia inermis, Jacq., *Trop. Amer.*, *W. Ind.*
78. Rivina lævis, L., George Town, *S. States*, *Trop. Amer.*, *W. Ind.*
79. Villamilla octandra, Hook f. (Rivina octandra, L.) Cayman Brac., *Trop. Amer.*, *W. Ind.*
80. Coccoloba uvifera, Jacq., George Town & Cayman Brac., *Florida*, *W. Ind.*, *Panama*, *Venezuela to Brazil.*
81. Cassytha filiformis, Jacq., *Tropics.*
82. Euphorbia heterophylla, L., George Town & S. Coast, G. Cayman, *Illinois to Peru & Brazil*, *W. Ind.*
83. " hypericifolia, L. " *Trop. Amer. & W. Ind.*
84. Phyllanthus angustifolius, Sw. near George Town, *Jamaica*, *Cuba.*
85. " speciosus, Jacq. Cayman Brac., *Jamaica.*
86. Croton lucidus, L. *Bahamas*, *Cuba*, *Jamaica.*
87. " linearis Jacq. (C. Cascarilla v. linearis, Griseb.) George Town, *Bahamas*, *Jamaica.*
88. " glabellus, L. (C. Eluteria, Sw., not of Benn.) *Cent. Amer.*, *W. Ind.*
89. Zamia, Z., pumila, L.?
90. Schomburgkia Thomsoniana Reichb. f., Cayman Is., *Endemic.*
91. Dendrophylax Fawcetti, Rolfe, Grand Cayman "
92. Hæmatoxylum campeachianum, L., N. W. Point, G. Cayman.
93. Thouinia? (Cayman Brac.)
94. Cordia speciosa, Willd. " (2 forms.)
95. Tabebuia triphylla, D. C. " *Bahamas*, *W. Ind.*
96. Aydendron? near George Town.
97. Smilax ilicifolia, Kth.? N. W. Point.
98. Tillandsia polystachya, L. Cayman Brac., *Bahamas*, *W. Ind.*
99. Crinum angustum, Roxb.? Grand Cayman.
100. Commelyna nudiflora, L., " (*Warm countries*).
101. Rhæo discolor, Hance, G. Cayman, *Mexico*, *Cuba*, *St. Thomas.*
102. Cyperus brunneus, Sw., South Coast & George Town, *W. Ind.*
103. " ligularis, L. *Trop. Amer.*, *W. Ind.*, *Trop. Afr.*
104. Eleusine indica, Gærtn. (*All warm countries*).
105. Stenotaphrum americanum, Schrk., *Trop. Amer.*, *W. Ind.*
106. Sporobolus indicus, R. Br. *Tropics.*
107. Polypodium Phyllitidis, L. Cayman Brac. & near George Town.
108. " incanum, Sw., *Trop. Amer.*, *W. Ind.*, *Trop. Af.*
109. Nephrodium patens, Desv., near George Town, *Trop. Amer.*, *Polynesia*, *Africa.*
110. Acrostichum aureum, L. " *Warm countries.*
111. Octoblepharum albidum, Hedw., Cayman Brac.
112. Polyporus sanguineus, Fries.

APPENDIX B.

Shells collected in the Cayman Islands by W. Fawcett, identified by Henry Vendryes, Esquire.

Class—Gastropoda.
Sub class—Prosobranchiata.
Order—Pectinibranchiata.

Purpura (Thalessa) deltoidea, Lamarck.
" (Shamonita) haemastoma, Linné.
Rhyzochilus (Coralliophila) galea Chemnitz; (Purpura galea, Chemnitz.)
Ricinula (Sistrum) nodulosa, Adams.
Triton (Simpulum) chlorostomus, Lamarck.
" (Gutturnium) vespaceus? (young), Lamarck.
Fasciolaria tulipa, Linné.
Latirus infundibulum, Gmelin.
Pisania pusio, Linné.
Nassa (Frontis) ambigua, Mart., (Nassa Antillarum, d'Orbigny)
Mitra (Scabricola) granulosa, Lamarck.
" Barbadensis, Gmelin.
" (Pusia) dermestina, Lamarck.
Marginella (Cryptospira) guttata, Sowerby.
" (") nivosa, Hinds.
" (Volvaria) avena, Valenciennes.
Oliva reticularis, Lamarck.
Olivella nivea, Gmelin.
Columbella mercatoria, Gmelin.
" (Nitidella) nitida, Lamarck.
" (Conidea) ovulata, Lamarck.
Strombus (Monodactylus) bituberculatus, Lamarck.
Daphnella lymneiformis, Kiener; (D. patula, Reeve.)
Conus mus, Hwass.
" nebulosis, Solander
" granulatus, Linné,

Cypraea exanthema, Linné.
" cinerea, Gmelin.
" spurca, Lamarck.
Trivia pediculus, Linné.
" quadripunctata, Gray.; (T. rotunda, Kiener.)
Ovula (Cyphoma) gibbosum, Linné.
Cassis flammea, Linné.
" (Levenia) testiculus, Lamarck.
" (Semicassis) inflata, *var.*, Shaw; (Buccinum inflatum, Shaw; C. granulosa, Lam.; C. sulcosa, Brugière.)
Dolium perdix, Linné. All young specimens of which the majority appear to be the West Indian form; D. galea, held to be distinct from D. perdix.
Oniscia oniscus, Linné; (Strombus oniscus, Linné.)
Natica canrena, Linné.
" (Mamma) lactea, Guilding.
Crepidula (Crypta) aculeata, Gmelin.
Hipponyx antiquatus, Linné.
Pyramidella dolobrata, Linné.
Littorina (Malaraphe) ziczac, Chemnitz.
" (Tectarius) muricatus, Linné.
Cerithium littoratum, Born.
" eburneum, Brugière.

ORDER—Scutibranchiata.

Nerita tessellata, Gmelin.
" (Peloronta) peloronta, Linné.
" (") versicolor, Gmelin.
Neritina (Puperita) pupa, Linné.
Trochus (omphalius) carniolus, Linné.
" canaliculatus, d'Orbigny; (T. carneus, Gmelin: T. indusia, Chemnitz.)
Fissurella (Cremides) antillarum, d'Orbigny.
" (Glyphis) larvae, Reeve.
" (") Listeri, d'Orbigny.
" (") cancellata, Solander.
" (Clypidella) fascicularis, Lamarck.
Patella (Acmaea) Surinamensis, Gmelin.
" (") leimopleura, Gmelin.

SUB-CLASS—Opisthobranchiata.
ORDER—Tectibranchiata.

Bulla occidentalis, Adams.

CLASS—BASOMMATOPHORA.
SUB-ORDER—Gehydrophila.
Fam. Auriculidae.

Melampus flavus, Gmelin.
" (Trivia) pusillus, Gmelin.

CLASS—PELECYPODA—Conchifera.
ORDER—Siphonida.
(*Sinu-palliata.*)

Tellina radiata, Linné.
" interrupta, Solander.
" constricta, Philippi.
" fausta, Solander.
Venus zigzag, Lamarck; (V. cancellata, Linné; V. cigenda, Linne.)

(*Integro-palliata.*)

Cardium laevigatum, Linné.
" elongatum, Lamarck.
Pectunculus castaneus, Lamarck.
" pectinatus, Lamarck.
Lucina divaricata, Linné.
" Pennsylvanica, Linné.
" tigerina, Linné.

ORDER—ASIPHONIDA.
(Homomyaria.)

Arca Listeri, Philippi.
" umbonata, Lamarck.

(Heteromyaria.)

Modiola demissa, Dillwyn.
Perna bicolor, C. B. Adams.
Lima scabra, Born.
Pecten ornatus, Lamarck.

Pupa (Strophia) Martiniana, Kuster, was the only Pulmonate gastropod, found in the collection.

No. 12. March, 1889.

BULLETIN

OF THE

BOTANICAL DEPARTMENT,

JAMAICA.

CONTENTS.

PRICE—Two-pence.

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

1889.

PARCHMENT COFFEE FOR EXPORT.

In the BULLETIN for October last, No. 8, letters were published with reference to the desirability in some cases of exporting coffee in parchment. Messrs. Lewis and Peat now report on some parchment coffee shipped from Jamaica. The Royal Mail Coy. cannot give information as to the name of shipper, and therefore it is not possible to compare the price with that of the same coffee finally cured in Jamaica.

Colonial Secretary's Office, Jamaica, 12th February, 1889.

No. 761—S. S. Circ.—10.1.89.

SIR,

In continuation of the letter from this Office No. 3712—S. S. Circ.—9.5.88, dated 3rd July last, I am desired by the Officer Administering the Government to forward * to you a copy of a letter from the Royal Gardens, Kew, enclosing a copy of a further letter from Messrs. Lewis and Peat, on the subject of cleaning parchment coffee in London.

I have, &c.,

NEALE PORTER, Colonial Secretary.

The Director of Public Gardens and Plantations, Gordon Town P. O.

(Circular.) Downing Street, 10th January, 1889.

SIR,

In connection of my Circular despatch of the 9th of May last, I have the honor to transmit to you, for publication, a copy of a letter† from the Royal Gardens, Kew, enclosing a copy of a further letter from Messrs. Lewis and Peat, on the subject of cleaning parchment coffee in London.

I have &c.,

KNUTSFORD.

The Officer Administering the Government of Jamaica.

(Copy.) *Kew Gardens to Colonial Office.*

Royal Gardens, Kew, 21st December, 1888.

SIR,

In continuation of my letters of 11th April and 23rd April of this year, I am desired by Mr. Thiselton Dyer to forward a copy of a further letter received from Messrs. Lewis & Peat, on the subject of cleaning parchment coffee in London.

2. It appears that, acting on the suggestions contained in the letters above quoted, which Lord Knutsford was good enough to communicate to the Governors of the West Indian and other Colonies interested in the production of coffee, shipments of coffee in parchment have been made, and, as regards Jamaica coffee, have produced very encouraging results. A small shipment made from Dominica has not proved so satisfactory, as the parchment coffee in the first instance was not sufficiently dried before it was shipped. The brokers draw particular attention to the fact that imperfectly dried shipments are useless.

I am, &c.,

(Sd.) D. MORRIS.

Edward Wingfield, Esq.

Messrs. Lewis & Peat to Royal Gardens, Kew.

6 Mincing Lane, E.C., 20th December, 1888.

DEAR SIR,

We beg to draw your attention to the sale of some Jamaica coffee sent home in the parchment and cleaned here, and recommend it to the notice of shippers generally.

The parcel $\frac{D}{Br.}$ per "Nile" sold as follows:—

5	Bags Bold Colory	@ 90s.	per cwt.
5	,, Medium size Colory	@ 87s.	,, ,,
1	,, Small	@ 76s.	,, ,,
1	,, Pea-berry	@ 84s.	,, ,,

which is very encouraging result.

We also sold two bags Dominica, but the coffee was not sufficiently dried on the other side, bringing only 76s. per cwt. Imperfectly dried shipments are useless.

We are, &c.,

(Sd.) LEWIS & PEAT.

D. Morris, Esq., Royal Gardens, Kew.

PLANT NOTES.

Ipomœas: Many of these plants are now producing their flowers in great profusion, and what exquisite, charming flowers they are! They are generally produced in little clusters, but these are often in such abundance, that in the early morning there is scarcely any part of the plant but the flowers visible.

* In Circular from Secretary of State dated 10.1.89.

† 21st December, 1888.

In habit the plants are usually climbers, but a few species trail along the ground. Their corallas are usually funnel, or bell-shaped, and in colour are either cream, buff, yellow, white, rosy, violet, purple, various shades of blue, scarlet, crimson, or a combination of two or more of these colours.

There are about 30 species of Ipomæa natives of Jamaica, but only half a dozen or so are cultivated as garden plants, although the majority of them are well worth a place in any garden, their lovely flowers, albeit so shortlived, being surpassed in beauty by few others.

Ipomœa bona-nox, L.—This is known as the "moon-flower" from the fact that its large, pure white, and fragrant flowers open only after sunset, but they remain open till nine or ten o'clock the following morning. The corolla tube is 3 in. long, and the limb about 4 in. diameter.

I. sinuata, Ort.– This species has palmate leaves about 4 inches in diameter, and its bell-shaped corolla, which is about 1½ in. long, is white with a crimson throat. This plant is frequently grown in gardens as an ornamental climber.

I. pentaphylla, Jacq.—This plant has digitate leaves, and its delicate, white, funnel-shaped corolla is about 1½ in. long.

I. quinquefolia, Gr.—This species has small, digitate leaves, and a corolla about ⅝ of an inch long, of a pale buff colour.

I. sidæfolia, Chois.—This is known as "Christmas-wreath" in Jamaica, and a branch of it in flower is indeed a ready-made wreath. It is exceedingly floriferous, and its corolla which is about an inch long, is white in colour, with a yellowish throat, and dark at the base, and it is fragrant.

I. umbellata, Mey.—This species has cordate leaves, and its flowers are produced in umbelliform cymes, often as many as two dozen flower buds and expanded flowers in a single cyme, and there are usually half a dozen flowers open together. Its corolla is bell-shaped, about an inch long, and of a clear, yellow colour. This is a very attractive and beautiful plant when in flower.

I. purpurea, Lam.—Leaves small, cordate; corolla about 1 inch long, purple in colour, with white throat

I. coccinea, Linn.—Leaves ovate-cordate, about 3 in. diameter; flowers produced in loose cymes; corolla crimson, or orange-scarlet; tube 1 in. long, and the limb about ⅝ in. across. This is a beautiful species and is often cultivated.

I. Quamoclit, Linn.—A slender twiner; leaves pectinate, about 4 in. long; corolla crimson or white; tube 1 inch long, and limb about ½ inch in diameter. This charming species is frequently met with in gardens, and is known as "Sweet-William." The white form is not at all common.

I. Horsfalliæ.—A magnificent species with digitate leaves deep green in colour, and funnel-shaped flowers of a rich crimson colour. It is not generally known that this plant is found in a wild state in Jamaica, but, nevertheless, such is the case. I have seen it growing wild at various elevations from near the sea-shore up to 4 000 feet, and so plentiful is it in some districts that an excellent starch is prepared from its tubers

I believe there are in cultivation varieties of this plant with flowers of various shades of colour between crimson and pure white.

I might add to this list the names of many more beautiful species, all easily obtainable, and all easily grown. Indeed, it may be said that these are plants requiring no cultivation whatever; they will grow and flower in any ordinary garden soil. In a wild state they are found growing in pastures, hedges, along roadsides, and in waste places generally.

Porana paniculata, Roxb.—This plant belongs to the same natural order (Convolvulaceæ) as the Genus Ipomæa. It is a very strong-growing climber, native of the East Indies, and is known in Jamaica by the colloquial name of "white coralila." Like the Ipomæas it is now flowering profusely. It has ovate-cordate leaves, so densely covered with gray tomentum underneath as to give them a whitish appearance. The flowers are produced in panicles at the ends of the branches in almost countless numbers.

The corolla is white in colour, and bell-shaped, like a miniature convolvulus. This is an excellent plant for covering a screen, fence, or even a tree, and when in full flower it is beautiful. Coming in flower too, as it does, towards the end of the year, when white blossoms are particularly useful for decorative purposes, is a recommendation, if one were needed, in its favour.

The plant is not over particular in its requirements; it will be found to thrive well in a sandy loam, with a moderate supply of water. Cuttings of ripe, or half ripe wood, root freely in sand.

W. Harris.

17th December, 1888.

CULTIVATION OF PINE APPLES.

The following note was sent in answer to a Correspondent, and may be useful to others:—

"I do not think that any attention has as yet been paid to the question of manure for soil exhausted by cultivation of Pine Apples. Land is abundant and the difficulty has been overcome by re-planting in fresh ground. But it is a very important question, and I shall always be glad to receive communications on the subject from growers. No doubt, in time with our accumulated experience, we shall be able to hit upon a system whereby we can always grow Pines in the same plot.

"In considering what manure to apply, we must first of all remember that Pines, above all things, requires perfect drainage. If the physical character of the soil is such that water is liable to be held for any time, Pines suffer, whereas in a light, sandy soil, they flourish. It would, therefore, not be judicious to apply stable or cattle manure, which goes on decaying for a long time in the ground, and retains moisture. On the other hand liquid manure, prepared from animal manures, and applied in a light soil, would doubtless be very beneficial, and would sufficiently supply nitrogenous food to the plants. Phosphates and mineral food generally would probably be best supplied from crushed bones, and the ashes resulting from the thorough combustion of bush and vegetable refuse."

W. F.

FERMENTATION.

(Reprinted from the Victoria Quarterly.)

Having just read a small book, "Ferments et Fermentations" by M. Leon Garnier, a countryman of the famous Pasteur, it occurred to me that if I put down a few notes and reflections on the subject, they might perhaps interest readers of the VICTORIA QUARTERLY MAGAZINE.

The word Fermentation is derived from a Latin word *fervere* to boil, and originally was given to any pheuomenon in which the mass swelled up, giving off bubbles. Familiar examples of this original meaning of the word are to be seen in the working of yeast in dough, and in the manufacture of rum, wine or beer. But the term has become generalised, as it has been discovered that other phenomena such as the souring of milk, and putrefaction, are really due to similar causes, and that the swelling and effervescence are only accidental concomitants.

We will try then to discover what similarity underlies such apparently totally different processes as the making of rum, and the decay of animal or vegetable refuse in our streets.

In order to do so, it will be necessary first to consider what happens in the life of any common plant, such as corn. Let us take a few seeds, and suspend them over water. They soon germinate, forming a few roots and leaves, and then die. These seeds have only moisture of pure water, and air, and yet they have grown. Whence comes their food? By carefully examining the seed in all stages, we find that the greater part of it consists of grains of starch, and that these disappear as the germination and growth of the seed progresses, being changed into sugar; finally, that not only the starch but the sugar also disappears. The starch was the supply of food laid up for the young plant to be used until it could obtain food for itself. But though starch is a convenient form in which to store nutriment for living beings, neither animal nor plant can make use of it in the form of starch. And again the solid grains cannot pass from the closed cells in which they are formed to the cells in which growth is going on, and where food is required. When we eat bread or yams, the starch is changed into sugar by means of a chemical change induced by a secretion in the saliva and pancreatic juice, and it is a similar secretion in seeds which enables the young plant to feed on the stored starch.

Advantage is taken of this singular property in seeds in the process of changing barley into malt. Barley to be malted is first steeped and absorbs so much water that it increases about one-fifth in bulk, and one half in weight. Very shortly after the grain has been put into steep, it is found that a substance to which the name of *diastase* has been given, is now formed in the seed. Diastase can be extracted in an impure form from malt, and is so powerful in its action that a certain quantity will change 2,000 times as much starch into sugar. It is often used in case of bad digestion under the name of "malt extract." When the diastase has done its work, the seedsis dried, germination ceases and the malt is now ready for the brewer. The action of diastase involves a chemical re-action in which starch is changed into sugar under its influence, but the diastase does not contribute any of its substance to the products of the re-action, it merely sets it going. It is this peculiar kind of chemical re-action that is included under the head of *fermentation*, and the body which sets up the fermentation is known as a *ferment.*

Ferments are of two kinds. soluble ferments, and organized ferments.

The number of *soluble ferments* or *diastases* is very great, and they are formed in a great variety of cells during the course of their development. Their action may be compared to that of certain of them in the digestive tubes of animals. They prepare food for absorption.

The diastase of malt is found in other germinating seeds besides barley, and also in starchy roots, like yams, when they are developing leaves.

Another diastase acts on cane-sugar spliting it up into glucose and levulose. This is called inversion of sugar. Cane-sugar is a reserve-material like starch, for although it is capable of diffusion from cell to cell, it is always changed into glucose when growth is going on. In the beet, for instance, the cane-sugar which has been stored up in its tissues is transformed in the spring into glucose to be used up in the development of its flowering shoots. The same thing occurs in the stalk of corn (maize) when the fruit is forming, and in sugar-cane when arrowing. These diastatic ferments appear to be formed in the growing parts, and to penetrate from them into the parts where the reserve-materials are stored up. This may be well seen in the germination of the seed of Phytelephas, which is generally known as "vegetable ivory." These seeds are often thrown up by currents on the sea-shore of Jamaica; they are composed of white cellulose so hard that they are carved in imitation of true ivory, and yet, when the seed is germinating. the delicate tissue of the minute embryo develops a ferment which dissolves the portion of the hard "ivory" next it. The solution is absorbed and used in growth, and the process continues until the whole of the hard seed is used up An exactly similar process takes place in the germination of the date-stone. Parasites, such as the fungi which penetrate the hard wood of living trees, doubtless act in the same way.

Ferments are sometimes *organized*, that is they are living beings and set up fermentation in consequence of their development. Of *organized ferments*, yeast is the most familiar example, and its development is accompanied by the decomposition of sugar into alcohol, carbonic acid, glycerine, and succinic acid.

But to understand better the action of these ferments, we must return to our cultivation of seeds. If we make a solution of such salts as are commonly found in soils, viz., nitrate of potash, gypsum, sulphate of magnesia, phosphate of lime, and a trace of salt of iron, and grow seedlings in this solution with proper exposure to sunlight, the plant will go through the whole course of its development, producing not only roots and green leaves, but flowers and seeds. The elements contained in these salts, together with those composing water, and the carbon derived from the carbonic acid in the air, are combined in various proportions to form the substance of the plant. The plant is a chemical laboratory in which, by means of the force derived from the rays of the sun, all these different substances, are analyzed and re-combined into very complex organic materials.

The plant with which we have been experimenting has green leaves, and has been able to break up the carbonic acid of the air, and make use of the carbon to build up its substance.

It is a strange fact that the presence of a green colouring matter in plants should be accompanied by this power of making use of carbonic acid, but there are many living beings belonging to the plant world which do not possess any green colouring matter in their tissues, and are therefore obliged to provide their carbon from compounds into which it has already been worked up by green plants.

Amongst the flowering plants there are a few destitute of green, but the fungi are universally so. In order to obtain their carbonaceous food, they live either on decaying organic matter, or they attack living tissues. Many of them simply extract the food they require; but others set up a decomposition in the materials upon which they are feeding, without making any use of the products of this decomposition. It is this kind of action, again, which is called fermentation.

Yeast is one of these fungus-ferments. If a drop of the frothy scum is examined under a microscope, enormous numbers of round bodies will be seen floating in the fluid. Each one consists of protoplasm, the basis of all living matter, and this substance is enclosed by a thin transparent covering of cellulose. These round bodies are so minute that if 1,000 of them could be placed in a line, they would only measure one-third of an inch. Yet each is a self-contained living being, and if put into a suitable nutritive fluid will multiply to such an enormous extent that it has been calculated that one yeast cell can in 24 hours produce 16 million cells. The commercial importance of yeast is due to the transformation which sugar undergoes when split up to afford it food. Sugar materials are divisible into two groups, one represented by saccharose or cane sugar, the other by glucose. They differ in their chemical formulæ, cane-sugar having a molecule less of water than glucose. Before cane sugar can be fermented, it must be changed into glucose, and this is effected by a diastase formed by the yeast itself, though the re-action also takes place under the influence of dilute acid. In the ordinary fermentation of malt, Pasteur showed that about 90 per cent. of the sugar was converted into alcohol and carbonic acid, about 5 per cent. into glycerine and succinic acid, and the remainder was used for food for the yeast-plant to supply substance for the cellulose envelope and the fatty particles in the protoplasm. The proportion of glycerine and succinic acid is greater when the process of fermentation is lengthened, and is less when the liquid is slightly acid.

Pasteur placed different yeast plants in identical liquids, and showed that beers of different flavours are produced, which possibly may be explained by supposing that each one has its own particular fermentative action, producing bye-products which vary in quality and quantity.

The great disproportion between the amount of sugar broken up into alcohol and the amount actually used as food by the yeast plant is very striking, and seeing that there is great expenditure in the production of alcohol which is positively hurtful to the yeast, stopping its action after a time, the question arises whether this development of yeast with so great a formation of alcohol is the normal condition of the plant. In alcoholic fermentation, very little air is allowed to the fermenting liquid, and it is found that a very thin layer of the liquid with free access of air allows the yeast to develop rapidly with very little formation of alcohol.

Pasteur proved this conclusively. First, he placed yeast in a sugary liquid which covered the bottom of a large vat in a thin layer, so that the air would have free access to the whole. The operation was stopped when a layer of yeast was deposited at the bottom of the vat. He found that the development of the yeast had been as abundant as it could be, one part to four of the sugar, which had disappeared. The production of alcohol was insignificant, the greater part of the sugar having been used up to form the ternary compounds of the yeast. As a second experiment, he took a flask full of a solution of sugar from which air had been expelled by boiling, and put a particle of yeast into it. When the fermentation was complete he found that very little yeast had been produced, in about the proportion of one part to 90 of the sugar which had been used up, but that almost the whole of the sugar had undergone a regular alcoholic fermentation.

Manufacturers of yeast as a commercial product can so arrange their processes that yeast multiplies without a trace of alcohol. Certain common moulds which grow freely on any damp surface, do not produce alcohol under ordinary circumstances, but if they are immersed in a proper liquid, they will excite alcoholic fermentation to a small extent. These considerations lead us to suppose that alcoholic fermentation is not the normal action of healthy yeast, but is due to a diseased condition of the cell dependent on the exclusion of a certain amount of air.

The practical conclusion is that while a certain amount of oxygen is as necessary to the yeast-plant as to higher beings, giving it energy, and inducing a quicker fermentation, an excess will lead to a great waste of sugar.

Other ferments also produce alcohol, and the cells of ripening fruit lose a portion of their sugar with fermentation of alcohol when the access of air is cut off.

"So full was Pasteur of the idea that the cells of a fruit would continue to live at the expense of the sugar of the fruit, that once in his laboratory, while conversing on these subjects with M. Dumas, he exclaimed 'I will wager that if a grape be plunged in an atmosphere of carbonic acid, it will produce alcohol and carbonic acid by the continued life of its own cells—and they will act for a time like the cells of the true alcoholic leaven.' He made the experiment, and found the result to be what he had foreseen. He then extended the inquiry. Placing under a bell jar 24 plums, he filled the jar with carbonic acid gas; beside it, he placed 24 similar plums uncovered. At the end of eight days, he removed the plums from the jar and compared them with the others. The difference was extraordinary. The uncovered fruits had become soft, watery and very sweet; the others were firm and hard, their fleshy portions being not at all watery. They had, moreover, lost a considerable quantity of their sugar. They were afterwards bruised and the juice was distilled. It yielded six and a half grammes of alcohol, or one per cent of the total weight of the plums Neither in these plums, nor in the grapes first experimented on by Pasteur, could any trace of the ordinary alcoholic leaven be found. As previously proved by Lechartier and Bellamy, the fermentation was the work of the living cells of the fruit itself, after air had been denied to them. When, moreover, the cells were destroyed by bruising, no fermentation ensued. The fermentation was the correlation of a vital act, and it ceased when life was extinguished."—(*Tyndall.*)

With all these various agencies producing alcohol, there is a great diffusion of it over the surface of the earth. Muntz has found that it is present in the soil and in water, and not only in water but in snow so that it would appear that this substance is contained even in air.

There are many ferments which interfere in the process of alcoholic fermentation, and most German beers now are made of a low temperature in order to exclude the operation of various disturbing ferments.

The lactic ferment found in milk, which has turned sour, interferes also with alcoholic fermentation forming lactic acid. The acidity can be prevented in milk, by boiling, and thus killing the germs.

Sugary liquids are also liable to viscous fermentation, due to a germ, somewhat larger than yeast, which changes sugar into mannite and gum.

The butyric ferment is another germ which changes glucose into butyric acid. It has been said that it is this germ which gives rum its peculiar flavour. It is found in the digestive canal of man and other animals, its particular function there apparently being to transform cellulose which is consumed for instance. in potatoes or yams, into glucose, while the starch grains released from their cellulose envelope are changed by the diastase already mentioned.

The special kind of fermentation known as putrefaction is produced by bacteria which decompose only proteid substances, that is, those having the same chemical composition as the white of egg. The decomposition is easily recognized by the odours of such gases as ammonia, and sulphuretted hydrogen. The ammonia which originates in this way in soils to which air has access is changed through the influence of another bacterium into nitrites and nitrates, which also appears to act on ammonia salts. This process is of great interest to the agriculturist, for their crops can only obtain the nitrogen which is an essential portion of their substance from the nitrates in the soil. Therefore it is first of all necessary to have decaying animal or vegetable matter in the soil, and then to ensure favourable conditions for the action of the ferment of nitrification. If there is an excess of organic matter, the nitric ferment does not develop until the special ferments of putrefaction have done their work. Plants, therefore, cannot make use of manure until it has well decayed, for it is only then that it will yield nitrates. Water must not remain too long on the soil, otherwise the action of this ferment ceases ; we thus see the necessity for good drainage. Burning the soil renders it sterile, for the germs are killed and the decaying matter is burnt into ash. Air is essential to the action of the ferment, and therefore it is desirable to plough lands deep, especially clayey soils through which air has a difficulty in passing.

There is no time to do more than simply refer to the connection between specific germs and diseases. This subject is attracting a great deal of attention at present, and important results have already been obtained.

In conclusion, I wish to call attention to the work which is done by these minute organisms in keeping the surface of the earth habitable. The solid bodies which have been formed out of gases and liquids by living beings are insoluble in water, and are not available in this condition to be resolved on death into their constituent parts. Animal life is dependent for its food ultimately on plant life, and therefore unless there existed some arrangement in nature by means of which dead plants and animals were resolved into their elements, which could be again re-combined into plant forms, there would be an accumulation everywhere on the earth's surface of vast piles of the dead bodies of plants and animals while air, soil, and water would gradually be exhausted of the elements necessary to vegetable life, and consequently *all* life would come to an end. It is to Pasteur that the honour is due of having first clearly pointed out that the necessary mechanism for the destruction of organic matter, the breaking up of the complex organic compounds, is found in the action of living beings so minute that they can only be seen under a microscope. The consequences of the work of the infinitely small may be infinitely great.

W. Fawcett.

FREE GRANTS OF PLANTS.

Free grants are occasionally made from the surplus stock only to public institutions, but it will save some correspondence, if information in the following particulars are forwarded with the application :—

(1.) Are the plants required solely for the grounds of the public institution named ?
(2.) Are these grounds fenced securely against the intrusion of goats, pigs and cattle ?
(3.) Do you undertake to keep the fences in proper order ?
(4.) Is there any provision for watering the plants, and tending them while young by keeping down weeds, &c.
(5.) Do you undertake to have holes dug for the plants before you send for them, and to have them planted at once when received ?
(6.) What is the area of the ground ?
(7.) Are there any trees or shrubs already growing ?
(8.) Describe the situation and soil.

Carriage of the plants from the Gardens to Kingston must be paid for before they are sent away.

Note.—A subscription of 2s. will ensure the delivery at any Post Office in Jamaica of 12 numbers of the Bulletin. Application may be made at any of the Gardens, or by post, to the Director of Public Gardens and Plantations, Gordon Town P.O., Jamaica.

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BOTANICAL DEPARTMENT.

JAMAICA.

CONTENTS.

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TOBACCO.

In Bulletins 6 and 8, particulars were given of a prize of Fifty Guineas offered by the London Chamber of Commerce for the best sample of Tobacco of 400 pounds weight grown in the British Colonies. It is now announced that the prize is, by the award of the Judges, divided equally between Jamaica and North Borneo. Messrs. Machado's Tobacco, grown at Temple Hall, in winning the prize will be even more in demand than at present, and it is quite probable that Jamaica Tobacco and Cigars will be sought for in European markets.

It rests with growers and manufacturers of Tobacco in this Island, by scientific cultivation and careful curing to maintain and increase the reputation thus gained; and it is possible for those who now are producing a very inferior kind to take advantage of any increased demand, not by selling worthless Tobacco and ruining the market for all, but by laboriously learning how to improve from the directions given by one who thoroughly understood the whole art. Such directions are given below, drawn up by a worthy Cuban, the late Mr. J. C. Espin, who lived many years in Jamaica, working himself in the fields, and afterwards being engaged in the manufacture of Cigars. This pamphlet, the result of long experience, was promised for use in the Jamaica Bulletin, but on Mr. Espin's appointment to undertake Tobacco culture in Trinidad, he preferred to take his manuscript with him. The Government of Trinidad purchased the copyright, and published the pamphlet as a Botanical Bulletin. By their permission, it is now reproduced in Jamaica, not for those who already understand their business, but to help those who are conscious of a need of improvement.

TOBACCO CULTURE.

By J. C. ESPIN: *For many years Planter and Manufacturer in Cuba and Jamaica, and late Government Expert for Trinidad.*

PREFACE.

The clear and ordinary language adopted in writing this Guide will, it is believed, be more within the reach of those who most need it than a more elaborate and scientific phraseology. Unacquainted with science, the writer merely explains the methods of growing and curing the Tobacco plant, without entering into its Natural History, Chemistry, etc., which he deems unnecessary in a purely practical Guide like this. The writer confidently recommends the methods here explained as they are based, not on *hearsay* and "*theory*," but on his own experience as a planter and manufacturer for many years. He assures those who may adopt this little book as their guide that if strictly followed out, the Tobacco obtained will be of excellent quality, depending, of course, on the physical conditions of the locality where grown.

Much has been written on Tobacco, a plant which forms one of the most important factors of national wealth in the countries where it is largely and efficiently cultivated; but the works on the subject, which we have had the opportunity of reading, are either so scientific in the language and style as to be beyond the knowledge of the majority, or so diffuse and full of different and even opposite methods as to bewilder the cultivator. There are some works which give directions contrary to our experience, and others again devote more space to the botany, physical and chemical properties of the plant, than to the proper manner of growing and curing it, which latter ought to be the principal aim.

With a view to supply, as far as our knowledge allows, a thoroughly practical and reliable guide, devoid of the defects above mentioned, it was decided to prepare the present Pamphlet, not that it will be, by any means, absolutely free from errors, but it will be one which we earnestly believe will be of real and practical assistance to the beginner, as it was written "in the field" whilst actually growing, curing and manufacturing "the weed" for the market, and therefore after every method had been thoroughly tested. Several manuscript copies of it were given to friends who desired to try the cultivation, and the results of their experiments were most successful.

As the writer is a native of Cuba and the original was written in Spanish, this is necessarily a translation, but it differs in no way from the Spanish in the arrangement, etc., the writer having carefully prepared the English as well as the Spanish, but a foreigner by birth, the writer begs the indulgence of the English-speaking readers towards the correctness or elegance of the English construction, as it is not possible for him always to frame his sentences in a style untainted by his mother tongue, and he begs to be excused for this somewhat lengthy Preface, and leaves to those who might follow this *Guide* to decide how far he has succeeded in fulfilling his object.

CHAPTER I.

The Tobacco plant was not known in Europe till the discovery of America in the fifteenth century It is said that Columbus, during his first voyage while off the coast of Cuba, sent some explorers to land and obtain information concerning the natural resources of the country, and that on their way back they, for the first time, witnessed the use of a weed, which the ingenious caprice of man has since converted into a universal luxury. They beheld several of the natives going about with firebrands in their hands and certain dried herbs which they rolled up in a leaf and lighting one end put the other in their mouths and continued inhaling and puffing out the smoke. A roll of this kind they called a "tobacco," a name since transferred to the plant of which the rolls were made.

There are many species of Tobacco, but the Cuban Tobacco plant is one known to Botanists as *Nicotiana Tabacum L.* (Cuban variety), and it is to the cultivation of this kind that we will direct our attention, it being the best Tobacco known and the only one I have cultivated.

The culture of Tobacco may be divided into five periods, viz., Nursery, Planting, After-cultivation, Curing and Packing, each of which will be treated of in its respective order in the following pages; but first a few words on Climate and Soil.

Climate.

Climate is an important point in the cultivation of Tobacco, but as this cannot be modified by artificial means we should seek a district where the temparature and moisture of the locality is similar to that of Cuba, warm and humid. In a country where the seasons differ from those of that Island the periods of cultivating must be accordingly varied.

Soil.

The soil as well as the weather affects the plant to a considerable extent, for plants grown under the very same climate, but on slightly different soils, produce Tobaccos altogether distinct in quality. For instance, in Cuba two neighbouring fields, which are of course under the same climatic influences, produce Tobacco which differ in many particulars. Therefore, not only must the seasons be carefully selected, but the soil also requires to be chosen with great care, a light sandy loam, mixed with a fair proportion of vegetable debris, being preferred to any other. Clay lands are very unsuitable. Sandy, loose-grained soil, absolutely free from clay, will produce Tobacco of far better quality in every respect than any other kind of soil.

CHAPTER II.

CULTURAL INSTRUCTIONS.

Nursery.

In the selection of the land for making the Nursery attention must be paid to the existing conditions of the soil, and action taken in accordance therewith. We will therefore describe in a concise manner the most convenient and the best methods of preparing it.

The best soil for making the Nursery is to be found on virgin or untilled land, and it is more easily prepared. On the other hand, in cleared and cultivated land the seedlings grow better and safer, but give more trouble than in virgin soil. Old, abandoned dung-hills, the sides along old wooden fences, hog-sties and similar places, are very good soils for making Nurseries on. The Nursery may be formed into BEDS or left LEVEL land, as appears most suitable.

1. Virgin land is prepared by cutting down every tree on the portion intended for the Nursery, leaving only a certain number of small trees whose branches will afford sufficient shade to the tender plants (these will have to be removed later on). The land should be prepared long and narrow and, with a North-easterly or South-easterly exposure. The land should now be swept with a broom made of the thin branches of trees or boughs so as to remove away all rubbish, etc., from it. The soil should be slightly hoed, and the rubbish arising from this hoeing swept and thrown away also. The soil is now ready for sowing the seed.

2. On cultivated soil it is preferable to select the plot as level as possible, but if it should be too much on the incline it must be drained by means of trenches dug *at the sides* of the Nursery to prevent rain water from running into it and carrying away the seed. This should also be done to Nurseries on newly-cleared land. The seedlings will thrive much better if it should be that the land has been used the year previous as a horse or sheep-pen, pig-stie, or dung-hill. The soil is prepared for sowing the seed just the same as on virgin soil.

3. Whether on virgin or on cultivated soil the seed may be sown in BEDS. The method of procedure is as follows:—In the month of May the soil is ploughed and immediately after it is hoed, and then covered with a layer of vegetable rubbish, such as dry grass, etc. A few days after, when weeds have sprung up, the rubbish is burnt for the purpose of destroying all insects and grubs which infest decaying vegetable matter, and left in this state till weeds again spring up. Another layer of vegetable rubbish is put on and burnt as before, and a couple of days after this last burning the soil is hoed and the BEDS made. They should be above four feet in breadth and of any desired length, though for convenience in walking through the Nursery they may be made about ten feet in length, the pathways along and across the beds being about half a yard in width. The height of the beds should not be more than ONE INCH above the level, having long wattles placed at the edges or borders of the beds sustained by pegs driven down at their extremities so as to support the earth. Corn is then planted in the middle of the beds, two grains per hole, and each hole two feet apart. Near the time of sowing the seed the soil is chopped with a cutlass without injuring the corn. Corn preserves the moisture of the soil and protects the young plant from the rays of the sun. If when the seedlings spring up the corn has EARS, they should be picked off, for they damage the seedlings.

4. A Nursery can be made so as to be at the same time a Tobacco field. It is done as follows:—The land is cleared of trees, the boughs and rubbish burnt and corn immediately planted on the land. Previous to sowing the seed, the earth is chopped and prepared as explained for beds. The seed is sown as usual, but when the plants are fit for transplanting they should be thinned out where two many grow together, and those taken out planted where there are few or none at a regular distance from each other as on a field. The Tobacco grown by this method yields more leaves than by being transplanted to a field, possessing besides the advantage of their being finer in texture and of a better colour. The after-cultivation and curing is identical to that planted otherwise. The Cuban planter calls the Tobacco so grown "*Criollo*" (Creole). This is generally done in the Nurseries after planting in the field is finished, but is never adopted as a regular system of culture, because there is no uniformity in the quality of the leaf and the quantity produced per acre.

The Seed.

1. Among the most important points in Tobacco culture is the selection of the seed. It should be taken off the most healthy and perfect plants, and when properly ripe, that is, when the seed pod

blacken. The plants selected for seed should be left uncut and should not of course be "topped," and all suckers plucked off. The seedpods on their stalks should be thoroughly dried and then hung up in bundles for some length of time. It is preferable to rub out the seeds of the pods, winnow and put into well-covered demijohns, jars, or glass bottles. The seeds sown the first year ought to be imported directly from Havana as the only means of securing the Cuban kind of Tobacco. Frequent supplies of seeds should be regularly supplied as it is apt to deteriorate if grown too long in one district.

Method of Sowing the Seeds.

Care must be observed in sowing the seeds that they are evenly scattered on the soil, for if they be thickly sown the young plants will spring up too closely and will be so delicate and tender that they will not stand transplanting. To secure the seeds being evenly scattered they should be mixed with dry fine earth or sand. If when the seed is sown it does not rain the soil must be moistened with a fine-rosed watering-pot, raising the hand as high as possible so that the water may bury the seeds, being careful at the same time that the water does not wash away or throw the seeds together. The seed should be sown a month and a half before the seedlings are required for planting, for at the end of this time they should be fit for transplanting. The proper sowing season is from the middle of August up to the beginning of October, on such a day as it is likely to rain. Should it not rain the soil must be watered as before explained.

Care of the Nursery.

When the leaves of the seedlings are about the size of a sixpenny piece or a shilling piece, the corn and branches of the trees left must gradually be cut away so that the young plant may become gradually accustomed to the heat of the sun, preventing by this means the risk of their perishing when transplanted.

The Nursery must be frequently weeded to prevent exhaustion of the soil and weakening the seedlings. The weeds must be rooted up with the hands, being careful not to injure the seedlings. Whenever the Nursery is weeded or seedlings have been removed for transplantation fresh seeds should be sown in order to always have a supply of seedlings. According as the shade is taken away the supply of water to the seedling should be, in like manner, diminished. If insects be noticed in the Nursery, it should be slightly watered with lime water, SUFFICIENTLY DILUTED SO AS NOT TO BURN THE SEEDLINGS, and the larger grubs destroyed every morning by hand. The seedlings, to be fit for transplanting, must have six leaves, and these leaves of the size of a *half dollar* piece Before rooting up the seedlings for transplanting, if no rain occurs, the ground should be properly wetted to facilitate their extraction with all their roots. They should be slightly shaken to remove some of the earth attached to their roots. In taking out seedlings for transplanting the fingers should be carefully put down to the root in order to avoid breaking the stalk.

CHAPTER III.

PLANTING AND PREPARATION OF THE LAND FOR PLANTING.

The proper month for planting is September, but if inundation of the land be expected, planting should commence in November.

We have noticed in various works on Tobacco Culture that artificial manures are highly recommended. We believe that by this means the Tobacco can be made to yield larger leaves, according to the quality of the artificial manure, but it can never be obtained possessing the aroma and other qualities essential to Smoking Tobacco. The only application admissible is that of lime, which SHOULD ONLY BE USED when the soil is very much exhausted. In the Island of Cuba, the Smoking Tobacco produced is doubtless without a rival in the world, and there manuring with artificial manures is never practised, as the experience of the *Vuelta-abajo* planters a few years since proves clearly the disadvantages attending such usage. It should be remarked that the manure used was Peruvian Guano. The crop obtained during that short period suffered greatly in its quantity and quality, so much so that the planters of *Vuelta-abajo* have given up altogether manuring with such foreign matters. The best method of preparing the soil for planting is the following, which is that employed in Cuba, the manure used being purely vegetable, with the exception indicated, viz., lime.

No other animals but hogs should be allowed to feed on the land intended for planting from the month of May. Weeds and shrubs are allowed to grow freely till July, when it is ploughed lengthwise and crosswise with all the bush. Fifteen or twenty days after, about which time the weeds, etc., ought to be thoroughly rotten, the land should be frequently ploughed, with a few days interval between each ploughing, if the soil be not too wet, so that by the month of September it shall have been ploughed about eight or ten times and the whole of the vegetable rubbish be perfectly rotten. All the sticks, roots of small trees which have not rotted should be picked up and thrown away and the land raked if not wet. It is convenient to have hogs feeding on the land during this time, as they help to mix up the soil. It is unnecessary to say that when about to begin planting they should be kept out of the field, for they would destroy the Tobacco plants. When there is no fear of floods and planting time has arrived, if there be any weeds growing on the land, it should be ploughed, attaching this time to the plough a log, about four feet in length, in such a manner as to break up the lumps of earth and at the same time collect the rubbish.

To Plant.—The land is ploughed in a direction from North to South, leaving at least a yard between each furrow, but if the soil be very fertile four feet should be left. The seedlings, after being up-rooted as before mentioned, are distributed along the furrows at a distance of eighteen inches from each other. Planting should be commenced *not earlier than three* o'clock in the afternoon on sunny days, but on a cloudy light showery day, planting may be carried on the whole day. Planting may also be begun before daybreak, so that the planting be finished by eight o'clock in the morning. The seedling is held with the left hand and the earth taken out of the hole with the right, and placing the seedling into the hole, throw some earth on the roots and slightly press it down, being very careful not to injure the tender stem of the seedling, and then fill up the hole with the loose soil. The depth at which the seedlings should be placed in the holes depends on its size, for which reason no exact rule can be given, but generally speaking, in ordinary size seedlings the root and a small portion of the stem only should be buried. Tall seedlings can be placed a few inches deeper, according to the size, but in no case should any seedlings be buried so deeply that the lower leaves touch the earth. One should also be careful not to ALLOW ANY EARTH TO FALL ON THE TOP OF THE YOUNG PLANT. Wet weather is most suitable for planting, and if the soil be very wet, the seedlings should be planted lightly, that is, avoiding all pressure on their roots. If the planting be done in furrows, the seedling should be placed on that side of the furrow called by the *vegueros* "*oreja*," which is the side on the *west*.

Seedlings from a distance.—When on any account planting has to be done with seedlings brought from a far distance, the greatest care should be observed in transporting and preserving them, for otherwise many will die when transplanted. The best manner is to take out the seedlings early in the morning and place them on the river bank (if there be any near) and under the shade of a tree so as to keep them altogether out of reach of the rays of the sun. After six in the evening of the same day or before dawn of the next they should be put up in small bundles, and before starting for their destination they should be sprinkled with cold water. As soon as they arrive at their destination they should be placed in the cool, under the shade of a tree. Every bundle should be undone and the seedlings separated widely apart and water again sprinkled on all so that when planting time arrives they are quite cool. If planted whilst warm very few seedlings will live.

If there is no rain when planting begins and the soil is very dry, sufficient water must be poured into each hole, and planting ought not to be performed till the following day, when the soil is moist. The newly-planted seedlings should be watered twice daily, before sun-rise and after sunset, for two or more days successively until it is seen that they have taken root. After the young plants are transplanted in the field those which have died must be replaced, and the operation repeated if necessary to insure a good crop.

Planting on Virgin Land.—For planting no trees or shade of any kind should be used, and therefore every one should be taken away on the land intended for a Tobacco field. Newly cleared land cannot be ploughed on account of the stumps and roots of the trees cut down. The roots could, of course, be dug out, but the expense attending this operation would be great. They may, however, be gradually dug out until in a few years none be left on the land.

When the soil suited for planting has been newly cleared and cannot for the reasons given be ploughed, HOLING must be adopted, which is done by means of a pointed pole or an iron implement made in the shape of a lance. After driving the instrument used with some force into the soil, turn it in several directions so as to break up the earth thoroughly, keeping a distance of EIGHTEEN INCHES from each hole and three feet from each row of holes. To give a regular and symmetrical appearance to the field we use a long, strong, single cord with pieces of coloured rags, or any other material fastened in at the distance apart which has been mentioned, namely, eighteen inches. The cord is kept stretched out by means of a stake driven in the ground at each end of the cord. In forming the rows of holes with this line the stakes tied at the end of it are placed at a distance of three feet from the preceding row.

CHAPTER IV.
AFTER CULTIVATION.

About eight or ten days after planting, if the soil is not too wet, the furrows are closed up by hoeing up the earth carefully around the plants and again performing the same operation at intervals of about fifteen days. This operation should be done if it does not rain. As a general rule it may be said that this operation of hoeing, or as it is commonly called, "MOULDING" should be performed as often as necessary to keep the soil loose and free from weeds. Moulding exerts a beneficial effect on Tobacco, aiding its growth and proper development nearly the same as rain does.

When the plants are still young two little narrow leaves (called "*barbas*" in Cuba) appear at the junction of the stem with the two lowest leaves, and they must be picked off as soon as they become visible, for if left they develop into long, narrow leaves, which greatly injure the plant. A process called "pruning" consists in taking off the two lower leaves of each plant as soon as they ripen. Care must be taken not to strip a piece of the bark of the stalk when removing them. When cured they produce a fairly good Smoking Tobacco. Particular care must at all times be taken to keep the plants free from grubs or caterpillars, and for this purpose hand-picking should be done at least twice daily, otherwise many of the best leaves will be perforated and rendered useless for wrapping purposes.

TOPPING (desbotonar).—The Tobacco plant grows more or less high, according to the fertility of the soil and the state of the weather during its growth. "TOPPING" is an operation which consists in plucking off the shoot button or bud (which encloses the flower) at the TOP of the plant. It should be taken off with the finger and thumb as being the safest way. The time when it should be plucked off is when the two little leaves which enclose the bud open out. Not more than *twelve leaves* should be allowed to remain *on each plant*, and the surplus leaves should be taken off along with the bud from the top of the plant. One must be very careful not to allow too much time to elapse and the flower to make its appearance, for then the leaves of the plants will be small in size and of an inferior quality. Eight days, or thereabout, after the "button" or bud has been removed, the suckers begin to appear, every one of which should be removed as soon as seen, and the operation must be performed as frequently as necessary in order that the plants may grow strong and vigorous. This operation is called ("deshijar") SUCKERING, the suckers being all those leaves which spring up at the junction of the stem and the leaves of the plant, as well as those that grow from the root and lower part of the stem. After the third suckering the plants will be fit for cutting, but this should never be done until the leaves are MATURED so as to obtain the Tobacco of prime colour, being careful at the same time to avoid their being too ripe, if this should happen they get discoloured, or dappled, thus losing in quality and producing much "FU (that is, almost valueless Tobacco). The leaf is MATURED when on its surface are formed ELEVATION BLISTERS, called by Cuban planters *"vejigar"* BLISTERING, and when the tops of the leaves, held in the hand, sound as if they cracked. It is then that the leaf is fully developed. When the plant has been cut suckers spring up. The leaves developed from these are called "CAPADURAS" or "CAPONES" and to obtain a good Tobacco from them NOT more than TWO SUCKERS must be allowed to grow from each parent-root, according to its strength, and leaving only those which spring up from *below the surface* of the *earth* and furthest from the cut stalk. The suckers or "ratoons" should be carefully weeded, avoiding throwing the earth on the cut stem or on the suckers, and moulding should be performed as frequently as the weather and the vigor of the parent-root requires it.

The after-cultivation and curing of these suckers is identical with that of the first crop of Tobacco. "Ratoons" or suckers are developed as many as five times in succession, provided the weather be rainy and the number of suckers left be proportionate to the vigor of the parent-root. The Tobacco obtained each time will be of good size and quality, and sometimes, in every respect, superior to the first cut.

CHAPTER V.
HARVESTING.

When the plant is properly ripe and fit for harvesting, cutting must not be commenced until the dew has disappeared and the leaves are thoroughly dry, that is, after ten o'clock in the morning and continued till about three o'clock in the afternoon. The best knife for use is the hook-nosed pruning knife.

The leaves are best cut in pairs *"mancuernas,"* commencing from above and proceeding downwards to a level with the earth, in preference to the method of cutting down the whole plant. The "mancuernas" should be placed on poles (of convenient length and thickness, first stripped of their bark) as quickly as possible to prevent the sun from burning the leaves while in the ground, for if this should happen the Tobacco would be greatly damaged. Each "CORTADOR" or CUTTER should have as many COLLECTORS as may be found necessary in order that the Tobacco cut may be on the ground the least possible time. The CUTTERS should throw the "CAPA" or *wrappers* (the best Tobacco) on the space or wall between the rows of plants which they may be following and the "TRIPA" or *fillers* in the next, thus keeping the two classes separate, and for a like reason each pole should be filled with the same class, and when full of the Tobacco should be kept separate in the House. When on the poles the Tobacco should be kept for a while in the sun to wither and then taken to the House; for while it is beneficial to dry in the sun when on the poles, it is destructive to the quality of the leaves if it is dried by the sun while lying on the ground.

If it be decided to cut the plant whole, as is sometimes practised, cutting always commencing at the proper time of the day, each CARRIER should be provided with bands eighteen inches in width and of any desired length. With these bands the cut plants are carefully tied into BUNDLES or "MATULES," so as not to break the leaves, and should be of a size which the men employed as carriers can readily carry. Instead of bands, bags may be used to carry the cut Tobacco to the Tobacco-house. Every endeavour ought to be used not to allow the Tobacco to remain on the ground longer than is absolutely necessary to pick it up, to avoid the inevitable burning which will occur if left long on the ground. The bundles or bag-fulls may be carried to the House either on head, small carts, or any other manner.

The manner of curing the Tobacco cut in these two ways will be described in another Chapter.

Before detailing the CURING, which has to be done in the HOUSE, it is convenient to give a brief sketch of a TOBACCO-HOUSE, and at the same time of the "PILON" or "PRENSA," the "BULKING-BOX" or "PRESS."

CHAPTER VI.
CURING.

TOBACCO-HOUSE AND PRESS.

It is understood that the House must be finished by the time cutting is to commence. The "PILON" or Press is to be made when the Tobacco is dry on the poles and nearly ready for bulking or fermenting in the PRESS.

THE TOBACCO-HOUSE.

The house should run from North to South (one end looking North and the other South). Of whatever length it is built, take HALF the LENGTH, LESS ONE PART for the breadth, and with these dimensions a well-shaped house will be constructed. TWO-THIRDS the BREADTH is taken for the LENGTH OF THE RAFTERS, and if the House be thatched, ONE FOOT more should be added to the length, so as to have a greater inclination of the roof to throw off the rain water rapidly. For example, a house of 20 yards in length (the posts supporting the roof being 4 yards high), the breadth will be 9 yards and the length of the rafters 6 yards: half of $20 = 10$, less 1 yard $= 9$ yards, and two-thirds of 9 yards $= 6$ yards. A house of these dimensions is to be divided into sections, "APOSENTOS," allowing a space of 27 inches between each section so that a man may easily get in to put up or bring down the poles. The same space left between each section (27 inches) should be left at both ends of the house to afford the same facility. A passage one yard in width should be left, dividing the house lengthwise into halves, and each half will have by this passage four sections on each side, thus making in all eight sections, and each of these sections will have *four* square yards. The apartments are framed by posts.

The poles for a house of the foregoing dimensions must be at least thirteen feet in length.

The poles filled with the Tobacco are placed on what are called in Cuba "BARREDERAS," which are stout, strong rails, of the length of the sections, nailed horizontally on posts, which form the sections one above the other and at a convenient distance, namely, ONE YARD, so that the tips of the leaves o the upper poles do not touch the butt ends of the lower. The space above the tie-beam is divided in the same manner as was done below it. To be able to do the division above as below, it is necessary to put two *tie-beams* and two *cross beams* or *cross pieces* to form each space, and by these the spaces separating each apartment below will be continued above. We would advise the beginner to see a house built by an Expert as the best means of becoming acquainted with its construction.

When the house is shingled or thatched, a kind of window or ventilator should be left at the top of each gable so that the air may refresh the Tobacco which is at the upper part of the house. In a foggy locality the sides of the house should also be covered with thatch. Several doors should be made so that after the fog has disappeared they may be opened and air allowed to circulate freely through the house. The sides of the house should be WATTLED.

THE PRESS OR "PILON."

The Press is made in one of the sections of the Tobacco-house, and of the required size. The section in which the Press is constructed must be well closed to exclude the outer air. Long logs are placed parallel to, a little apart from, each other, and on these a kind of floor is made of either boards or wattles, at a height of about one foot. The floor so formed is covered with thatch or dry plantain leaves, and the Tobacco can now be placed in it.

CONDITIONING OR FERMENTATION.

1. MANCUERNAS, or pairs of leaves.

As soon as the poles are carried to the House filled with the Tobacco, cut and arranged as before described, they are placed on the horizontal rails or "BARREDERAS" closely packed together. They are left in this state for three days, if it be in the months of October, November or December, but in any of the following months they must be kept so packed for not more than one or two days.

When the leaves become *yellow* they are said *to be ripe* and then the poles *must be* separated *a foot* from each other.

There are two methods of treating the Tobacco when in this condition:—

Method A.—Allow the poles to remain the foot apart till the stalks and the *midribs* or *middle vein* of the leaves get dry, then carry up the poles to the *upper* "*barrederas*" and again pack closely, *if there be want of room*, but if room be not needed, then they may be put a foot apart.

Method B.—Separate the leaves which may be sticking together and place the poles filled with the Tobacco out in the sun for three days, being very careful *not to allow rain to wet the Tobacco*, and replace them in the house every day at about 3 or 4 o'clock in the afternoon to avoid the dew. Horizontal bars of a kind similar to those used in a gymnasium are made on which to place the poles filled with the Tobacco. At the end of three days the poles are placed on the upper "barrederas," and there allowed to dry properly. The poles may be closely packed if room be needed, *but this should never be done unless the "middle vein" or midrib be thoroughly dry.*

I prefer this method to the former, because there is no fear of "*Sahorno*" (putrid fermentation), and the Tobacco acquires a better colour.

Considering the advantages of this method, it is almost superfluous to advise the adoption of it in preference to the former.

2. *When the method is adopted of cutting the whole Plant.*—The bundles or "matules," when brought in from the field, are unloaded at the House, and should be opened out at once and the Tobacco scattered about as widely as possible to allow it to cool to prevent its sweating, When cool and there is no risk of sweating, the stalks of two plants are tied together at the root end with any kind of string, fastening four stems to one string, which should be just long enough to allow the Tobacco to be hung up on the pole, like the "mancuernas." In case the Tobacco plants be rather large, instead of two, only one should be tied at each end. The string should be tied below the upper leaf, on the butt of the stalk, so as to prevent their falling down. One must be very careful to see that the labourers tying do not put more than four small plants or two large ones in each string.

After being placed on the poles the Tobacco cut in this manner is treated just the same as that cut in pairs of leaves, or "mancuernas." Although we have attempted here to describe one of the most important operations, yet it is a fact that scarcely any one can become efficient in the practical part unless he assists in carrying out the work for some time under the instruction of an Expert.

METHOD OF BULKING IN PRESS.

(EMPILONAR.)

Method 1.—At the beginning of Spring, when the Tobacco becomes soft and pliant on account of the humidity of the weather, the poles are taken down - the time for which must also be regulated by the condition of the leaf—the leaves are stripped off, or removed from the stalks and made into bundles or "matules," 18 inches in length by 18 inches in depth, the breadth being the length of the leaves. The leaves are placed with all their butt ends together and properly tied to form the "matul." The "matules" are more easily formed by means of two pairs of short stakes driven in the ground in the House, at the proper distance, viz., 18 inches, strings to be used for tying up the bundles are passed between each pair of stakes. The stakes in each pair being driven apart at a distance according to the length of the leaves. After the bundles are made they are put in the *pilon* or press tightly packed together, covering them up with thatch or dried plantain leaves, putting on top of all a few blocks of wood, or any other weight, to press the Tobacco slightly. It should now be allowed to remain in the press for *at least eight days* before commencing the SORTING of the leaves, but it is preferable to allow the Tobacco to remain in the press for about *thirty days or more,* as the Tobacco is benefited by the press, and there is no risk in its remaining here for any length of time, provided *the leaves as well as their mid ribs be thoroughly dry* when put into the press. The *weights should be removed after* thirty days.

When about to SORT the leaves as many bundles as can be worked up in a day are taken out of the press, opened out, and the tips and the butt ends of the leaves are moistened with a wet sponge The bundles are again made up and placed into the press, covering them as before. *Twenty-four hours after*, when the leaves will have just enough moisture to be handled without breaking, the bundles are taken out as fast as the leaves are SORTED

SORTING, classification or choosing of the leaves, is done to separate the different kinds of leaves according to their qualities, etc. Each planter may classify or sort his tobacco as he thinks best, but the simplest classification is: into *first class* CAPA (wrapper); *second class* CAPA, *first class tripa* (filler); *second class tripa* and *third class tripa*, the remainder being "FUNK," or inferior Tobacco. The leaves which have been SORTED should be immediately, or rather simultaneously, made into *hands* or "*manillas*." A "*hand*" "*garilla*" or "*manilla*" is made by placing the butt ends of the leaves evenly together until the hand is full of leaves, selecting a leaf which is not very sound, twist it like a rope, and wrap it around the butt ends of the leaves so as to tie them properly together, then divide the whole bunch of leaves with the hand and draw the tying-leaf through and close the bunch, thus securing the leaves, afterwards place the HANDS in the press again.

I am greatly in favour of the foregoing method of bulking on account of the many advantages it possess over the following, which is by some adopted as the usual method of curing at this stage:—

Method 2—If for want of room in the House or on account of very wet weather the Tobacco becomes mouldy and there be fear of losing it, it should be put into the press at once In such a case it should remain in the press not longer than is absolutely necessary for stripping off the stalks and sorting the leaves, *never beyond eight days*, as the dampness of the stalks spoils the leaves. The after-treatment is the same as the first method.

CHAPTER VII.

PACKING AND BALING.

As soon as it is desired to pack the Tobacco the *wash* is prepared with which to sprinkle it. The "manilla" is held in the left hand, and with the right the wash (betun) is sprinkled on evenly, and the hand of Tobacco well shaken to remove drops of wash on the leaves, they are then put aside in a heap and allowed to remain so for a couple of hours, or until the leaves be sufficiently pliant and soft to permit handling without breaking, and they are again put back into the press. After remaining in the press for about four or six days the *hands* or *manillas* are taken out and shaken and made into *bunches* of three or four *hands* each, called "*manojos*," and then put into bales. When *baled*, the Tobacco undergoes its last fermentation, being ready at the same time for the market, and the curing of the crop is at an end. The *yaguas* which are strips of palm bark used in baling, must be properly dry and pliant and evenly flattened by pressure. Each bale should hold eighty-one *manojos* The bales are made in a wooden frame, which is constructed on different patterns It is useless to describe the process, as no description whatever can teach the manner of making a bale. It must be learnt by practice as many of the other processes also must be. After the bales are made they should be put out in the sun till the *yaguas* and ropes with which the bales are tied be thoroughly dry. After drying they should be stored away in a suitable dry place having a wooden floor.

When more than three bales are put together, one on the other, the pressure of such a weight takes away the softness and elasticity of the leaf, but on the other hand renders it a better Smoking Tobacco. Every one, therefore is at liberty in this particular to use his discretion to suit his interest.

Besides *yaguas* cases are used for packing Tobacco, those made of cedar-boards being preferable, but packing in *yaguas* or baling is by far the best. Such is the prevailing opinion amongst planters in Cuba that it is a common saying there, that "God made the *Yagua* for the Tobacco" (Dios hizo la yagua par el tabaco.)

APPENDIX.

(*a.*) A Nursery 110 yards long and 22 yards wide will grow a sufficient number of healthy seedlings to plant a field of 10 acres.

(*b.*) For a Nursery of the foregoing size about two pounds of good, healthy seed should be sown, and if these do not grow, fresh seed must be sown again.

(*c,*) On an acre of land 10,000 plants can be cultivated, but the exact number is 9,680 plants. One man should not attend to more than the number of plants which can be grown on an acre of land.

(*d.*) The number of plants that will give a quintal (100 lbs) of Tobacco cannot be exactly estimated, for it depends on the state of the weather and the fertility of the soil. But in general terms it may be said that if the soil is good and the weather is favourable 1,000 or 1,500 plants will give a quintal.

(*e.*) Should it rain whilst cutting is going on, the operation must be discontinued until the weather is again fine—as the leaf must on no account be cut while wet.

Tobacco should not be cut during rainy weather, as at that time the suckers are growing freely and take away the quality of the leaf, which is in a measure regained by succeeding dry weather.

BETUN OR WASH.

Take 5 lbs. of old, strong Tobacco stalks and put into 2 or 2½ gallons of water, and boil sufficiently to reduce the quantity of water to about one third so as to obtain a strong, well boiled infusion. The vessel in which this infusion is made should be new and perfectly free from grease. Take a clean barrel, fill with clear water, and put into it a sufficient quantity of Tobacco-stalks, three quarters of which should be of the former crop and one fourth of the last. Allow it to ferment for four days, and on the fifth day, when it should be used, add as much of the infusion to this as will darken it, and it may now be used.

No. 14.

July, 1889.

BULLETIN

OF THE

BOTANICAL DEPARTMENT

JAMAICA.

CONTENTS:

PRICE—Two-pence.

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

1889.

PARCHMENT COFFEE.

In BULLETIN No. 12, the price was quoted for coffee sent home in parchment, as ranging from 76s. to 90s. per cwt. There was no means then of comparing the price with that of fully cured coffee, but Mr. John Davidson of Bellevue has since informed me that he was the shipper, and has been good enough to send me the sale note of cured coffee sent home at the same time.

It will be seen from his letter below, that parchment coffee compares favourably with cured coffee in price Mr. Davidson speaks for those who have the full complement of machinery and abundance of water power, when he says there is no appreciable difference in price. For those who have no mill, it is a great boon to be able to export their coffee in parchment.

W. F.

John Davidson, Esq., to the Director Public Gardens and Plantations.

Bellevue, April 30th, 1889.

W. Fawcett, Esq.

Dear Sir,

I enclose you a sale note of 11 brls. coffee sold at the same time as those sent home in parchment and mentioned in the Bulletin. There is no appreciable difference, the only advantage that I can see is in cases where the machinery is either incomplete or defective, and where there is no water power. I do not think much, *i. e.* any money is saved, but pilfering is avoided which is sometimes carried on particularly at one stage before sending away the coffee; for settlers' coffee it would hardly answer, unless bought in the berry, as small lots from several places to make up a shipment would be all different, and indifferently cured, and once the coffee has gone wrong in the parchment you cannot get it *straight* again.

Yours faithfully,
(Signed) JOHN DAVIDSON.

Copy. SALE NOTE. 12th December, 1888

From Park, Macfadyen & Co.,
25 Lime S. West,
London, E. C.

To John Davidson, Esq.,
Jamaica.

Ex. Ship	Mark	Produce	Description	Price
Medwa .	D B V.	11 Barrels Coffee	Fine fine ordinary green.	87/6.

CACAO.—PLANTING AND CURING.

SITUATION.

Mr. Morris in " Cacao : how to grow and how to cure it," gives it as his opinion that " Cacao to be successfully cultivated in Jamaica, must be confined for the most part to our moister valleys and hollows. Where the plains meet the hills, at elevations say 150 to 500 feet, and, where there is good shelter from prevailing winds, Cacao should thrive well. . . . The rain-fall should not be below an average of 60 inches per annum, nor should the mean annual temperature be below 75° F."

SOIL.

The soil should be rich and moist, and more important still, should be deep, for the tap-root is long, and if it reaches rock or clay, the tree dies off. A soil with a certain amount of lime or marl is to be preferred.

NURSERIES.

When seed is very plentiful, it is sometimes the custom to sow 2 or 3 seeds together in each hole and when the plants are from 4 to 7 months old to pull up the weakest, leaving only one at each spot.

It is a better plan, however, to sow the seeds first in a nursery, and then plant out with the first rains. If the number is small, the seeds may be sown in bamboo pots, which can be readily slit, when taken out into the field. If beds are used, they should be about 20 feet long by 3 feet wide, somewhat raised and composed of leaf-mould or friable loam shaded with Palm leaves or thatch. The plants should be transferred to the Cacao-walk when they are from 6 to 8 inches high.

PLANTING.

The young Cacao-plants are placed at intervals of about 13 feet apart every way. Between every 2 Cacao-plants, a banana must be planted to afford shade for the first 2 or 3 years ; and at intervals of 39 feet, trees are grown for the sake of permanent sheds when the bananas are cut down. It is also necessary for the first few months to grow such plants as cassava, chillies, or gungo peas, close to tho seedlings. It is well to have all these various kinds of shade-plants put into the ground before, or at any rate at the same time as, the Cacao. For permanent shade, such trees as the Sandbox Tree, the Jac-Tree, the Guango, and the Hog Plum are recommended.

CURING.

The Cacao exported from Jamaica obtains a price so far below Trinidad Cacao, that it was determined to make some experiments in curing, in order to be sure that the low price was due, not to bad seed, but to bad curing.

The first experiment consisted in curing mainly according to the directions given in Mr. Morris's pamphlet. The beans were taken from the pod, and placed to ferment in a barrel with holes in the bottom through which the moisturo drained out. The temperature never rose above 92° F, and remained for some days at that point. After 6 days, the beans were taken out, and spread in the sun in a thin layer, women being employed to rub them occasionally between their hands, and remove the refuse. They were turned over at intervals to prevent scorching, and were shaded during the middle of the day when the sun was at its hottest. At night they were placed in a heap in the store-room. Not a drop of rain was allowed to touch them, and they were not washed. After about 6 days, the bean breaks easily, and if properly cured, should be of a good chocolate colour without any white skin between the component parts, of a vinous smell, and a sweet (not bitter) taste. Half of the beans were clayed with red clay, but this operation made no difference in the final result, and is evidently useless. The cured beans were shown to Mr. Bravo, a manufacturer of Chocolate in King St., Kingston, and he pronounced them equal to Trinidad for his purpose. It is strange that he should have to import Cacao from Venezuela, and Trinidad, and pay the duty because he cannot get native Cacao properly cured.

Taking a hint from Mr. Bravo, another experiment was made, which varied from the first in the following point :—The beans were not taken out of the pods, and placed in a barrel, but the pods were simply cut in half, and thrown into a heap with plenty of banana leaves over them. The temperature rose gradually from 92° on the first day to 106° on the sixth. Mr. Bravo pronounced this sample to be better than the first, very much like some Trinidad, but inferior to some samples from Venezuela.

Only experience can determine exactly the best conditions necessary for first class curing, but these experiments show that by the method of washing and simply drying the beans without any fermentation, our settlers are just throwing money away. The beans are good enough, it is the want of curing which produces the inferior chocolate.

These results are due to the careful way in which the experiments were carried out by Mr. Harris, the Superintendent of Hope Gardens.

It would help settlers very much if the clergy, school teachers, and others interested, would try to impress on their minds the following few directions for curing Cacoa :—

Never let a drop of rain or water touch the beans.

Never wash them.

Cut the pods in two, and pile them in a room or shed in a heap with plenty of banana or plantain leaves over them.

After from 4 to 6 days, spread them out in a thin layer in the sun.

In the middle of the day when the sun is too strong, shade them.

Turn them over now and then, rub between the hands, and pick out the trash.

After 4 or 5 days the beans will be cured, if they break easily; if the colour is dark chocolate, not red; if there is no white skin inside ; if it tastes sweet, not bitter.

CASTOR OIL PLANT.

The Castor Oil plant (*Ricinus communis, L.*) is now extensively cultivated in India and the United States, and the oil, if carefully extracted, is a valuable product. As the plant grows in Jamaica like a weed, it would probably pay to cultivate it. On many sugar estates, it is found necessary to allow the land to go into ruinate, piece by piece, in order that it may recover from the exhaustion incidental to the growth of the cane when sufficient manure has not been applied. In Europe, rotation of crops, as well as artifical manures, have taken the place of the old method of leaving the ground fallow, and it is possible that castor oil may be a suitable plant to succeed the sugar-cane, and to grow in exhausted coffee fields. In some parts of the world, it is grown merely for the sake of improving the land. The refuse of the seeds after the extraction of the oil, is also a valuable manure.

The soil best suited for the Castor Oil is a sandy loam. There are a great number of varieties sown with small and others with large seeds. The small seeds are considered to afford the best oil for medicinal purposes, and it is therefore advisable to cultivate only these varieties. The cultivation is simple, and similar to that of corn (maize).

The yield varies from 15 to 50 bushels (of 46lbs.) to the acre; and 100lbs. of good seed yield about 5 gallons of oil.

In order to harvest the seed, the best plan is to cut the pods when they are just turning brown and put them on a barbecue. When the pods have all burst, the empty husks can be picked up, and the seeds swept together and collected. The same care should be taken as in coffee, cacao and pimento to prevent rain touching the seeds ; if there are more than 50 acres under cultivation, a drying house is necessary.

To extract the oil the simplest way is to bruise the seeds in a mortar and then boil them in bags under water. The use of the bags is to retain mucilaginous matter and other impurities, while the oil risesto the surface, is drawn off, strained, and bottled. But oil prepared in this way, is only fit for lucubration, illumination, &c., not for medicinal purposes.

The preparation by expression is far superior. The first requisite is to get rid of the hard skin. On a small scale this may be done by pounding gently in a mortar, but it is more conveniently effected by passing the seeds between two rollers, set just at such a distance from each other as to break the skin, though sometimes the seeds are allowed to be slightly crushed. The seeds are cleaned by winnowing, and carefully picking over. The details of the further processes differ very much, but there are two principal plans of procedure.

In India, a plan somewhat like the following is employed. The cleaned seeds are put into hempen bags, and pressed in moulds into the shape of bricks. The bricks are placed in layers in a hydraulic press, each layer being separated by a sheet of iron heated to 90°. The pressure is applied gradually, and the oil thus obtained is of the first quality. The crushed mass is again subjected to pressure with the plates heated at 100°. This gives a second quality of oil. After standing for some time, a sediment is deposited, the oil is drawn off, and filtered through flannel bags.

Another system, which is preferred in California, is as follows :—The shelled seeds are placed in a shallow iron reservoir, and submitted to a gentle dry heat, not greater than can be borne by the hand;

They are then put into a screw-press, which may be worked by horse power. The liquid which comes away is boiled for one hour with an equal amount of water. The clear oil is removed next morning, and again boiled with a small quantity of water.

"At the exact point when the water has all boiled away, which is indicated by the bubbles ceasing to rise, the process is stopped, as every care must be taken not to push the heat too far."

The oil is sometimes bleached by placing it in tanks or large glass vessels, and exposing it to the sun. It loses some of its purgative power, but nevertheless obtains a higher price in the market.

ROPES FOR FIBRES.

So much has been written of late years with regard to the adaptability of our native fibres for various purposes, that it would be superfluous for me to attempt to go over the same ground again, but I cannot refrain from making a few remarks on the large quantity of ropes of various sizes imported and used in the Island, while rope-making materials grow everywhere in abundance. This latter fact is recognized, and taken advantage of by the peasantry, indeed many of them partly make a living by the sale of ropes, short lengths—usually about 25 feet long, and headstalls made of fibres from the barks of trees.

The barks mostly used for this purpose are the "Mahoe" (Hibiscus elatus, L.) "Trumpet tree" (Cecropia peltata, L.) and "Burn nose" (Daphnopsis tinifolia, Gr.); leaf-fibres are also made use of to some extent, and it is a pity that they are not entirely used instead of bark-fibres. Very strong ropes are made from the fibre obtained from the leaves of the "Keratto" (Agave Morrisii, Bak.) "Pinguin" (Bromelia Pinguin, L.) "Banana" (Musa sapientum, L.) &c.; also from the aerial roots of a species of Ficus.

The fibres named are those most generally used, but there are plenty of others equally valuable, and some of them, are very common in certain districts, e. g. "Ippi-Appi" (Carludovica Plumieri, Kth.) "Silver Thatch" (Thrinax argentea Lodd.), "Ochra" (Hibiscus Abelmoschus, L.), "Dagger Plant" (Yucca aloifolia, L.), several species of Crotolaria which are common weeds. "Pine-Apple." (Ananas sativa, Lindl.), "Aloe" (Furcræa cubensis, Haw.) and many other plants to be had in abundance, yield good, strong fibres suitable for making ropes and cordage. Nearly every peasant is the owner of one or more head of stock, and he requires rope not only for reins, but also to tie loads on the animals' back and for a score of other uses. When we look at the matter in this light we can form some idea of the large quantity of rope which must be annually required. The use of barks for this purpose should be discouraged, except perhaps the "Trumpet tree" which is very plentiful every where and, as far as I am aware, is of no other value. The "Mahoe tree" which yields the bark most prized, also yields one of our most beautiful and valuable native woods, and in country districts where this tree is plentiful hundreds are killed every year through being stripped of their bark for rope making. I have only alluded to the rope required by the peasantry, but there is no reason why every bit used in the island should not be made here. The machinery necessary for the manufacture of rope is, I believe, simple, and might be worked under the superintendence of any intelligent person. The raw materials are plentiful, and the demand for the manufactured article, if offered at reasonable rates, would, I am sure, be steady and good. I feel confident that a fortune awaits the man with sufficient means and courage to start this industry. He might begin by manufacturing ropes of various qualities and sizes, and when he gains sufficient experience of the relative values of the fibres at his command, and his work people understood the working of the machinery, &c. he could introduce the manufacture of bags of different kinds. The number of these annually required for coffee, cocoa, and pimento, not to mention many other things for which they are used, must be simply enormous. These are small matters, comparatively speaking, and though the total spent on rope and bags by a single member, or estate during the year, may not amount to much, yet, taking the whole island, the money expended on these two necessary articles must be a very respectable sum.

W. Harris.

SOWING AND GERMINATION OF SEEDS.

No hard and fast rule can be laid down for sowing seeds. Small ones are, as a rule, sown thickly while large seeds are planted singly and at some distance apart. Then, again, large seeds require to be covered rather thickly with soil, while small seeds need only be very lightly covered.

Germination is the first act of vitality in plants. The quantity of moisture necessary to enable the seed to germinate varies with the nature of the plant. Seeds of water plants should be entirely immersed, but those of land plants need only be kept moist, and it is essential to germination that they should be kept moist, for if allowed to become dry they shrivel (except of course hard coated seeds like some palm seeds) and the germ looses its vitality. If seeds get too much water on the other hand (except water plants) they undergo a kind of maceration which destroys their germinative power. The atmosphere should have free access to the seeds, hence the soil should be light and open. Seeds buried in stiff clay, or at considerable depths below the surface do not germinate. All seeds do not take the same time to germinate, beans and peas for instance germinate very rapidly, while some of the Palms, Ceara rubber, &c., often take years before showing any signs of growth.

The soil used for covering seeds should always where practicable, be sifted. Where a large quantity of small seed is sown, *e. g.* tobacco seed, it will answer the purpose if, after the seed is sown, the beds are lightly raked over so as to cover the seeds. Very small seeds need not be covered at all, but immediately after sowing they should be watered and the water will carry them down a sufficient depth for all their requirements. It is always safer to sow small and delicate seeds in boxes or pots, but it is of great importance that these should be thoroughly drained. The boxes or pots may be covered with glass which will prevent excessive evaporation and will keep the atmosphere in them in a state conducive to germination. The glass should be removed as soon as the young plants appear or they will be "drawn" by it, and will become weak and straggly.

Ants are very fond of some small seeds and in a short time will carry away every seed out of a box. To put a stop to the depredations of these mischievous little creatures a good plan is to have a stand made with four legs, large enough to hold one or two seed boxes, and either have the legs tarred, or stand each in a small tin of kerosine oil; this will prevent the ants getting at the seeds. I have already mentioned that all seeds do not take the same time to germinate, some taking a few days, and others years. It is not desirable that we should have to wait one or two years for the seeds of a certain plant to grow, and some remedy to prevent this long delay, or rather some remedy to promote and assist germination is usually resorted to. Various remedies have been suggested, but the most effectual is generally admitted to be that of soaking the seeds in water for some time previous to sowing. The water causes the seeds to swell and the tough integuments which enclose the embryo burst. Although soaking seeds to induce germination is a good remedy it is not always an effectual one. I have mentioned that the seeds of the Ceara rubber (Manihot Glaziovii) often take years to germinate, and this has been the case although the seeds were soaked in a box, two sides of which were made of perforated zinc, placed in a running stream of water and allowed to remain there for over two months. The seeds of this tree, however, are exceptionally hard, and recourse was had to filing and grinding down the ends of them. This was rather a tedious and slow process but was fairly successful. The seeds of the Ivory nut Palm (Phytelephas macrocarpa) also take a very long time to germinate. Some seeds lose their vitality soon, while others retain it for a long time. Nutmegs, for instance, should be sown when quite fresh; if kept for any length of time the kernel shrinks and will be heard to rattle in the shell if the nut is shaken. When this is the case germination cannot take place and it is useless to sow the nuts. I might mention also that great care should be taken in handling nutmegs when even quite fresh If roughly shaken the embryo becomes detached and the seed will not grow. Coffee and Cacao seeds also require to be sown immediately after ripening.

In sowing seeds in beds in the open, as for instance, Cacao, it is best to sow in small drills 6 or 8 inches apart, and the seeds should not be placed too thickly, so that when the young plants appear they will have sufficient light, air and space to develop It is the practice in some parts to "plant at stake," as it is called, that is, the ground is loosened and the seed is placed where it is intended that the plant produced by it shall occupy a permanent position. It is a much better plan, however, to raise the plants in beds and transplant when strong enough. If a planter wishes to establish, say, 2,000 nutmegs on his property he cannot possibly give them the same care and attention during their infancy, if the seeds are planted singly over a large area of ground, as if he had all in a seed-bed or nursery under his eye.

W. Harris.

BOTANICAL NOTES ON COMMON PLANTS GROWING IN JAMAICA (2).

The following notes are in continuation of those in Bulletin No. 9. They are intended for the use of those who wish to practice themselves in the use of botanical terms. It will be found easy enough to understand them, after mastering Sir Joseph Hooker's very interesting "Primer of Botany."

(18) Turkey Bloom, Kill-Buckra Weed, Caltrop (Tribulus).

The calyx consists of 5 *distinct sepals (poly-sepalous)* with the edges *overlapping* in the bud (*imbricate*); it is inserted *below* the pistil (*inferior*). The corolla consists of 5 *distinct petals* (*poly-petalous*), imbricate and inserted *below the pistil* (*hypo-gynous*). The stamens are *10 in number*, *free from one another* (*dec-androus*), and hypogynous; 5 are opposite the petals, and 5 are alternate which have a gland at their base outside; the anthers are fixed about the centre with the lower portion of the lobes free. Within the stamens there is a tenlobed fleshy ring (*disc*). The pistil is composed of 5 *united carpels (syn-carpous)*; it is *free from the calyx* (*superior*); the carpels are opposite the petals, each with 3 ovules placed one above the other, imbedded in the tissue of the ovary; the style is short with 5 stigmas.. The *ripe ovary (fruit)* consists of 5 to 10 distinct portions; each, woody, *not opening* (*in-dehiscent*), with 2 long spines and numerous short spines; each with 3 seeds, sunk obliquely in the woody tissue. The seed has a thin white *skin* (*testa*), is *without endosperm* (*ex-albuminous*); the cotyledons are oblong; the radicle is short.

The species are herbs with prostrate branches. The leaves are stipulate, compound, with the leaflets arranged along each side of a common stalk (*pinnate*), and ending with a pair of leaflets (*abruptly pinnate*)

There are two species of this genus in Jamaica:—

Tribulus cistoides, L. (Turkey Blossom or Kill Buckra Weed) in which the calyx *soon drops (deciduous)*; and the fruit breaks up into 5 portions, each of which is divided transversely into one-seeded compartments.

Tribulus maximus, L. (Caltrop) in which the calyx is persistent, and the fruit breaks up into 10 portions, each with one seed.

They belong together with Lignum Vitæ *(Guiaeum officinale)* to the order Zygophylleae, of which the following are the principal characters:—There are 4 or 5 sepals, usually inferior, and imbricate. There are 4 or 5 petals, hypogynous, and usually imbricate. The stamens are hypogynous, usually with a scale at the base, equal or double the number of the petals. The disk is hypogynous, usually fleshy. The ovary is lobed or angled, 4 or 5-celled. The embryo has little or no endosperm.

The order belongs to the group Polypetalae of the Dicotyledons.

(19.) Horse Radish Tree. (Moringa pterygosperma, Gærtn.)

The flowers are irregular. The calyx consists of *5 united sepals (gamo-sepalous)*, the edges *overlapping in the bud (imbricate)*, inserted *below the pistil (inferior)*; the tube is short; the limb is divided nearly to the base *(5-partite)*, the lobes are petaloid and somewhat unequal. The corolla consists of

5 distinct petals (poly-petalous), attached to the calyx *round the ovary (peri-gynous)*. There is a fleshy *ring (disc)* lining the calyx-tube. The stamens are *10 in number and free from one another (decandrous)*, inserted on the edge of the disk, perigynous, 5 perfect opposite the petals, alternating with 5 without anthers; the filaments are hairy at the base; the anthers are one-celled, opening by a long chink. The pistil is free from the calyx *(superior)*, and is composed of *3 united carpels (syncarpous)*; the ovary is stalked, one-celled, with numerous *reversed (anatropous)* ovules, inserted on *3 lines of attachment (placentas), on the walls (parietal)*; the style is tubular, open at the apex. The long pod-like fruit is *dry, splitting up (capsule)* into 3 valves, which bear numerous seeds along their middle. The seeds are 3-winged, *without endosperm (ex-albuminous)*.

There is only a single genus in the order Moringeæ, of which the following are in brief the characters: The disk lines the calyx-tube. There are 10 stamens, of which 5 are without anthers. The ovary is one-celled, with 3 parietal placentas. The ovules are numerous. The order belongs to the Dicotyledons, Polypetalae.

(20.) Jamaica Snap-dragon, Spirit Leaf. (Ruellia tuberosa, L.)

The calyx consists of 5 *united sepals* (*gamosepalous*) which are distinct nearly to the base (5-partite), inserted *below* the pistil (*inferior.*) The corolla consists of 5 *united petals* (*gamo--petalous*), twisted and overlapping in the bud (*contorted imbricate*); it is funnel-shaped, the tube is narrow for a short distance and then expands, the limb is spreading, with 5 roundish lobes. The stamens are 4 in number, of which one pair is longer than the others (*didynamous*); they are affixed to the corolla (*epi-petalous*) at the upper portion of the narrow part of the tube; the anthers are arrow-head-shaped (*sagittate*). There is a fleshy ring (*disc.*) surrounding the base of the ovary. The pistil consists of 2 united carpels (*syn carpous*) it is free from the calyx (*superior*); the ovary is divided into 2 cells by a *partition* (*septum*) with several ovules in each cell; the ovules are reversed (*anatropous*) inserted on lines of attachment (*placentas*) running along the middle of the septum. The style is thread-like (*filiform*) with one large stigmatic lobe and another very short. The fruit is *dry, splitting up* (a capsule) along the back of each carpel (*loculicidal dehiscence*) the 2 valves curving back with half the septum in the middle of each, bearing the seeds. There are several flat roundish seeds, *without endosperm* (*ex-albuminous*), the stalks of the ovules (*funiculus*) have grown out and hardened into hooks. This species is a herb. The leaves are opposite, entire, oval, tapering into the very short stalks. The flowers are in axillary panicles, the branches of which are *forked in pairs* (*dichotomous*). The bracts are small and narrow.

Ruellia belongs to the order Acanthaceæ, in which is also included the well-known genus Thunbergia. The following are the characters of the order: The flowers are irregular and often enclosed within bracts. The calyx is inferior, usually composed of 4 or 5 imbricate sepals. The corolla is gamopetalous and irregular. The stamens are either 2, or 4 (didynamous). The ovary is superior of 2 united carpels. The capsule splits with elasticity into 2 cells, exposing a few roundish seeds, hanging to the cells by cup-shaped or hooked processes (*retinacula*). The seeds are exalbuminous.

The order belongs to the group Gamo-petalae, of the Dicotyledons.

(21.) Pine Apple (Ananas sativa).

A Pine-apple plant must first be examined when the head which afterwards becomes the fruit is quite young. Cut the head longitudinally. All the central portion is a thickened stalk with the flowers embedded in it and with a leafy shoot at the top. Each flower is inserted above a small altered leaf (*bract*), which also is partially embedded in the stalk. The lower flowers are the oldest. The sepals, thick and hard, are 3 in number, free above the ovary, imbricate. The 3 petals are distinct, inserted with 6 free stamens round the top of the ovary. The ovary is surrounded by the base of the calyx and sunk into the stalk; it is 3-celled with several ovules in each cell. The ovules grow straight without any bending on themselves, so that the micropyle is at the end away from their attachment (*ortho-tropous*). The style is thread-like with 3 stigmatic branches at the apex. The ovaries and stalk enlarge to form the pine-fruit (*syn-carpium*). The seeds are small, compressed; the embryo is small, near the *hilum* (the scar where the seed is attached), and partly immersed in the abundant endosperm. The stem is short and leafy. The leaves are long, spiny-serrate.

Ananas belongs to the order Bromeliaceæ, to which also belongs the Pinguin and the Tree-pine. The characters of the order are as follow: The flowers are regular with 3 sepals and 3 petals. There are 6 stamens. The ovary is 3-celled, generally inferior, with numerous ovules. The seeds are albuminous; the embryo is small, situated in a hollow of the copious endosperm near the hilum. The species grow on trees or rocks, sometimes on the ground.

The order belongs to the Monocotyledons.

W. F.

No. 15. October, 1889.

BULLETIN

OF THE

BOTANICAL DEPARTMENT,

JAMAICA.

CONTENTS:

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JAMAICA:

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1889.

SUGAR CANE.

The Assistant Colonial Secretary to the Director of Public Gardens and Plantations.

Colonial Secretary's Office, 27th August, 1889.

Sir,

In continuation of the letter from this Office No. $\frac{4514}{S.S.\ 163}$ dated the 13th instant, I have the honor to forward to you herewith, for your information, a copy of a letter from Kew Gardens to the Colonial Office on the subject of sugar-cane disease in the Island of Java.

I have, &c.,

(Signed) J. Allwood, Asst. Colonial Secretary.

The Director of Public Gardens and Plantations, Gordon Town P.O.

Kew Gardens to the Colonial Office.

Copy. Royal Gardens, Kew, 20th July, 1889.

Sir,

I am desired by Mr. Thiselton Dyer to acknowledge the receipt of your letter of the 19th instant, forwarding an extract from a letter from the West India Committee respecting the importation of sugar canes to the West Indies from Java and elsewhere.

2. The disease of sugar cane known in Java as Sereh appears to have been in existence there for many years, but it is only recently that it has assumed a serious aspect. At present it is con[illegible] western sugar-growing district. Eastern Java is as yet free from it.

3. The exact nature of this disease does not appear to have been determined. It may not be infectious but on the other hand there can be no doubt that it is causing serious injury to the sugar industry in Java, and the Queensland Government has already taken action with the view of preventing infected canes being introduced to that Colony.

4. The course suggested by the West India Committee is one which appeared to Mr. Thiselton Dyer to be justified by the present circumstances. No sugar canes from the East Indies, Queensland or Mauritius should for the present, and until the nature of the Java disease has been determined, be introduced to the West Indies, and further it would be well for planters as well as Heads of Botanic Establishments in the West Indies to keep any recently introduced canes under observation with the view of preventing the spread of any disease that may appear amongst them.

I am, &c.,

(Signed) D. Morris.

It may be as well to state that the introduction of sugar canes from Java and Mauritius is already forbidden by the following Proclamation by His Excellency Sir H. W. Norman :—

L. S.

H. W. Norman.

By His Excellency Sir Henry Wylie Norman, General of Her Majesty's Forces, Knight Grand Cross of the Most Honorable Order of the Bath, Knight Grand Cross of the Most Distinguished Order of Saint Michael and Saint George, Companion of the Most Eminent Order of the Indian Empire, Captain-General and Governor-in Chief in and over the Island of Jamaica and its Dependencies.

PROCLAMATION.

In virtue of the power vested in me in that behalf by the First Section of Law 4 of 1884, entitled "The Seeds and Plants Importation Law, 1884," I do hereby prohibit, until further Proclamation, the importation into this island of Seeds or Plants, or any description of earth or soil or any article packed therewith, that may have come either directly or indirectly from any of the following Countries: Natal, South India, Ceylon, Mauritius, Java, and Figi.

Given under my hand and the Broad Seal of this Island, at King's House, this Second day of December, in the Fifty-first Year of Her Majesty's Reign, Annoque Domini, 1887.

By Command,

J. Allwood, Acting Colonial Secretary.

9th September, 1889.

The Governor directs the publication, for general information, of the following letter from the Assistant Director of Kew Gardens to the Colonial Office, on the subject of the improvement of the sugar-cane which His Excellency has received through the Secretary of State for the Colonies.

By Command,

Neale Porter,
Colonial Secretary.

Kew Gardens to the Colonial Office.

Royal Gardens, Kew, 9th August, 1889.

Sir,

With reference to your letter of the 8th December, 1885, and subsequent correspondence on the subject of the improvement of the sugar-cane in the West India Colonies, I am desired by Mr. Thiselton Dyer to forward for the information of the Secretary of State, some of the results which have been lately obtained in furtherance of this object.

2. It will be within your recollection that in my letter of the 12th May, 1886, extracts from which were circulated by the Colonial Office for the information of sugar-producing Colonies, it was suggested that the attention of Botanists and Sugar Planters in such Colonies should be directed to any variations appearing accidentally in the cane fields and that canes exhibiting such variations should be carefully cultivated with the view of testing their value.

3. The circulation of these and other suggestions emanating from Kew has apparently been the means of directing attention to the possibility of securing new varieties of sugar-canes and of generally improving their yield in crystallisable sugar. Indeed the correspondence received at this Establishment has shown that the subject has received attention in such widely placed Colonies as Fiji, Queensland and Mauritius, as well as in the West India Islands and British Guiana.

4. At Barbados a series of very interesting investigations has been carried on for the last four years at the Botanical Station of the Colony under the direction of Professor Harrison and Mr. Bovell. These investigations, supported by the intelligent action of the local Government, were in the first instance confined to trials of various Sugar Canes introduced to the West Indies by the Botanical Establishments of Jamaica, Trinidad and British Guiana, and to the yield of these as compared with the yield of canes already known in the island. The experiments were also directed to test, in an exhaustive manner, the relative value of various manures and to determine under what conditions such manures were calculated to yield the best results.

5. A summary of the conclusions arrived at in these investigations has been regularly published by order of the House of Assembly of Barbados, and it is needless to refer to them here in detail.

6. These investigations, however, possess a special interest because in connection with them a fact has been elicited which it is hoped will have an important bearing upon the ultimate improvement of the sugar cane. It has been shown with some probability by Messrs. Harrison and Bovell, that under certain circumstances it is possible to raise sugar cane from seed—an occurrence, owing to its extreme rareness, about which there has been so much doubt that it has been thought impossible.

7. The first announcement respecting the probability of sugar canes having been raised from seed at the Barbados Botanical Station was made in the Kew Bulletin for December last. Since that time further information has been received which appears to show, in a perfectly natural and circumstantial manner, that certain varieties of sugar canes still retain the power of producing mature seed. From a botanical point of view this is sufficiently interesting to require more than a passing notice. From the point of view of the sugar planter it is a fact which, if established and intelligently followed up, is capable of effecting as much improvement in the sugar cane and in its yield in sugar as has been effected of late years in the beet. For the first time it has been shown that it may be possible to pursue such a system of selection by seminal reproduction in the case of the sugar cane as to greatly increase its value as an industrial plant.

8. The economic bearing of the discovery of seedling sugar canes at Barbados will, however, depend very much upon the means taken to utilise it to the best advantage. From the experience gained in the improvement of other cultivated plants by means of seminal reproduction, this fact properly utilized cannot fail to yield results of an important character.

9. At present Mr. Thiselton Dyer is of opinion that Messrs. Harrison and Bovell should be encouraged to devote special attention to the subject of seedling sugar canes, especially in testing the richness in sugar of the various seedling canes already established by them. It is hoped that the Government of Barbados, to whom great credit is due for the results already obtained, will in view of the importance of the subject, be disposed to support these investigations by such funds as are necessary for the purpose in view.

10. Now that the fact that certain varieties of sugar canes may produce mature seed appears to be available for their improvement, it is desirable to carry out a series of detailed and systematic experiments to determine how far it is possible to cross one variety with another and produce a progeny possessing certain well marked and highly valued characteristics. This is a natural development of the present circumstances, and the results will entirely depend upon the skill and judgment brought to bear upon them.

11. To assist in this work it may be found desirable that experiments of the character suggested in the last paragraph be also carried on at the Botanical Establishments at Jamaica, Trinidad and British Guiana. With this view and the concurrence of the Government of Barbados, a few of the seedling canes, and if possible, some of the seed might be distributed to these Establishments for the joint observation and investigation of the Botanical and Analytical Officers connected with these Colonies.

12. As considerable interest is taken in this matter outside the West Indies, Mr. Thiselton Dyer will be glad to receive a few seedling canes for experimental cultivation at Kew. Further it is important from a scientific point of view to obtain specimens of what is known to be mature seed of the sugar cane and that such specimens be placed for observation and safe-keeping in the Herbarium attached to this Establishment.

I am, &c.,

(Signed) D. Morris.

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

CINCHONA BARK FROM JAMAICA.

The following correspondence on the subject of cinchona bark from Jamaica has been kindly placed at the disposal of the Department by the Hon. H. H. Hocking :—

Copy.

The Assistant Director, Royal Gardens, Kew, to the Honorable H. H. Hocking.

Royal Gardens, Kew, 1st August, 1889.

My dear Hocking,

I received the two specimens of cinchona bark safely on the 25th June, and I communicated them to Mr. David Howard, head of the firm of Howard & Sons, who was good enough to undertake to analyse them for me. I enclose a copy of his report herewith. You will find that No. 1, which you say is from your field across the river and 6 years old next October, is of slightly better quality than No. 2, which is from the first field planted behind the house. The difference may be in the soil and exposure or in the portion of the stem from which the bark was taken. Bark low down on the collar is the richest and it gradually falls off as you get nearest to the young branches, which contain very little quinine. The yield, on analysis, of 2.23 per cent. of quinine in No. 1, equal to about 3 per cent. of quinine sulphate, is not particularly good. In 1883 officinalis bark sent by me from 9 year old trees, growing on Monkey Hill, above Latimer Plantation, yielded 5.13 per cent. of quinine (equal to 6.95 of quinine sulphate). This analysis was made by Howard & Sons on the same lines as yours. Your trees at 6 years ought to give a better return than 3 per cent. of quinine sulphate, and it is quite possible they will do so by the time they are more fully matured. In any case this analysis shows that your plantation is not yet sufficiently matured to yield good bark, and if you were forced to strip your trees and put the bark in the market now—apart from the question of low prices—you would do so at a disadvantage. I have worked up the question on this side as fully as I could by sending Howard's report to Jenkins and Phillips and to Hamilton.

I enclose their replies. If I can obtain a sample of the South American Loxa bark, so highly thought of by the French, I shall send you a piece. You will notice that Hamilton gives some very interesting news respecting Ceylon shipments. You will not be ready to ship your bark for another year or two so it is a good thing, the market is not likely to improve immediately.

As this subject of Cinchona will interest Fawcett I shall be glad if you will let him see this correspondence and take notes of it if he wishes to do so. What is true in one case is likely to be true in other cases. I cannot ask Howard to analyse barks for me gratuitiously often, but I felt it was worth while taking up the subject just now in order to obtain definite information for the guidance of yourself and other persons interested in Cinchona cultivation in Jamaica.

(Signed) D. Morris.

Mr. David Howard to Royal Gardens, Kew.

Copy. Stratford, London, E., 25th July, 1889.

My dear Sir,

I have completed the analysis of the Loxa bark from Jamaica, and find as follows (as alkaloids.) :

	Quinine.	Cinchonidine.	Cinchonine.	Amorphous.
No. 1	2.23o/o	0.44o/o	0.04o/o	0.51o/o
No. 2	1.74o/o	0.57o/o	0.06o/o	0.55o/o

In each case there was a trace of Quinidine. The tests are thus very much what Loxa bark of similar appearance from South America would give. It is rather a Chahaguera than a Crespa or Uritusinga which give the richer yield that characterises the finest officinales from the Dodabetta plantations. On the other hand the percentage of cinchonidine and cinchonine do not suggest any hybridization with Succirubra.

Believe me,
Yours faithfully,

(Signed) David Howard.

D. Morris, Esq., M.A., F.L.S.

Messrs. Jenkins and Phillips to Royal Gardens, Kew.

Copy. 21, Mincing Lane, London, E.C., 29th July, 1889.

Sir,

We beg to acknowledge the receipt of your letter of the 25th July, enclosing copy of a letter received from Mr. David Howard giving analyses of two samples of Loxa bark from Jamaica.

On the market now bark analyzing as under would be worth—

No. 1	2.23o/o	Quinine	2½d.,	2¾d. per lb.
No. 2	1.74o/o	"	2	

We shall at any time only be too happy to give you any information you may require about the market here for Cinchonas.

We may say in passing that the fine old South American H. O. Loxa quills mentioned in the letter by Mr. David Howard are sold for the French market for making wine. This bark has a peculiar flavour and bouquet, which are recognized and well known by the Parisians, which fragrant quality or bouquet is quite wanting in the Loxa bark when grown in India, Jamaica, or Java. Fine silvery H.O. South American Loxa would fetch upon this market 2/2 to 2/6 per lb.

Thanking you for the sight of these two analyses.

We are, &c.,

(Signed) Jenkin & Phillips.

D. Morris, Esq., M.A., F.L.S., Royal Gardens, Kew.

Mr. John Hamilton to Royal Gardens, Kew.

Copy. 12 Gt. Tower Street, London, E.C., 31st July, 1889.

DEAR SIR,

I now return the two copies of Reports on the Jamaica bark, the perusal of which has much interested me. I am expecting some improvements in the value of Cinchona later in the year. Those who have good bark should not, in my opinion, be in too much of a hurry to realize. The Market now is suffering *more* from a plethora of quinine than a redundancy of bark.

After this season ending 30th September, I am told the exports from Ceylon will not again exceed 8 million lbs. and the fall will come gradually from that point according to supply and demand requirements.

That there can arise any *large* increase in the value of bark during the next 18 months there are at present no grounds for supposing.

Thanking you again for your courtesy.

I am, &c.,

(Signed) JOHN HAMILTON.

D. Morris, Esq., M.A., F.L.S.

The correspondence given above refers to *Officinalis* Bark, but *Succirubra*, Druggists' Bark, appears to have a brighter future. A sample was sent to Kew from the Government Cinchona Plantation, and the following communication was received in reply :—

Extract.

Messrs. Burgoyne, Burbridges & Co. to Royal Gardens, Kew.

12 Coleman St., London, E.C , 24th July, 1889.

"In reply to your esteemed favour of the 13th inst., the Cinchona Succirubra Bark [from Botanical Department, Jamaica] would fetch about 8d. to 9d. lb. if sent on the market in the same condition as the sample received ; but if it were not so much broken it would realize from 1s. to 1s. 2d."

(The whole of the bark of one tree was sent to Kew, and Mr. Morris notes that it was a broken piece thatwas sent to Messrs. Burgoyne.)

SISAL HEMP.

Sisal Hemp is extracted in Yucatan from several plants, but the true plant (*Agave rigida*) is one nearly allied to the Koratoe (*Agave Morrisii*), a native of Jamaica.

The true Sisal Hemp plant exists under several varieties, but the one which is most largely cultivated is of a greyish-green colour with thorny spines on the edges of the leaves (*Agave rigida*, var. *elongata*). The Department, with the aid of the Government and the British Consul at Progresso, was able to secure one dozen plants of this variety from Yucatan, but it has proved quite impossible to obtain any more, as the planters there wish to preserve the monopoly. There are now about 100 plants at Hope Gardens, and they are being propagated as fast as possible.

Another variety (*Agave rigida*, var. *Sisalana*) was very freely distributed in the Bahamas by His Excellency Sir Henry Blake when he was Governor in that Colony. The inhabitants now see the great importance of this industry, and the Government has been induced to forbid the export of any plants for three years. This variety is of a dark green colour, and has no spines on the edges of the leaves. The absence of spines on the edges saves trouble and expense in harvesting. There are a few of these plants in the Hope Gardens. It has been ascertained that this variety grows in the Caicos Islands, and His Excellency Sir H. A. Blake has directed that arrangements shall be made for the importation of as many as can be obtained. It is expected that these plants will arrive next February.

There is another plant which also yields a large quantity of the Sisal Hemp exported from Yucatan, namely, Silk Grass *(Furcroea cubensis.)* There is already a large quantity of this plant in Jamaica, and there ought to be no difficulty in planting out a large area. However, it only yields from 2 to 3 per cent. of fibre, whereas the true Sisal Hemp plant yields 4 per cent. Another species (*Furcroea gigantea*) is the Mauritius Hemp of commerce.

Mr. D. J. Stoddart wrote a pamphlet in the year 1886, on the cultivation of Sisal Hemp, which was printed at the Government Printing Establishment but is now out of print. Mr. G. Preston was sent as a Special Commissioner to Yucatan by the Government of the Bahamas to enquire into the working of the Fibre Industry, and his Report was published during the present year.

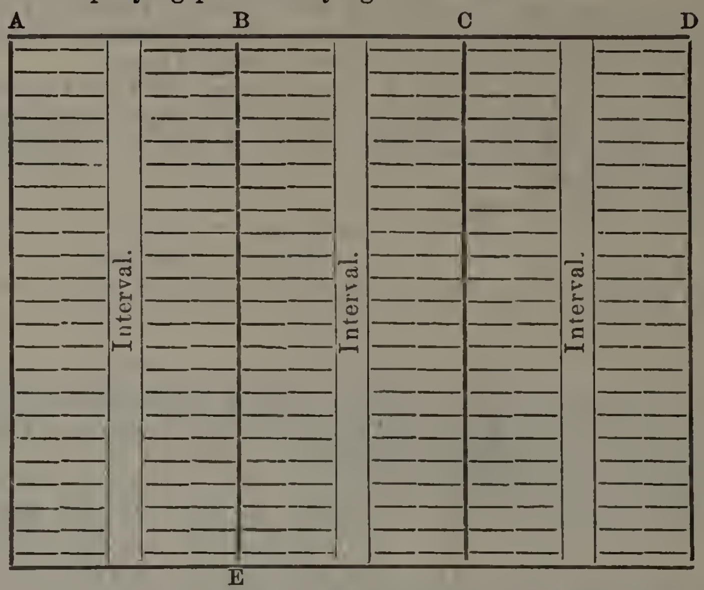
Notes have been drawn up from these Reports for the benefit of those who have not the means of consulting them :—

Soil.—Any dry, poor land will suit Sisal Hemp, but rocky, gravelly soil is the best for the production of the finest fibre. Moist land is not suitable, nor rich land, like old Sugar Estates, for though the leaves grow well and fast, the fibre is poor and small in quantity. Shade is prejudicial, even to the young plants.

Planting.—Young plants are the best for planting out, and they should not exceed two feet in height. If the plants have to be carried a long distance, the roots should not be trimmed, but when they are planted out, the roots should be cut off down to the trunk, and the dry leaves pulled off. The plants are put out in straight rows : the distance between the rows being 12 feet, and between the plants 6 feet in the rows. There will then be about 600 plants to the acre. Roads, running perpendicular to the rows, may be formed at intervals of 10 chains. It is necessary to keep the plants at this distance apart, for if they are too close, the leaves may be damaged in high winds, resulting in great loss of fibre. Great care is taken in Yucatan to put out the plants quite upright, and stones are even placed to support them in a proper position, for they grow as they are planted.

The rainy season is the best time for planting.

Stoddart gives the accompanying plan for laying out a field :—



The field is divided into three sections, each of which measures 10½ chains, and is represented as follows :—

A to B first section, B to C second section, C to D third section ; in the middle of each runs an interval of proper width having a depth on either side within each section of about five chains. The short lines drawn across indicate the rows of hemp between which the cutter works, and therefore has —while cutting in any section—a distance of not more than five chains to carry the leaves to the interval, where the cart gets loaded. Each section has its boundary line as is shown from B to E.

Culture.—The culture is extremely simple. No shade of any kind is allowed, bush is cut down, and trees taken up by the roots. The young suckers are taken off, and if they are not required for planting out, they are burnt. Any plant of quite low growth may be planted between the young plants to give "catch crops." When the plants are about two years old, cattle may be turned in to keep the grass low, and to prevent bush springing up. Sisal Hemp plants thrive better without either hoeing or ploughing. Various estimates have been formed of the duration of these plants, but at any rate they last from 12 to 20 years. When they show signs of dying off, new suckers are planted between and thus there need never be a vacant spot in the plantation.

Harvesting.—When the leaf is ready for cutting, it will have inclined downwards to a horizontal position, and its colour will have become darker. Cutting should commence from the bottom, and the leaf must be taken off clean and as close as possible to the trunk. As soon as the leaf is cut, the prickles on the edges and point should be trimmed off. The leaves are then made up, point and base alternately, into bundles of fifties for delivery at the works. Thirty such bundles are a day's wo but of course more can be done, if the variety is cultivated without the prickles on the sides of the leaves. The bundles are placed on the edge of the cart-road, 30 bundles being a load for a dray. The workmen are paid so much per 1,000 leaves.

The time required for the leaves to ripen after planting varies, according to soil and situation, from 2 to 3 years.

Extraction of Fibre.—The fibre should be extracted from the leaves as soon as they are brought in. If left for more than 2 or 3 days after cutting, the fibre is spotted.

When the fibre is extracted by passing the leaf through the machine, it is hung on drying stands in the sun for about 2 hours until it is quite dry. If rain comes on, the fibre must be hung up under cover, or it will become discoloured. In wet weather a fire is kindled to warm the drying house, or operations are suspended.

The fibre is often bleached by leaving it on the drying stand for 24 hours after being dried, but it requires to be constantly turned. The fibre is improved in appearance, but weighs less.

The drying stand is made by erecting posts 4 feet high and fastening rails or wire on the top from one to another.

The refuse from the leaves is dried in the sun and burnt.

Particular attention is paid in Yucatan to the operation of baling, and all discoloured fibre is separated and packed as a second quality. Even the cordage used to cord the bales of first quality must be of the same kind. The bales are pressed either by a screw or a hydraulic press, and great care is taken to make the bales neat-looking and of uniform weight.

Machinery.—One fibre machine is required for every hundred acres of plants.

Preston says :—"The first farm I visited, "Chenkj," was running 6 of Death's fibre machines or wheels 50 inches in diameter, 8 inch face and 8 knives or scrapers, driven by a No. 7281 10 h.p. Marshall, Sons & Co.'s stationary engine, and each wheel was cleaning the leaves at the rate of 20 to the minute or 8,000 per wheel for a day's work. 2 men at each wheel, standing between the wheel and rack containing the leaves, feed the machines as fast as their hands can move—1 boy to two wheels supplies the feeders, and 3 others carry away the fibre to the drying ground adjoining. It is the most simple thing possible, requiring no skilled labour. There is no water used either for soaking the leaves or washing the fibre, which after exposure to the sun for 2 hours, is fit for baling. The engine is driven by an Indian.

"Many of the engines are supplied by Brown and May and the wheels are all from Death and Ellwood, Leicester. There are in the State of Yucatan very many machines and many engines, but no hand power machines. The machines or wheels at present in use have been working ever since they were first introduced 20 years ago: the knives or scrapers require renewing occasionally.

"The working hours at this farm were from 4 a.m., to 12 noon, or earlier, if the 8,000 leaves to each machine were cleaned with an interval for breakfast. The fibre is all housed the same day, the machine men in the afternoon lending a hand in gathering it in from the drying ground. If the farm has a press it is properly baled; if not, it is hand-baled and sent to Merida at once, 8 bales on a dray drawn by six mules, or by road and railway from the more distant farms and there re-baled or sold as it is.

"Here was a farm cleaning daily 48,000 leaves or 72,000 lbs., of the crude material yielding 3,600 lbs., (5 o/o fibre) costing at the farm 2½ cents per pound Mexican silver (33⅓ below gold) worth in Merida 10⅝ cents gold. . . . There are in Yucatan some 200 henequen farms of all sizes, the largest running 30 machines and employing 500 hands, and several others of 20 wheels or more. Many famers' daily incomes are $500 to $2,000 clear profit." *

Yield.—Each plant should produce 30 leaves in the year. If there are 600 plants to the acre, this gives 18,000 leaves per acre per annum. One thousand leaves weigh about 1,500 lbs., and, yielding about 4 per cent. of dry fibre, give 60 lbs. of hemp. Thus, each acre should yield about half a ton of hemp per annum.

The following quotations are taken from a recent number of the "British Journal of Commerce:"—

Fibre.—Algerian, curled, green,	per ton	...	£ 7	0	0					
" " black	"	...	11	0	0					
Aloe "	"	...	15	0	0	to	£18	0	0
China Grass "	"	...	33	0	0	to	36	0	0
China jute "	"	...	22	0	0	to	23	0	0
Mexican "	"	...	34	0	0	to	38	0	0
Raffia "	"	...	25	0	0	to	26	0	0
Rhea "	"	...	9	0	0	to	13	0	0
Kitool "	per lb.	...	0	0	3	to	0	1	0
Hemp.—Polish	per ton	...	24	0	0	to	31	0	0
Italian	"	...	33	0	0	to	50	0	0
Sunn	"	...	6	0	0	to	15	0	0
Other East India	"	...	6	10	0	to	22	0	0
Manilla, brown, etc.	"	...	45	0	0	to	50	0	0
" fair	"	...	51	0	0	to	52	0	0
" good	"	...	53	0	0	to	55	0	0
" Quilot	"	...	55	0	0	to	66	0	0
Mauritius	"	...	36	0	0	to	43	0	0
New Zealand	"	...	30	0	0	to	36	0	0
Sisal	"	...	53	0	0				

The following is of importance in connection with this subject:—

Washington, Sept. 27.—A copy of resolutions, adopted at the Republican Convention of Pratt County, Kan., on September 7, will be presented to President Harrison to-morrow. The resolutions substantially say that the duty levied on imported fibres, suitable for making binding twine, has failed in its protective features to develope or give the farmers a home product to take the place of the foreign fibres, and that American grain-growers are compelled to rely on imported fibres of which to make binding twine suitable for binding grain. To continue collecting a duty on such imports is working a hardship on the grain growers by increasing the cost of their binding materials.

Congressman S. R. Peters was requested to frame and introduce a bill into Congress to place all raw fibres that are used and are suitable for making binding twine on the free list, and to use every means in his power to have the bill passed at the earliest possible date. The President was petitioned to call the attention of Congress to the matter, asking immediate relief.

COCA.

The following account of Coca is taken from Dr. Weddel's "Voyage dans le nord de la Bolivie:"—

"The cultivation of *Erythroxylon Coca*, as carried on in Bolivia in the present day, does not appear to differ from that which prevailed previous to the conquest; and the province of Yungas de la Paz is that which, since the Spanish occupation, seems to have supported the most considerable plantations. All the slopes of the mountains, below an elevation of 2,200 mètres (7,217 feet), are literally covered with them, and the traveller has continually in view the factories or *haciendas* where the leaf is prepared for the purposes of trade.

"The *Coca* Shrub is propagated from seed. For this purpose the seeds, immediately after gathering are scattered on the surface of the light and frequently watered soil of a little nursery (*almaciga*) where they come up generally at the end of ten or fifteen days. The waterings are continued, and, should the sun strike the young plants too violently, they are sheltered with mats.

* Mr. Kennedy, of the Railway Work Shop, is engaged in the improvement of his Fibre Machine, and it is hoped that it may turn out a great success.

"The following year the shrubs, whose height is already from 40 to 50 centimètres (16 to 20 inches) are transplanted into a plot of ground specially prepared for them and called a *cocal*. The arrangement of these plantations is much more complicated than that of an ordinary plantation, and varies according to the inclination of the surface. When the *cocal* occupies the slope of a mountain, which is the usual case, the cultivator forms a series of narrow steps, each intended for a single row of shrubs, and the more elevated (consequently, the less numerous) as the surface is more steep. They are generally supported by little stone walls, which serve not merely to contain the earth and prevent its drying, but also to protect the stem and roots of the young shrubs from the too direct influence of the solar rays, by means of the projection which they form above the level of the soil.

"Where the ground is level, they make, instead of steps or terraces, simple furrows *(uachos)* in a straight line, and separated from one another by little walls of well-moulded earth, called *umachas*, at the foot of each of which is planted a row of the shurbs, more or less far apart from each other.

"At the end of a year and a half the plant affords its first crop, and from this period to the age of forty years or more it continues to yield a supply. Instances are cited of Coca plantations which have existed for nearly a century, and which still produce. Nevertheless, the greatest abundance of leaves is obtained from plants of from three to six years of age. When the trees run up too much, the produce is less than when they spread; they are therefore pruned in some cases to favour an increase in breadth, which, however, is never considerable, as the form of the shrub is irregular. The average height of the wild plant appears to be about 2 mètres, but in cultivation it is generally allowed to attain but 1 mètre (39 inches).

"The first gathering which takes place in a Coca Plantation is at the expense of only the lower leaves of the shrubs, and it is therefore called *quita calzon*.* The leaves of which this gathering consists are larger, and more coriaceuos than those of subsequent collections, and also have less flavour. They are mostly consumed on the spot. All the other gatherings go by the name of *mitas*, and take place three times, or exceptionally, four times, per annum. The most abundant harvest is that occurring in March, that is, immediately after the rains; this is the *mita de marzo*. The most scanty is that which takes place at the end of June, or beginning of July, and which is called *mita de San Juan*. The third, named *mita de Santos*, is made in October or November.

"The watering of the Coca plantations greatly increases their productiveness. Forty days are then sufficient, I have been told, for naked shrubs to become covered with new leaves; but these leaves are not equal in their properties to those produced without irrigation; their colour is also less deep, and they frequently blacken in drying. Artificial watering is needful, moreover, only during the dry season, and the cultivators who have the means of employing it, realise nearly always four, and sometimes even five, crops in the year. This is particularly the case in the districts of Irupana, where there are facilities for obtaining water that do not exist elsewhere.

"I have examined the soil in which *Coca* is cultivated, and almost everywhere have found it composed of sandy, argillaceous earth, softish to the touch; it originates in the decay of the schists which form the chief geological feature of these mountains. The soil of the Coca plantation is, in one word, formed of what we call primitive or normal earth, but is naturally mixed with an abundance of angular fragments of unaltered schist, which, if not removed, would interfere with the growth of the roots. This is therefore done by the cultivators while preparing the furrows for the reception of the shrubs, the stones being employed for the little walls before spoken of; indeed these little walls, or *umachas*, are often formed entirely of the stones thus met with. I need hardly say that it is to the greater or less perfection to which this preliminary operation is carried, and to the labours incurred subsequently in stirring up the soil from time to time, and in keeping it free from weeds, that the *haciendero* owes the abundance of his crops. The last operation I have mentioned is especially needful while the shrubs are young, the weeding, which is regularly performed after each crop has been collected, is called *mazi*.

"The collection of the leaves of the *Erythroxylon* is performed much in the same way as that of tea. It is, in general, women and children that are employed upon this operation, which is all the easier from the pressure of the little walls separating the furrows of the plantation. The gatherer squats down, and holding with one hand the branch she wishes to pluck, removes with the other the leaves, often one by one. The leaves are deposited in a cloth, which each Indian carries with her, and afterwards collected in sacks or some other recipients to be carried to the plantation.

"Nothing is now easier than the preparation of the *Coca*. The leaves are carried from the plantation to the house, or *casa de hacienda*, where they are spread out in the sun, in little courts constructed especially for the purpose, and the floors of which are formed of slabs of black schist *(pizara)*; if the weather is fine, they are left there until completely dry, which takes place without their shape becoming altered. They are then packed with strong pressure into bags made of the sheath of the banana leaf, strengthened with an outer covering of coarse woollen canvas. The bales thus formed contain, on an average, twenty-four pounds of leaves and go by the name of *cestos*. The *tambor* is a bale of double the size of the *cesto*, whose price at La Paz varies from 4½ to 6 piastres, 18s. to 24s.†

"The leaves of the *Erythroxylon* approach in shape and size those of tea, but they have never the dentated margin; on the under side, a prominent and curved line on each side of the mid-rib serves to distinguish them from most other leaves known. When dried well, they are of a very pale green, deeper on the upper than on the under side; their odour is then agreeable, and even analogous to that of tea. . . . This *bouquet*, if I may so term it, is very perceptible on tasting the Coca, and serves, according to its abundance, in indicating its quality. On the other hand, in a concentrated infusion, and still more so in a decoction, it is a bitterness mixed with something styptic that more particularly strikes the palate."

* From *quitar*, to take away, and *calzon*, pantaloon.

† As it is easily damaged by damp in transit, the only absolute security is to have it soldered in tin or zinc, enclosed in wood, such packages generally contain two tambores, or about a Spanish quintal of 100 pounds.

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BULLETIN

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JAMAICA.

CONTENTS:

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1889.

LANCEWOOD SPARS.

Joseph Sturge, Esq., Birmingham, Montserrat Company, Limited, to Director Public Gardens and Plantations, Jamaica.

Dear Sir,

I append copy of my friend's notes on the growth of Lancewood in Cuba. Probably you can find out more about this tree in Trelawny and those parts of Jamaica where it grows. Our trees in Montserrat which our gardener fetched from the neighbourhood of Old Harbour, in Jamaica, grow very slowly and have not flowered yet. I fancy it will only do well on a limestone sub-soil.

Yours truly,

JOSEPH STURGE.

[ENCLOSURE.]

"Lancewood spars are called here "Palas de yaya" or "Valos de yaya," and they are shipped in large quantities to Europe, occasionally also to Jamaica from which Island they are presumably re-shipped. The trees grow on low moist ground near Manzanilla, not in a swamp and not on the hills, but in such a situation that in rainy weather it is impossible to get them down to the shore on account of the softness of the coast. The climate of Manzanilla is warm and moist more so than on the northern coast, and the immediate neighbourhood is not so hilly as that of Baracoa, in fact it is almost flat. As to the age at which the spars are cut no trustworthy information was given me. One said one thing and one another with a great deal of certainty until I elicited that the trees grow quite wild, that they are not planted or looked after in any way, and then I said that I supposed the fact was that the trees were cut whenever they attained a suitable size. This they allowed was exactly what happened, so they know no more about the age of the spars than I do. However, it appears that the length of spars is about 5 varas (13 feet 9 in.) and they are usually cut from 14 to 24 inches in circumference. The thicker they are the more valuable of course because from the thickest four or five shafts can be made. The tree according to my informants bears no nut nor any other fruit that they have seen, and in reply to my question as to the time of cutting I was gravely informed that it depended entirely upon the Moon.

Mr. Sturge writes subsequently as follows :—

"If any one in Jamaica has taken up the systematic cultivation of lancewood, I should be much obliged by your putting me in communication with them, as that is a culture in which I feel much interest."

COCA.

(Erythroxylon Coca.)

Coca is cultivated on the mountain slopes of the Andes from an elevation of 2,000 feet up to 7,000 feet. It is said that soil with much lime in unsuitable.

In Jamaica, Coca has been grown successfully at nearly sea-level at Spring Garden by the Hon. W. B. Espeut, the leaves yielding, according to the Kew Bulletin for January, 1889, analysis of 0.76 per cent of total cocaine,—a very high percentage, and remarkable, considering that the plants were only 6 months old, when the leaves were gathered. There has been no success at present in growing the plants at Cinchona at an elevation of 5,000 feet. and possibly the night temperature is too low, as it falls sometimes to 53° F. At Castleton (600 feet), and in the Parade Garden, Kingston (about sea-level), Coca has been grown for some years, but the Castleton leaves have not as high a percentage (0.65), as those from Spring Garden.

The oldest leaves, those which break, when bent in the fingers, contain the most cocaine, and it is well to allow the young leaves to remain to supply the wants of the plant.

The leaves give the best results when dried in the shade. They are gathered at all times of the year, or only once a year according to soil and situation.

"Since the discovery of the anaesthetic properties of cocaine the demand for Coca leaves in South America has considerably increased for export purposes. A distinct loss in the alkaloids generally, as well as in cocaine, has been noticed during the transit of leaves to this country, and latterly, in consequence, it has become the practice to extract the alkaloids from the leaves in South America and export to the United States and Europe a crude preparation which is largely taken up by manufacturer of cocaine. This crude alkaloid contains 70 per cent. of pure crystallisable cocaine, and is selling fo about 15s. per ounce. The demand for Coca leaves has therefore fallen off, and it is probable that the cultivation of the Coca plant in our tropical Colonies may never assume large proportions. Small and exceptionally fine samples of Coca leaves may find a limited market in this Country or on the Continent; and possibly in India and Eastern countries it may be worth while to grow sufficient leaves to meet the local demand for cocaine. Beyond this it is scarcely possible to go, if it is borne in mind that South America is able without further extension of cultivation to produce such enormous quantities of Coca leaves, that the one-eightieth part would be sufficient to swamp the cocaine markets of the whole world. In a letter dated January 25th 1889, Messrs. Burgoyne, Burbidges, Cyriax, and Farriers reported that the commercial value of "Coca leaves yielding total alkaloids of 80 per cent. would be about 6d. to 8d. per pound." (KEW BULLETIN).

The following account is given in the THERAPEUTIC GAZETTE (Detroit) by Dr. H. H. Rusby, who was for some time engaged in the study of Coca in Bolivia.

"For the details concerning cultivation here presented I am chiefly indebted to Mr. Oscar Lohse, one of the most intelligent cultivators in this country, and proprietor of the Finca of San Antonio, two leagues from the town of Caroica, Yungas.

"The district of Caroica may be considered as fitly representing the remainder of Yungas as representing the principal Coca districts of this republic. The conditions of soil and climate may be briefly stated. Proceeding eastward from La Paz, itself somewhat more than ten thousand feet above the sea, for a distance of four or five leagues, we reach the summit of the pass over the easternmost cordillera of the Andes, this cordillera having an average elevation in this immediate district of perhaps sixteen thousand feet. This ridge, always more or less snow-covered, cuts off a large portion of the westward-bound clouds, which are either precipitated in the form of rain before reaching the summit, or, arriving there, are deposited in the form of snow, and then returned by means of rivulets to the valleys, chiefly of the eastern slope. It should be noted that in Northern Peru and Ecuador this cordillera is higher than here, so that the eastern slope in those regions is more profusely and regularly watered than here. From this pass, had we a direct road, we could travel in half a day, so steep is the descent, to the banks of the Caroica River. having an altitude of only two thousand four hundred feet. When we have descended to six thousand four hundred feet we should meet with our first Coca plantations, and after passing the two thousand foot level we should have left them principally or entirely behind. Within this four or five thousand feet, then, lie the cocales of Bolivia. No description can convey a perfect idea of the steepness of this luxuriant slope. Travel, entirely by riding-animals, is extremely difficult. There are only occasional places where we can readily leave the road, and here plantations are established. The hedge of Coffee-plants at the roadside proves on examination to be the uppermost row of a plantation; and as we peer down among the shrubs we marvel that anyone can preserve his footing while cultivating or collecting the coffee. The scenery is of course magnificent, and of a different type, I should think, from that of any other part of the world. The mountains are too young to have lost to a great extent their ragged out-line, yet softness is imparted by the richness of the vegetation. We stand among the coca-plants and distinctly see another cocoal nearly four thousand feet below us.

"The cultivated plants of the coca district are coffee, rice, cacao, sugar cane, tobacco, maize, cotton, (the arborescent species), sweet potatos, yuccas, and the ordinary garden vegetables. The principal fruits are oranges, bananas, cocoanuts, lemons (sweet and sour), citrons, grapes. chirimoyas, alligator pears, tumbas, pomegranates, grenadillas, figs, papayas, lukmas, melons, and pine apples, the last just introduced.

"The soil in such a broken country is of course very diversified, ranging from a very light decomposed shale or sandstone to a heavy blue or chiefly yellow clay.

"The rainy season begins in October, and continues until May or June. During this time the rains are copious and almost constant. During the succeeding two months there is scarcely a drop of rain, and during the next two there are occasional showers.

"Such are the conditions under which the Coca grows in this section.

"When we come now to consider the methods of cultivation here adopted, we must be cautious about accepting them as the best, merely because they are generally followed here. It is to be remembered that the Bolivian system of agriculture has not received the attention that it should have had, and that it is very probable that reforms might be introduced in present methods.

"Nor is it proper to proceed concerning Coca-culture without a few words concerning what is meant by the "best quality" of Coca-leaves. To a manufacturing chemist the best quality would mean the quality that would yield the largest percentage of crystallizable cocaine, obtainable in the easiest manner, while the same Coca might be considered for domestic consumption as representing one of the lower grade. It is highly probable that the amount of cocaine forms no element in the Indian's estimate of the quality of Coca, no more than the percentage of nicotine establishes the quality of a particular grade of tobacco. Coca-leaves are classed in general by the Indians as "Lajas dulces" (sweet leaves) and "Lajas amargas" (bitter leaves). The former are made sweet by the abundance of alkaloids other than cocaine. While it is true that a greater abundance of those alkaloids is usually accompanied by a larger percentage of cocaine also, yet the variation in the amount of the latter is not so great as in the former; so that while in the sweet leaves the bitter taste of the cocaine is masked by the presence of the other alkaloids, in the bitter leaves its flavour is the predominant one. The presence, then, of these *sweet alkaloids*, as we may call them, translating the simple and expressive term of the Indians, determines the domestic value of the Coca, and all that is known of the best methods of cultivation is based on the production of the highest percentago of these alkaloids. Experience may determine that for manufacturing purposes a very different line of principles of culture should be followed.

"I have made a large number of assays tending towards elevations, soils, exposures, seasons, ages of plants, and of leaves, different varieties, wild and domestic, different parts of the plant, and various modes of drying and packing. The results will be embodied in a future monograph, mere passing references being made to them for the present. I have about concluded that the percentage of the sweet alkaloids varies inversely as the amount and continuousness of moisture that the plant receives. Thus, the Peruvian, Ecuadorian, and Brazilian Coca, which, as I have stated, is much more copiously and regularly watered than the Bolivian, is markedly inferior, so that Bolivia regularly exports about one-eighth of her crop to those countries. I am inclined to think that the greater breadth and thinness of the northern leaf may be partly due to the greater water-supply and the consequent greater degree of evaporation. Again, the Indian always seeks the Coca grown at the higher elevations, where the humidity is much less and more irregular than in the districts along the rivers. We are thus obliged, for reasons to be elaborated in the future, to regard these alkaloids as preserving a sort of a balance of moisture, by which the plant stores up during the wet weather a concentrated supply of water, which may be very slowly yielded up during a time of need.

"Having thus chosen a high altitude, the next thing is to select a soil. A rivalry exists between a yellow clay and a hill-side soil rich in vegetable matter. My assays have yielded the best results (as to total alkaloids) from soils of the latter class and I am inclined to think that those who prefer the former soil do so because it yields a somewhat larger crop.

"The ground for the nursery-bed is prepared during the latter part of the dry season by breaking it up very thoroughly to the depth of a foot or more. The fruits mature during the early part of the rainy seasons, December and January. They are red, and consist of a fleshy outer portion and a shell-like inner portion, which encloses the single seed. These people suppose that the germ cannot escape from the shell if planted in its natural condition, and they have continued for hundreds of years to deposit the seeds as soon as gathered in a shaded place, in layers an inch or more deep and covered with a thin layer of decaying leaves or similar substance. The heat generated by the decomposition of the fleshy pericarp serves to induce germination, and the embryo bursts from its bony covering. This growth unites them in from eight to fourteen days into a solid mass, which is broken up into small pieces and planted in furrows in the nursery. In this process very many of the sprouts are broken off and the plants destroyed. Mr. Lohse has adopted the plan of sewing the seeds broadcast as soon as gathered, and covering with a little earth, or better, a layer of banana leaves or decaying vegetable matter. Germination requires from eight to twelve days longer, but all the plants are saved.

"In either case, a covering of brush or straw must be placed over the nursery, at first only three or four inches above the surface, and elevated to six or seven inches, as the plants grow. Usually this elevation is repeated once more.

"All this taking place during the rainy season, the plants have reached a good size before the advent of the dry weather, and so do not call for any artificial water supply.

"Advantage is taken of the ensuing dry season to clear the land and prepare the ground for the new cocal. On the manner in which this is done depends much of the future well being of the plants. The ground should be thoroughly powdered to the depth of two, and, if possible, three feet, all roots and large stones being removed. On these steep slopes it is necessary to terrace, the terraces being supported by stone walls, the stones laid dry. The width of the terraces, according to the slope, varies from several feet, with a number of rows of plants, to much less than the height of the wall, only a single row of plants being admissible. It is here generally believed that shade tends to the production of the best quality of leaves; so the cocales are planted thickly with a small broad topped leguminous tree related to the St. John's bread, but whose name I cannot at this moment recall. There is no doubt that this is a mistake. I have made repeated comparative assays of shade-grown and sun-grown leaves from adjoining plants, and invariably found the latter much richer in total alkaloids. I judge the custom to have arisen from two considerations. There is, as I have stated, a period of two or three months when the plants receive no rain, and then these trees afford a protection from the fierce heat. Secondly, shade conduces to the production of a large, smooth, beautiful leaf, of elegant colour, and thus adds to the appearance of the product. The terraces being thus prepared, on the advent of the permanent season, the plants, now from 8 to 12 inches high, are transplanted, being set from one half to six inches apart, according to the ideas of the haciendero. From this time until the first leaves are picked, the greatest care must be taken to keep the soil thoroughly stirred and free from weeds. The plants having been transferred in October or November of one year, the first picking is made in March or April of the second following year, one year and a half from the time of transplanting, or two and one half from the seeds. In case an insufficient space has been prepared, the remaining plants are often left until the following year, and then transplanted, the operation being much more dangerous to the life of the plants.

"The chief danger of picking the leaves earlier than the period indicated above is not the strain upon the vitality of the young plant, as many of the leaves drop off themselves, but because it is almost impossible to avoid breaking off the very tender tips of the twigs, the result being fatal to many plants. Immediately after this first picking, fresh leaves develop with great rapidity, and in July or August of the same year the plant flowers for the first time. The lovely white flowers, if undisturbed, remain from three to six days, but from the very first they are dislodged by the slightest jar, the corolla falling entire, although it is morphologically polypetalous. The fruit ripens in December and January.

"During the first few years the percentage of alkaloid increases rapidly, reaching its maximum at or before the age of ten years. At the age of twenty it begins to diminish, but with extreme slowness, so that the plants are practically in their prime up to the age of thirty-five or forty. It is probable that the decline is then due rather to the exhaustion of the soil than of the vitality of the plant. Fertilisation of the soil has never been resorted to. It is probable, as suggested by Mr. Lohse, that as much can be done for the Coca in this way as has been done for other plants.

"A Coca harvest is called a mita, an Indian word meaning a division or drawing of lots, and there are from three to five in a year, according to the season. The time of picking is determined solely by the condition of the leaves. When they have become mature they turn yellow if in the dry season, and brown if in the rainy, and within eight days at the outside will fall to the ground and be lost. As soon as the mita is over, the ground is cleared from weeds, and, under an ignorant notion that further cleaning is injurious, is left undisturbed until after the next mita. But Mr. Lohse has tried the plan of keeping the ground clean, with the result, thus far, of receiving the next crop in little more than one-half the time required by his neighbours. No irrigation is resorted to during the dry season. Although it is possible that good might result, at least to the welfare of the plant and the size of the crop. I suspect that after a long time an abundant and steady supply of water would result in a decrease in the amount of alkaloids. Mr. Lohse has tried the experiment of mulching at the end of the wet season with a few inches of banana leaves or other refuse, with excellent effect upon the plants during the succeeding dry season.

"This plant is subject to only two diseases of any importance. The first is taja, which I suppose to be the result of a fungus which attacks the undeveloped leaves and tender twigs. It is said by some to be caused by careless picking, in which the twigs are broken. By others it is said to result from the planting of seeds taken from young plants. The only remedy is to remove and burn the diseased portions. The second disease, if such it can bo called, is the ravages of a caterpillar called "uto," which makes its appearance in December, and destroys the crop so quickly that it admits of no remedy.

"The method of picking and drying the Coca has been so often and so well described of late that it is not necessary to dwell upon it. Coca-picking is a profession to which the children are trained from a tender age. The leaves are picked singly, both hands being employed with a rapid alternating motion which strips a twig in an instant. Great care is taken to avoid breaking the twigs, and the young leaves are not picked. Little sacks are tied about the waist or the women's aprons are pinned or sewn into the required form. They are then transferred to larger sacks, which must be filled and emptied with great promptness, or the leaves will become heated and turn black.

"The price here paid for picking is a Bolivian dollar, equal to about seventy-one cents United States currency, or three shillings English, for each thirty pounds, which, when dry, will weigh about twelve pounds.

"The leaves are exposed to a hot sun upon a pavement of nicely fitted flat stones, and stirred occasionally until dry. Under the most favourable conditions the drying is accomplished in about three hours. About the Coca place are built the storage and packing sheds. These are furnished with very broad doors, and men are in constant attendance to sweep the Coca with brush-brooms through these broad portals at the slightest indication of rain. A very few drops of rain are sufficient to decolorise and ruin the sale of the Coca, though it is my impression that such decolorisation, if produced by but little rain, is no indication of loss of cocaine. During the first few days that the dry Coca lies within the storage-sheds it undergoes a slight sweating process.

"When I come now to speak of the best methods of packing the Coca for export, it is fair to say that nothing definite is known. Such Coca as has reached Europe or the United States in good condition has done so purely by accident; for perhaps the very next lot, dried, packed, and shipped as nearly as possible in the same manner, has arrived entirely ruined. I have tried many methods, and as often as I had thought that the secret was discovered, my hopes have resulted in disappointment.

"As regards the exportation of the culture of Coca, the experiment has been tried, I believe, but once. Several years since, Mr. F. L. Steinart, of La Pay, shipped a small quantity of seeds via London to Ceylon, and during the past season the first products were shipped to London and sold at a high price. Seeds for export should be exposed for several days to a hot sun, so as to rapidly dry the fleshy exterior, which thus forms a protection to the germ within.

"It is my opinion that the Coca-plant is adapted for culture in many countries where it is now unknown. Among the countries where it would be well to experiment with are Guatemala, Mexico, the East and West Indies, India, Southern China, portions of Africa and possibly of Italy. It is doubtful if it would grow in any portion of the United States. Requiring an average temperature of at least 70°, the only districts at all suited would be Florida and Southern Texas; and it is highly probable that proximity to the sea-coast at so low an altitude would prove fatal. Nor would irrigation prove adequate in those countries possessing a long dry season. The plants must not only have an abundant supply of water at the roots; they must be bathed in a humid atmosphere for the greater portion of the year. But from what I have read of some of the countries above named, I am confident that the plant would there find a congenial home. Jamaica offers especially hopeful conditions."

ABANDONMENT OF ORANGE CULTURE IN THE AZORES.

Copy. The Montreal Company (limited) Birmingham.

To. W. Fawcett, Esqr., Botanical Department, Jamaica.

Dear Sir,

Another piece of information that has come before me lately may be of interest to the readers of your Bulletin.

The fruit merchants in Paddingham mentioned to me that the shipments of oranges from St. Michaels, Azores, were rapidly diminishing and that the island had in fact ceased to be an important shipper of oranges, just as the neighbouring island of Terceira which formerly shipped a hundred cargoes a year of oranges, ceased about 15 years ago to ship any.

I was told that the cause of the failure in St. Michael was some disease, the effects of which were shown by the fruit.

I wrote to Mr. Reid, H.B.M.'s Consul in St. Michaels and received the following reply from him :—

"Two causes have operated in reducing the shipments of oranges from St. Michael's one being the disease from which the orange trees suffered and the other the unremunerative prices offered by the English markets for St. Michael's fruit. The disease is known locally by the name of Lagrima which signifies a "tear" because an exudation of resin in the form of tears takes place on the trunk and branches which is followed by the cracking drying up and peeling off of the bark and eventually the attacked limb dies and has to be cut off.

To stop the flow of resin the bark of the affected part is bruised but the disease very often shifts its locality till the tree dies of exhaustion. Latterly the smaller branches and twigs have been affected and the fruit while still green falls off in considerable quantities. The cause of the disease is not known and no remedy or method of treatment has been discovered for its cure. I have seen orange gardens well looked after, the land well manured and dug, the trees pruned and cleaned and again others left almost in a state of nature, but all having orange trees suffering from the disease. This state of things coupled with the competition of the fruit from Spain and other parts has brought about the almost total extinction of the orange trade of St. Michaels and has induced landed proprietors to abandon the replanting of their orange groves and to cultivate instead the vine and the sweet potato, the latter for the consumption of two large distilleries."

Yours very truly,

JOSEPH STURGE.

MANUFACTURE OF LEMON ESSENCES IN SICILY.

The following extract is taken from the London "Times":—

The United States Consul at Messina in a report on the cultivation of oranges and lemons in Sicily describes the mode of manufacturing lemon essences. With three strokes of a sharp knife the cutter peels the lemon lengthwise and lets the peel fall into a tub under the chopping block. He then cuts the lemon in two and throws it from his knife into a bucket. He works with wonderful rapidity, and fills from ten to twelve tubs with peel a day, and is paid 2½d. a tub, weighing 77lb. His left hand and right index finger are protected with bands of osnaburgs or leather. The fresh peel is soaked in water 15 minutes before the essence is extracted. Peel that has stood a day or two remains soaking from 30 to 40 minutes that it may swell and offer a greater resistance to the sponge. The workman holds a small sponge in his left hand, against which he presses each piece of peel two or three times—simple pressure, followed by rotary pressure. The women employed in this work run a piece of cane through their sponges to enable them to hold them more firmly. The outside of the peel is pressed against the spon as the oil glands are in the epicarp. The crushing of the oil cells liberates the essence therein contained. The sponge, when saturated with the essence, is squeezed into an earthen vessel held in the lap. The peel is so thoroughly pressed that not a single cell escapes. This is ascertained by holding the pressed peel to the flame of a candle; should it neither crackle nor diminish the brilliancy of the flame the cells are empty. This process yields, besides the essence, a small quantity of juice and feccia (dregs). The separation of the essence juice and feccia soon takes place if the vessels are not disturbed; the oil floats on the juice and the dregs fall to the bottom. These three products derived from the peel have no affinity with each other. As the essence rises to the surface it is skimmed off, bottled, and left to settle for a few days. It is then drawn off with a glass siphon into copper cans, which are hermetically sealed. After the essence has been expressed a small quantity of juice is pressed from the peels, which are then given to oxen or goats or thrown on the manure heap and well rotted, or they would make too heating a fertilizer. The yield of essence is variable. The industry is carried on five months in the year. Immature fruit contains the most oil. From November to April in the province of Messina 1,000 lemons yield about 14oz. of essence and 17 gallons of juice. The essence is so valuable that the workmen are closely watched, for they are most ingenious in secreting it about their persons. Six men work up 8,000 lemons a day; two cut off the peel, while four extract the essence and obtain 136 gallons of lemon juice and 7lb. of essence. Dealers sometimes adulterate their essences with fixed oils, alcohol, or turpentine, but these mixtures may be easily detected. The essence of sour orange mixed with the essence of lemon produces an aroma similar to that of the essences of bergamot.

FRUIT CANDYING IN ITALY.

A good deal of interest has been drawn of late years in fruit-producing countries, especially in some of our colonies, as to the best mode of preserving fruits for exportation. That of preserving them in syrup in hermetically sealed tins has been found to answer well, and has become very generally adopted; but the process of candying with sugar is felt in some countries, and with some fruits, to be preferable, consequently enquiries are frequently made as to the modus operandi adopted in fruit candying countries on the Continent, about which little seems to have been known out of the country where it is practised.

The following account of this industry, which has just been drawn up by the British Consul at Leghorn, will, therefore we doubt not, be of considerable interest to our readers, especially to those in sugar-producing countries:—

Mr. O'Neill says: "It would be a mistake to suppose that Leghorn is a great centre for this industry in all its branches. The candying of fruits, whole or cut, is carried on at many other places to a larger extent. At Genoa, and westward along the French Riviera, at such places as Grasse, this industry is carried on, and we know that in Spain and Portugal fruits are also candied, Madeira being especially noted amongst the possessions of the latter for this manufacture.

"Moreover, upon enquiry, I find that in this city of over 100,000 inhabitants only seven establishments are occupied in the manufacture, and that these seven when in full working, only employ about 200 hands. Leghorn can hardly, therefore, be considered a great centre of the fruit candying industry. It does, however, I believe occupy the first place in Italy, and, perhaps, throughout the Mediterranean for the preparation of the candied citron and orange peel so largely used in all branches of confectionery; for the citron is brought to us for this purpose from Corsica, from Sicily, from Calabria, and other southern provinces of Italy, from Tunis and Tripoli, and even from Morocco, and the candied peel of the fruit is exported hence to North America, to the United Kingdom, and to Hamburg, for distribution throughout Germany. Sugar also is imported for the purpose of the manufacture from Egypt. The wood of the boxes in which the candied peel is packed reaches us from Trieste, and the immense earthen ware vessels necessary for the saturation of the fruit in sugar syrup are made in the neighbourhood of Florence. On all sides, I hear, that Corsica produces the citron of the finest quality, those of Sicily and Calabria are regarded as slightly inferior, whilst that which comes from the African Coast is held in still lower repute, and, indeed, appears to be of a different variety, being larger, and having a smooth instead of the rough granulated surface generally characteristic of the Citron. The African Citron is probably somewhat deficient in the essential oil which forms the medical property, and gives the flavour to the rind. The Oranges imported into Leghorn, whether for consumption or for candying, are nearly all brought from the Islands of Sicily, Sardinia and Corsica. I shall perhaps convey the clearest impression of the treatment of the fruit and the processes through which it passes, if I follow it through the various stages of its preparation, from its arrival at this port to the moment of its departure hence in cases filled with boxes neatly packed with the cut candied peel. In all the countries I have mentioned above as contributing the raw fruit for this industry, it is treated in the same manner for the over-sea passage. The fruit is simply halved, and placed in hogsheads or large casks filled with a fairly strong solution of brine, the fruit being halved merely to ensure thorough preservation of the rind by an equal saturation of the interior as well as the exterior surface. In these casks it arrives at the doors of the manufactory. The first process to which it is then subjected is the separation of the fruit from the rind. This is done by women who, seated round a large vessel take out the fruit, skilfully gouge out the inside with a few rapid motions of the forefinger and thumb, and, throwing this aside, place the rind unbroken in a vessel alongside them. The rind is next carried to large casks filled with fresh cold water in which it is immersed for between two and three days to rid it of the salt it has absorbed. When taken out of these casks, the rinds are boiled, with the double object of making them tender, and of completely driving out any trace of salt that may still be left in them. For this purpose they are boiled in a large copper cauldron for a time varying from one to two hours, according to the quality of the fruit and the number of days it has been immersed in brine. When removed from this cauldron, the peel should be quite free from any flavour of salt, and at the same time be sufficiently soft to absorb the sugar readily from the syrup, in which it is now ready to be immersed. The next process to which the rind is subjected is that of a slow absorption of sugar and this occupies no less than eight days. Needless to say that the absorption of sugar by fresh fruit in order to be thorough it must be slow, and not only slow but it must also be gradual—that is to say, the fruit should at first be treated with a weak solution of sugar, which may then be gradually strengthened, for the power of absorption is one that grows by feeding.

"The fruit (and this holds good more especially with the rind) would absorb with difficulty, and more slowly and unequally if plunged at once into a thick syrup, than if gradually treated with weak solution, easier of absorption, and by which it has been thoroughly permeated first. It is a knowledge of this fact that governs the process I now describe. The fruit has now passed into what I may call the saturating room, where on every side are to be seen long rows of immense earthenware vessels about 4 feet high and 2½ feet in extreme diameter, in outline roughly resembling the famed Etruscan jar, but with a girth altogether out of proportion to their height. and with very short necks and large open mouths. All the vessels are filled to their brims with Citron and Orange peel, in every stage of absorption, *i.e.* steeped in sugar syrup of, roughly speaking, eight different degrees of strength. I said before that this is a process that occupies almost always eight days, and as the syrup in each jar is changed every day, we may divide the mass of vessels before us into groups of eight. Take one group of this number, and we are able to follow the fruit completely through this stage of its treatment. With vessels of such great size and weight, holding at least half a ton of fruit and syrup, it is clearly easier to deal with the syrup than with the fruit.

"To take the fruit out of one solution, and to place it into the next stronger, and so on, throughout the series, would be a toilsome process, and one, moreover, injurious to the fruit. In each of these jars, therefore, is fixed a wooden well, into which a simple hand suction-pump being introduced, the syrup is pumped from each jar daily into the adjoining one.

"How is the relative strength of the syrup in each jar regulated?" is the next question.

"The fruit itself does that," is the foreman's reply; and this becomes clear from the following explanation:—Number your group of jars from 1 to 8 respectively, and assume No. 1 to be that which has just been filled with peel brought straight from the boiler, in which it has been deprived of the last trace of salt and No. 8 to contain that which, having passed through every stage of absorption but the last, is now steeped in the freshly prepared and therefore the strongest solution of syrup used in this stage. We prepare daily a syrup of the strength of 30°, measured by the 'provino,' a graduated test for measuring the density of the syrup," continued the foreman, "and that is poured upon the fruit in jar No. 8. To-morrow the syrup from this jar weakened by the absorption from it, by the fruit, of a certain proportion of sugar, will be pumped into jar No. 7 and so on daily through the series. Thus No. 1 containing the fruit itself regulates the strength of the syrup, as I said." "But if the syrup has lost all its strength before the seventh day, or arrival at jar No. 1?" we ask. Care must be taken to prevent that, by constant testing with the 'provino," is the reply; "and if that is found to be the case, a little stronger syrup must be added to the jar."

"A slight fermentation next takes place in most of the jars but this, so far from being harmful, is regarded as necessary, but of course it must not be allowed to go too far. There is yet another stage, and that, perhaps, the most important, through which the peel has to pass before it can be pronounced sufficiently saturated with sugar. It is now boiled in a still stronger syrup, of a density of 40° by the testing-tube, and this is done in large copper vessels over a slow coke fire, care being taken to prevent the peel adhering to the side of the vessel by gentle stirring with a long paddle-shaped ladle. The second boiling will occupy about an hour. Taken off the fire, the vessels are carried to a large wooden trough, over which is spread a coarse, open wire netting.

"The contents are poured over this, and the peel distributed over the surface of the netting, so that the syrup—now thickened to the consistency of treacle—may drain off the surface of the peel into the trough below. The peel has now taken up as much sugar as is necessary.

"Now comes the final process, the true candying of the covering of the surface of the peel with the layer of sugar-crystals which is seen upon all candied fruits. To effect this a quantity of crystallised sugar—at Leghorn the same quality of sugar is used as is employed in the preparation of the syrup—

is just dissolved in a little water, and in this the now dried peel, taken off the wire netting, is immersed. The same copper vessels are used, and the mixture is again boiled over a slow fire.

"A short boiling will suffice for this, the last process, for the little water will quickly be driven off, and the sugar upon cooling will form its natural crystals over the surface of the fruits. Poured off from these vessels, it is again dried upon the surface of the wire netting, as before described. The candying is now complete, and the candied-peel is ready for the packing room, to which it is carried off in shallow baskets. In the packing room may be seen hundreds of boxes of oval shape, or if I may so speak, of rectangular shape, with rounded corners, and of different sizes, for each country prefers its boxes to be of a particular weight, Hamburg taking the largest, of 15 and 30 kilos., the United States of America preferring smaller, of 10 and 12 kilos., whilst England takes the smallest, of 5 kilos., and one containing about 7 English pounds. The wood of which the tops and bottoms cf these boxes are made comes to us in thin planks from Trieste, and a skilful packing is generally done by women, and the boxes are lined with white paper. They are then packed in cases of 100 kilos., 10 of the smaller American boxes filling a case. The candied peel is now ready for export.

"I think I have now spoken of all that need be noticed in the actual manufacture of candied Citron and Orange peel at Leghorn.

"There are, however, a few reflections upon the very existence of this industry here which seem to me suggestive and instructive ones. In my inquiries into the course of the industry I find that the fruit itself, and every ingredient and article necessary to the preparation of the candied-peel comes to us from abroad. The fruit of the best quality is from Corsica; Egypt furnishes the sugar. England provides the fuel, distant provinces of Italy contribute a portion of the raw product and the wood for the boxes in which the peel is exported. The province of Leghorn provides nothing but the labour necessary to the manufacture. Nor is this industry one that has fallen into Livornese hands from any specially acquired local handicraft or skill. How, then, does this industry exist here in these days of keen international competition? No doubt it is mainly supported by the large drawback granted by the Italian Government upon the duty paid on the chief and dearest ingredient in manufacture—sugar. The Customs tarif in force imposes a duty of 76.75 lire upon 100 kilos. of the sugar used (classed in the tariff as of second class) but grants a drawback of 60.50 lire upon a hundred kilos. of the exported article. Without this large measure of support there can be no doubt this industry would immediately and wholly collapse. With it even, it finds it difficult to hold its ground. Exporters tell me that the United Kingdom is beginning to call for the fruit to be sent to it direct from the countries of production in the same condition that it reaches Leghorn, viz., steeped in brine, and the manager of one of the factories I visited confirmed this with an air of very natural chagrin by telling me that he had himself seen 600 hogsheads of fruit shipped in brine in one vessel last year from Bastia for England."—(*Gardner's Chronicle.*)

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MISCELLANEOUS FIBRES.

By C. F. Cross.*

In presenting my report upon the "Miscellaneous" fibrous raw materials in the Exhibition, I shall keep as far as possible within the limits prescribed by its more immediate scope and purpose, which I take to be the promotion of industry and commerce. At the same time in deference to the universal experience that the extension and improvement of our commercial industries is ever making greater and greater demands upon the resources of investigators and that empiricism as a guide to development must give way, more and more to the methods of science, I shall endeavour to keep in view so much of the first principles of the subject as is necessary to the formation of the scientific judgment in regard to our raw materials, and to show that in this judgment is contained the solution of the more practical questions of their commercial application.

It is the more necessary to do this, since this department of industry has been perhaps exceptionally fruitful of baseless enterprise of abortive attempts to make into commercial undertakings that which careful antecedent investigation would have consigned to the long list of the unprofitable. Further, these Exhibitions serve as land marks of progress in industrial science, and their literary records, written to the furtherance of this important end, are of especial value to technical and scientific men. As a precedent for the scientific treatment of our subject, I may cite Dr. Hugo Muller's report to the Vienna Exhibition (1873) upon the subject of Vegetable Fibres, a report which has contributed in no small degree to the spread of sound views concerning their chemical nature, treatment and applications, and would have done more, but for the circumstances of its publication, which render it somewhat inaccessible to the English reader. This is only one of a large number of treatises which have been written during the last twenty-five years, most of which aim at industrial developments, at the same time basing their treatment of the subject upon scientific considerations, more or less. It is nevertheless true that these efforts have not borne much fruit in extending our commerce in fibres, and that the number of fibres which we may regard as constituting the staple of our textile industries remains very much within the familiar limited range. There arises consequently the very pertinent enquiry: Is there any necessity in the nature of things for an extended application of the multitudinous Vegetable Fibres? Are not those fibres, now in possession, sufficient not only in supply but in kind, *i.e.*, in variety, for all the possible purposes of vegetable textiles? Supposing the supply insufficient, are we not rather to seek the remedy in improved methods of producing and treating our present raw materials, than in introducing new ones? Especially since a new fibre means new methods and machinery for the agriculturists and spinners.

It is to questions of this kind that science can give direct answers, and I think it necessary to give some indications of the method pursued by the investigator in answer to such enquiries. It is not my intention to deal critically with the methods of the several investigators in this field, beyond pointing out that while sound in themselves, they are for the most part either chemical or microscopic, and their results therefore require complementary interpretation. For the rest my criticism will be limited to the selection of the best from amongst these methods. The purpose in view being to widen the common ground between scientific and practical men in a great department of industry, I may, in elucidating the common method of investigation, ask for the indulgence of either if I have to traverse familiar ground. If at the same time new points of attack should be revealed to those who are busy in wresting Nature's secrets, the writer will have the additional satisfaction of helping as a fellow pioneer.

It is well known that the Vegetable Fibres group themselves industrially, according to their applications, and it is also well known and interesting to note, that the grouping follows very much the classifications which we call physiological. Thus cotton as a seed hair is distinct, consisting as it does of independent ultimate cells: the Miscellaneous Fibres, on the other hand, with which we have to do —a class which includes all other fibrous raw materials—are, in contradistinction, fibre-aggregates. The conditions of this aggregation are various. The ultimate fibre being a hollow tube with more or less thickened walls, and of comparatively short length ($\frac{1}{25}$ inch–2 inches), these are built up together into a compound fibre: (1) by apposition merely; (2) by a stronger adhesion determined by a species of fusion of contiguous cell walls; (3) sometimes by, what may in such case be properly termed, incrustation, *i.e.* a cementing together through the intervention of a third substance. This encrusting substance may be cellular, in that case the whole aggregate is or was an integral part of the living skeleton of the plant; or the incrustation may be due to amorphous substances, such as gums, which are rather products of degradation, or excreta, than concerned in the general functions of the plant. (4) In certain cases, by reason of the preponderance of fibre or elongated cells, the whole of a plant comes to be regarded as a fibrous raw material, and is treated in the arts as such, *e.g.*, Esparto, and the straw of cereals. In these the fibre aggregation, being organic, is usually of such a character as to require a chemical process of disaggregation to bring it into evidence. Raw materials of this kind are used either for paper making, or for the very coarsest textiles, *e.g.* mats.

Though the union of the fibre into bundles or complexes is resolved to a greater or less extent by the processes of separation and preparation for spinning, the spinning processes adopted require a

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* Reprinted from the *Colonial and Indian Exhibition Reports.*

unit of length such as can only be given by a fibre bundle, as described above. To this spinning unit it is convenient to give the term "filament," as distinguished from the ultimate fibres, or fibre cells, of which it is built up. Given the filament, and confining our attention for the present to mechanical or structural points, the value of a raw material will depend upon the length, together with the relative fineness or degree of divisibility of the fibre bundles.

The value of a yarn or fabric depends upon its strength and durability; and these qualities in turn upon the ultimate composition, structural as well as chemical. These are expressed by experimental numbers, the results of investigation, and are what we may term the constants of the fibre, they are determinable by laboratory investigation, with the precision which necessarily attaches to scientific measurements. First: in regard to the form or structure of the ultimate fibre. What we may call the universal element is the typical Bast fibre of Vegetable Physiology; a fusiform tubulated, elongated, thick-walled cell. These cells vary but little in diameter from plant to plant ($\frac{1-5}{100}$ mm.), but on the other hand considerably in length. Comparing flax (25–40 mm.) with jute (1–3 mm.), for instance, the disproportion is very great; and, as we shall see, a considerable factor of the difference of value of the fibres. Secondly: in regard to the composition of the fibre substances, *i.e.* the chemistry of the raw materials. The fibre constituents, while they resemble one another generally in composition and properties, nevertheless exhibit certain striking distinctions All the raw fibres are made up of a portion which yields readily to the action of oxidising agents and alkaline solvents—which are in effect the agents universally employed in bleaching the vegetable fibres and a more resistant portion which does not yield. This latter is the cellulose basis of the fibres. The isolation of cellulose is therefore to the chemist what bleaching is to the textile manufacturer. If the operation be followed, in regard to its influence upon structure, with the aid of the microscope, it will be found to be attended by a disintegration, more or less, of the filaments, *i.e.*, that the cellulose obtained consists of the ultimate fibres or fibre-cells. It is the length of these individual cells, together with their proportion in aggregate weight to the raw fibre, which are the primary constants of the fibre. The common chemical feature of the vegetable fibres is, therefore, that when treated exhaustively with oxidising agents and alkaline solvents, they yield a white lustrous residue of cellulose; while on the other hand this constitutes a proportion in weight varying from fibre to fibre, and is made up of ultimate fibre cells varying considerably in length from fibre to fibre.

The following are the constants for the more important textile fibres:—

		Percentage of Cellulose.		Length of ultimate Fibre.
Flax	...	80.0	...	25-40 mm.
Hemp	..	80.0	...	25-40 "
Rhea	...	75.0	...	60-200 "
Jute	...	75.0	...	3 "

The above fibres are physiologically identical: they are the bast tissues of dicotyledonous annuals. The filaments are bundles of from three to fifteen fibres, as seen in sections at any point, more or less compactly welded together.

The second of the greater divisions of the Vegetable Fibres includes the fibre bundles of the monocotyledons, which furnish a large proportion of the raw materials for the rope-making industry. In these the filament is not only a much larger aggregate, and therefore coarser, but is in many cases more complex in structure. In place of a homogeneous bundle of bast fibres, we have bast fibres and vessels, cemented together and often enclosed in a cellular sheath. The bundles, moreover, as seen in section under the microscope exhibit considerable variations from the cylindrical, which is characteristic of bast filaments; thus in the aloe fibre the crescent form prevails. The bundles, though containing other structural elements, are, however, for the most part made up of the typical bast fibre, of which we can often count as many as 50–100 in the section. The dimensions of these fibres, as well as the percentage of cellulose in the filaments of the more important in this class, are given below:—

		Percentage of Cellulose.		Length of ultimate Fibre.
Manilla	...	63.0	...	3-6 mm.
Phormium	...	67.9	...	8-15 "
Agave	...	76.0	...	2-8 "

So far we have taken the raw fibres as made up of cellulose and non-cellulose, the latter yielding more or less readily to the action of oxidising agents and alkaline solvents. The non-cellulose, unlike the cellulose, is a very characteristic constituent, in the sense that the raw fibres divide themselves into two well-marked groups, according to its composition, viz.:—(1) the pectic; (2) the lignified. In addition to their being sharply distinguished by their reactions, the union with the cellulose is much more intimate in (2); so that whereas boiling with alkaline solutions suffices to hydrolyse and dissolve away the pectic portion of the *pecto-celluloses*, the *ligno-celluloses* are not so resolved: in this and in many other respects they have more the chemical characteristic of a homogeneous body. The distinguishing characteristics of the ligno-celluloses are (*a*) direct combination with chlorine, the chlorinates giving an intense coloration (magenta) with solution of sodium sulphite; (*b*) a bright yellow colour-reaction with solutions of the aniline salts; (*c*) a deep purple with phloroglucol in presence of hydrochloric acid (conc.); (*d*) conversion into an orange-coloured nitrate, on treatment with a mixture of nitric and sulphuric acids.

Of the above-mentioned fibres, flax, hemp and rhea belong to the first group, jute to the second, while the monocotyledonous fibres, as might be expected from their more complex character, manifest the properties of both groups.

The pectic fibres, as a class, are superior to the lignified in respect of softness and divisibility of the filaments. Moreover, it is remarkable that the characteristics of the latter group are always correlated with shortness of ultimate fibre; they are also generally inferior in regard to proportion of cellulose. We are now, therefore, in possession of the equivalents, in science, of the inferior position which they occupy in commerce and the arts. Generally, moreover, we find that our constants and the inferences to be drawn from them lead to a classification of the fibres, which is in most respects an endorsement of long-established usage, and we have, therefore, the more confidence that the application of these criteria to new and hitherto undeveloped raw materials will enable us to form certain conclusions as to their value.

We turn from the textile fibres to consider briefly the third and fourth divisions of vegetable fibrous substances—those which are so constituted as to be unavailable for the textile manufacture, and which can only be made available for paper-making through a process of chemical disintegration. Those of monocotyledonous origin employed for this purpose are entire stems or leaves, (Bamboo, Straw, Esparto). By the preliminary boiling process, usually at high temperatures, *i. e.* under pressure, the structures are so far resolved that the separation into cellular and fibrous portions is only a matter of breaking and washing. The resolution is completed by the bleaching operation, by which the residues of "incrusting and intercellular matters" are oxidised and dissolved away, leaving a disintegrated mass of ultimate fibres, and as regards chemical composition, a pure cellulose. Of bast tissues (dicotyledonous) very few are worked on this plan, the consumption in European manufactures being virtually limited to jute "cuttings," and the Adansonia fibre, the bast of the Monkey-bread Tree, which is imported from West Africa. These, moreover, are used in the manufacture of wrapping papers, and not as a cellulose or bleached fibre. The woods of the coniferous species, Abies and Pinus, are, on the other hand, largely used in paper making, both as mechanical pulp, obtained by simply grinding the wood to a fibrous mass, or by chemical processes of resolution of various kinds which reduce the wood structures to a mass of ultimate fibres easily brought by bleaching agents to the condition of pure cellulose. The following are the constants for the more important fibrous materials of the above class:—

	Percentage of Cellulose.	Length of Fibre.
Adansonia	55.0	3-5 mm.
Wood (coniferous)	53.0	1–3 "
Straw	52.0	1–2 "
Esparto	52.0	1–2 "

So far, in dealing with these several classes of raw materials, we have introduced (1) the primary constants, which have reference to the cellulose and the ultimate fibre of which it is made up, and (2) we have spoken in a general way of the properties of the "non-cellulose." It is impossible within the narrow limits of this report to deal with the large number of minor characteristics, both of the raw fibres and of the celluloses isolated from them, which necessarily have to be taken into account by the investigator in determining the position of a fibre in the scale. A brief description of the scheme of analysis which has been adopted in the investigation of the fibres will suffice to show what are the more important of these. The statement of the results of analyses is given in the following manner:—

	Moisture	Hygroscopic water or water of condition.
Separate portion taken for each determination. Results calculated in percentage of dry substance.	Ash	Total residue left on ignition.
	Hydrolysis (*a*)	Loss of weight on boiling raw fibre 5 minutes in 1 per cent solution of caustic soda.
	" (*b*)	Loss of weight on continuing to boil 1 hour.
	Cellulose	White or bleached residue from following treatment: (1) boil in 1 per cent. NaOH5 minutes. (2) Exposure to chlorine gas 1 hour. (3) Boil in basic sodium sulphite.
	Mercerising	Loss on treating 1 hour with 33 per cent. solution caustic potash—cold.
	Nitration	Weight of nitrated product obtained by treatment with mixture equal volumes nitric and sulphuric acids, 1 hour in the cold.
	Acid purification	Raw fibre boiled 1 minute with acetic acid (20 per cent.) washed with water and alcohol and dried.
	Carbon percentage	The carbon in the fibre from above, determined by combustion.

For a more detailed account of the above chemical methods, a paper published in the "Chemical Society's Journal," 1883, p. 23, should be consulted. Those interested in the microscopic investigation of fibres should consult M. Vétillart's work, "Etudes sur les fibres végétales textiles," of which a very good abstract, by the author himself, is published in Mr. Christy's "New Commercial Plants and Drugs," No. VI.*

Having thus taken a general survey of our subject-matter and laid down the fundamental principles upon which these plant fibres require to be investigated, we may now proceed to the results of the particular examination of the raw materials to be found in the Colonial sections of the Exhibition.

Our commerce in this department has been hitherto very limited, nor have the Colonies developed any considerable manufacturing industry on the basis of a home supply of such raw materials. With India, on the other hand, not only have we an extensive commerce, but the multitudinous fibres obtainable from its extensive flora have been so studied by scientific observers, native and European, as to have given us a systematised technology of the subject. It is not surprising, therefore, that we find in the Indian section of the Exhibition that which can scarcely be said to be afforded by any of the Colonial sections—an extensive and well-authenticated collection of fibrous raw materials. These have been submitted to exhaustive investigation by the writer in collaboration with others, and the results will be submitted as a report to the Indian Government and published by them. Those of our Colonies having a similar flora, more especially the West Indian, will be able to take advantage of the information therein to be published; and as it will contain a full account of the scientific methods pursued, it will be advisable for those who follow up this aspect of the subject to read it as complementing the present report, which is necessarily somewhat meagre.

*The best general scientific account of the vegetable fibres will be found in Spon's "Encyclopædia of the Industrial Arts," 1881: Article "Fibrous Substances."

CANADA.

It is to be regretted that the attention of flax-spinners was not directed, by exhibits, to the question of the future importation of flax-straw and dressed fibre from this Colony; on the other hand, the subject has been publicly ventilated at a Conference held under the auspices of the Commission, at which a paper was read by Mr. E. B. Biggar While recently in Belfast, inspecting the new Cardon flax-dressing machine at the works of Messrs. Combe, Barbour & Combe, I had the opportunity of putting some Canadian straw through the process. The yield was fully 25 per cent. on the straw, and the fibre of excellent quality. The impression created in Belfast is such as to lead us to anticipate a large trade with the Colony in flax. The importation into this country from the Continental flax-growing centres reached in 1880 the large total, in money value, of 3½ million pounds (sterling); for this trade competition has now opened out new channels, the most important of which is Canada, with its unrivalled agricultural capabilities. It is unnecessary to enlarge on a matter which has the attention of practical men, both here and in the Colony. I may allude, however, to what I said in introducing the subject, in regard to the conflict which will ensue, in response to the keen demands of competitive trade, between new fibres on the one side, and increased supplies of the old on the other. The more we know of the properties of flax, the more the conviction grows of its many-sided superiority. Supposing a largely-increased cultivation of the plant, and allowing all that is claimed for the new flax-dressing machines, both in regard to increased yield and superiority of condition, it is certain that both fibre and fabrics will be produced at increasingly lower prices. A corresponding increase in the aggregate consumption will depend ultimately upon the limit of profitable production, and the extent to which flax can displace the competing fibres, cotton and hemp, which again is very much a question of intrinsic superiority; on both issues we may expect the consumption of flax to increase largely, and to some extent, therefore, to the prejudice of new fibres which may be introduced to commerce. The subject is a complicated one, and practical considerations based on first principles must "give us pause" in dealing with new problems in fibre-commerce lest we yield to the illusory claims of mere novelty, and forget the *a priori* claim of long-established usage. Such considerations have peculiar force in reference to flax, and I have not neglected what appeared to be a favourable opportunity of insisting upon this side of the question. There is another department of the fibre industry in which Canada will doubtless play an increasingly important part, and that is the production of wood pulp for paper-making. There were a number of exhibits of mechanical wood pulps in the Foresty Section (Group II., Class 2) to which it is not necessary to allude more specially, as these are already articles of commerce. In Class 2 of Group V. also, there was an exhibit of chemical pulp prepared by the Canada Paper Co., Montreal, which is deserving of mention, as also are the papers manufactured by the same company. This subject will be found thoroughly discussed in all its aspects in the reports of the Forestry Exhibition, Edinburgh, 1884, and it would be out of place, therefore, to enter here into a detailed discussion.

AUSTRALIAN COLONIES.

There were no exhibits in the sections of New South Wales and West Australia to which particular attention can be directed.

In the former I found specimens of bast, from various species of Sterculia, but these were of no especial interest. In Western Australia there was a specimen of the indigenous Spinifex, with a rope of native manufacture. Mr. George Whitfield exhibited two bundles of fibrous plants (identified by Mr. Jackson of Kew, as a species of Daphne), with a view of their being investigated by a paper maker. The low yield of cellulose (24·6 per cent.,) however, together with their very imperfect preparation, precluded any useful result.

The South American Commissioners exhibited two fibrous substances "Mullett's" fibre, the long sword-shaped leaves of the *Lepidosperma gladiatum* and "Porcupine Grass."

These fibres on analysis yielded the following percentages of cellulose respectively: 34·4 and 36·5 The *Lepidosperma* examined in transverse section, under the microscope, was found to contain a fair proportion of fibrovascular bundles, on which the constituent bast fibres have an average length of 1·5–2·5 mm.

These results were such as to justify a paper-making experiment, for which, with commendable foresight, the Commissioners had brought a sufficient quantity. The raw material was sent to the well-known paper mill of Mr. E. Joynson, of St. Mary Cray, Kent, he having kindly volunteered to personally superintend the work of converting it into paper. The substance was "pulped" by the process of boiling, at 40lbs. pressure, with basic sulphite of soda (20 per cent.) afterwards washed, bleached and beaten in the ordinary way. A small portion was made into sheets on a hand frame, and yielded a paper of a slight yellowish colour, which left nothing to be desired in point of strength.

The bulk was run on the machine, the operation being witnessed by Sir Samuel Davenport and Mr. Scott. Here also an excellent paper was produced, exceptionally strong, and taking a good finish in the glazing rolls. The result was altogether satisfactory, and Mr. Joynson asked to be supplied with sufficient raw material for making a ton of paper, in order farther to demonstrate its paper-making qualities. This request has been complied with, and a quantity of three tons is now on its way. It is intended to make this into paper for exhibition in Adelaide this year. The Porcupine Grass having been found on preliminary investigation to be more nearly allied to the well-known Esparto, was pulped on the usual plan of treating the latter, viz., boiling under pressure with caustic soda solution. The grass, however, having been collected by amateurs, and therefore with a plentiful admixture of roots and seeds, yielded a very unpromising mixture. By carefully picking over a small portion, and beat, ing it in a model beater, after bleaching, some excellent pulp was obtained and made into sheets on the frame. In this way the paper-making qualities of the fibre was satisfactorily demonstrated. In these two raw materials, therefore, the Colony has a supply of good paper-making fibre their value will of course be determined very much by local considerations. The papers which they make are similar to those obtained from Adansonia and Esparto respectively, the yield being some 10–15 per cent. less. This will convey a better idea of their market value than an attempted money estimate, which would probably be misleading.

In the Victoria Section, Mr. Guilfoyle, the director of the Botanical Gardens, Melbourne, exhibited specimens of fibres, and also contributed very interesting notes upon the same in the Handbook. It was scarcely expedient to repeat upon these specimens investigations already completed with the fibres in the Indian and other sections. The results of these taken together with Mr. Guilfoyle's notes will be of interest to those who are considering the question of the production of fibres in the Colony. Baron von Mueller's name occurs several times in the Catalogue, but not in connection with fibres. It may be of interest to mention that I received from him, during the course of the experiments upon *Lepidosperma* above detailed, a specimen of fibre obtained from this plant by means of the Sulphite treatment, which I had brought before his notice.

In the Queensland Section there was an interesting exhibit of "fibres grown near Brisbane, and prepared by Mr. A. McPherson." This contained some very fine specimens of Jute, and also of the fibre of *Sida rhombifolia*, the latter being especially noteworthy. These fibres are similar in their main characteristics; but while they may be classed together, the Sida is unquestionably superior.

This is shown, first, by comparison of chemical composition, the results of analyses of the raw fibres being as follows :—

	Jute.	Sida.
Moisture ...	10.3 ...	10.7
Ash ...	1.2 ...	0.6
Hydrolysis (*a*) ...	15.0 ...	6.6
Hydrolysis (*b*) ...	18.0 ...	12.2
Cellulose ...	75.0 ...	83.0
Mercerising ...	16.0 ...	6.6
Nitration ...	125.0 ...	137.0
Acid purification ...	1.0 ...	0.1
Carbon percentage ...	46.5 ...	45.0

The cellulose in either case is obtained in the form of ultimate fibres of the normal type, the average length being 2 mm. in both, the diameter 0.015 mm.

Secondly: Sida shows superiority in point of uniformity, fineness and divisibility of the fibre bundles, and further in softness and in the colour of the raw fibre, and also in capacity for bleaching: the dyeing capacity of the fibres is about equal. It is interesting to note that the distinctions in favour of Sida are closely correlated with the above results of analysis. The net result of the comparison is, that while belonging with Jute to the lower grade of textile fibres, Sida is much to be preferred, and should certainly displace Jute, more especially in the higher uses to which this fibre is put. As we are informed that the plant grows luxuriantly in the Australian climate, there is a very strong case already made out for calling the attention of the authorities to the question of the production of the fibre.

The specimens of Jute exhibited were of unusually good quality. Mr. McPherson also exhibited fibre from the *Hibiscus sabdariffa*, obtained from the plant by the somewhat novel process of "exposure to the weather for five months." The specimen yielded on analysis 71 per cent. Cellulose, the ultimate fibres closely resembling those of Jute.

In this exhibit there was a sufficient demonstration of the fibre-producing capabilities of the Australian Colonies, and the matter will no doubt be taken up practically in proportion as a supply of fibrous materials comes to be demanded for home manufactures.

NEW ZEALAND.

In this Court the only exhibit of Vegetable Fibres was that of *Phormium tenax*, including both machine and native (Maori) dressed fibre, and a number of yarns and cloths, spun and woven from the same. As is well known, this so-called New Zealand Flax has been the subject of extensive investigations, with the object of improving the methods of preparation, and extending the applications of the fibres, without, it must appear, anything like commensurate results. Having studied the reports which have been published, and also made an investigation of the fibre upon the lines laid down in this report, I shall briefly note the judgments I have formed upon the capabilities of the fibre, with the evidence upon which they are based.

It is scarcely necessary to point out that the terms Flax and Hemp, which has been applied to the fibres, even with the qualification of "New Zealand," are misleading, as misnomers usually are. Nothing can be clearer than the distinctions established by investigations, both chemical and morphological, between the two great types of Vegetable Fibres—the bast fibres of the Dicotyledons, and the fibrovascular bundles of Monocotyledons nor can these distinctions be more clearly brought out than in a comparison of the "constants" of Phormium fibre with those of Flax or Hemp.

The following are the results of analyses of the machine dressed fibre in the Exhibition, and of a specimen of Irish Flax of somewhat low quality :—

	Phormium.	Irish Flax (Heckled).
Moisture	11. 4	9.1
Ash	0.75	1.6
Hydrolysis (*a*)	13.6	13 3
Hydrolysis (*b*)	21.2	22.1
Cellulose	67.5	80.2
Mercerising	19.5	8.4
Nitration	96.9	125 0
Acid purification	1.5	4.3
Carbon percentage	45.0	43.2
Mean $\frac{\text{length}}{\text{diameter}}$ of ultimate fibres	$\frac{8 \text{ mm.}}{0.015 \text{ mm.}}$	$\frac{33 \text{ mm.}}{0.02 \text{ mm.}}$

The main distinctions are (1) the relatively low percentage of cellulose in Phormium; (2) the very low yield of the nitration product, which indicates the presence of cellulose of very inferior stability—this is confirmed by the relatively large loss in mercerising; (3) in morphological characteristics, the flax consisting of bundles containing, at any point, but few fibres, whereas the Phormium bundles are very large, and for the most part complex in structure, and therefore variable, containing a preponderance of bast cells (very thin-walled compared with flax), with a central core of vessels, the whole enclosed in a monocellular parenchymatous sheath. Such distinctions we cannot fail to see are correlated with distinctions in physiological function: and that this is so will be more clearly elucidated in the forthcoming report on Indian fibres before alluded to, in which the number of fibres examined is sufficient to admit of general conclusions.

These distinctions, moreover, must determine the different applications of the fibres in the arts, and the evidence we have discourages any attempt at replacing the fine spinning textile fibres of Exogenous origin by their poorer relations the fibres of the Monocotyledons. While, however, Phormium will never be entitled to rank with Flax and Hemp, there is, we think, with Phormium, as with certain others of this class of fibres, a higher use than those to which they are at present applied. This will depend, in any one, first upon the degree of fineness, which also involves uniformity, and divisibility which it has, naturally, or to which it can be reduced by chemical treatment; and secondly, upon the cost of production.

Now Phormium is distinguished amongst the Monocotyledons* by its very large yield of fibre, which of course favourably influences, in direct ratio, the second consideration. The question therefore of newer applications resolves itself rather upon the former issue. The comparative fineness of the native-dressed fibre shows that careful selection and preparation of the raw material†—which are characteristic of the Maori treatment can accomplish much in this direction, but this superiority of method is not realisable commercially, or at least only partially. We have therefore to consider the alternative, or chemical treatment. In the report of the Commissioners of the New Zealand Exhibition of 1865 we find strong testimony in favour of a mild alkaline treatment of the raw material. To quote from this report: "They" (*i. e.* the alkalis) "enable us to clean the fibre with ease, but they impair its strength always imparting to it a brownish tint, which can scarcely be looked upon as other than a sign of decomposition. In the use of soap—the last chemical experimented upon—we have all the advantages obtained by the use of alkalis, without their disadvantages; but the high price of this article would prevent its adoption for this purpose if used alone." Then after suggesting the joint use of soda (carbonate) to minimise the quantity necessary to use, they conclude by saying, "the fibre obtained in this way is easily cleaned. is not discoloured, and appears as strong as that prepared without the use of chemicals."

Quite apart from the recommendations of the Commissioners in the particular case of Phormium the hydrolitic action of the alkalis has long been known and used as the most effective and safest way of treating raw fibres for the removal of non-cellulose impurities. In recent years a great deal of work has been done with the sulphites in this direction. The results obtained with the basic alkaline sulphites are such as to give a complete range of treatments down to the isolation of the ultimate fibres with the minimum of chemical modification of the fibre constituents, and therefore alteration of the natural colour of the fibre. It is impossible in this report to do more than consider the more practical questions involved, and I must limit myself to a bare statement of the advantages of sulphite of soda in relation to the treatment of Phormium. Its solvent action is superior to that of soap; the combination of the base with sulphurous acid gives to the compound a deoxidising power, the effect of which upon the fibre is a notable bleaching action, owing to recent improvements in manufacture it can be produced at a cost one-third that of soap, and it is worthy of note, at about one-third of the cost of the crystalline compound formerly exclusively known to commerce. The process of treating fibres and raw fibrous materials with this sulphite patented by myself in England in 1880, has been worked out with considerable success by Mr. J. P. Strangman, of Sarno, Italy, for the preparation of a finer spinning fibre from dressed Italian hemp. This gentleman accompanying me in one of my rounds at the Exhibition, expressed his willingness to test the process upon the machine-dressed Phormium. Sir Julian von Haast having been approached on the subject, secured the co-operation of Mr. D. W. Bell of 14 Milton Street, E. C., who shipped a parcel of 12 cwt., of fibre to Italy. The results of the contemplated experiments will be announced in due course. Such a process is of course different from that recommended by the Commissioners, in starting from the dressed fibre; the purpose however is the

* 15-20 per cent. on the green leaf as compared with the average 3-7 in Aloe, Manilla, &c.

† It is interesting to note that the mean length of the ultimate fibre was determined at 11.15 mm. in the native-dressed specimens, as against 8 mm. in the machine-dressed.

same. In the face, however, of these recommendations, above quoted, a trial of this method of treatment upon the green leaves is to be urged upon the attention of the authorities. I have made laboratory experiments with leaves supplied to me by Sir Julius von Haart: on scutching the leaves after treatment a very superior fibre was obtained. On examining this fibre in section under the microscope the bundles were found to be satisfactorily divided, and largely freed from their cellular sheath. In colour and softness the product was far superior to the machine-dressed fibre. It remains to consider what are the possible applications of the finer fibre, thus prepared. Mr. Strangman proposes to put the products which he obtains through the ordinary twine-spinning machinery. It will be as well not to anticipate the results of this trial by any predictions.

There is another application which I am investigating, with the kind assistance of my friend Mr. J. R. Barlow, of Bolton, who has undertaken the experiments, that is, a process of reduction of the treated fibre to something like the staple of raw cotton: a treatment which has been successfully applied to the spinning of yarn from various wastes. The reduction is effected in a special machine from which the resulting "wool" is taken through the carding process and spun into a weft yarn. The results of the trials of this process upon the treated Phormium will be duly reported. Reverting to the treatment of the green leaves, attention should be directed to the employment of the rejections of the leaves and the fibrous waste as a paper-making material. From the air-dry leaves exhibited in the collection, 49.5 per cent. of cellulose was isolated by the ordinary method. Such a yield which would be sensibly the same for all parts of the leaf taken together with the comparative ease of isolation, and the satisfactory length of the ultimate fibre, leads to a favourable estimate of its value for paper-making: sufficiently, at least, to afford a "set off" against the cost of producing the fibre. This has doubtless been considered, but finding no mention of the matter as having been put to a practical test, I have thought fit to mention it in passing.

In submitting these considerations, I am sensible of the difficulty of contributing to elucidate a problem which has already and for many years engaged the attention of distinguished men both here and in the Colony. Still in spite of the excellent work which has been done, it does not appear that there is a definite estimate, scientific or commercial, of the capabilities of the Phormium Fibre; and if this communication is effective in the least degree in stimulating further inquiry it will have fulfilled its purpose. It may not be out of place briefly to summarise the results of this recent investigation of the matter. The reports of the Commissioners (1870-1872) point to an inadequate investigation of the Chemistry of the fibre, the methods adopted being empirical and not uniform with those now generally adopted; consequently the question of chemical modification of the fibre for the improvement of its quality, as well as treatment of the raw materal for the same end, has not been fully investigated.

Such an investigation is the more promising of practical result in the case of Phormium, on account of the exceptionally high yield of fibre. Experiments have been undertaken under the auspices of the Executive Commission, starting with the machine-dressed fibre, to test the various treatments with alkaline sulphites, which in more recent times have been successfully applied to other raw fibre and fibrous materials; and further to test the spinning qualities of the resulting modified forms of the Phormium fibre. It would be desirable to put the green leaves through a similar treatment with the view of preparing a finer fibre in the first instance. The rejections of the leaves and fibrous waste, yielding a good percentage of long fibre, should constitute a satisfactory paper-making material; and upon this a definite estimate should be taken. Considering for a moment, in conclusion, the present position of Phormium as a fibre competing with Manilla for rope-making fibres, laboratory investigation rather establishes the superiority of the former than justifies the preference which has been given to the latter. The following results were obtained with a selected specimen of Manilla:—

Moisture	...	...	...	10.5 per cent.
Hydrolysis (*b*)	...	..	...	13.5 "
Cellulose	...	...	...	58.0 "
Ultimate fibres. Length		...	...	3–7 mm.

There is a very close structural resemblance between these fibres,* as might be expected from their physiological similarity. The chemical composition will vary to a certain extent with the method of preparation but the comparison having been made upon specimens very similar in condition may be taken as fair. The matter appears to require further investigation.

FIJI.

The exhibits in this section were perhaps rather of technical than commercial interest, though there were indications of possible developments in the latter direction.

The most noticeable feature were the curtains which adorned the entrances to the Court. These native productions are made from the prepared bast of the Broussonetia or paper mulberry, and adorned with barbaric designs, printed, as the Commissioners informed me, by means of such primitive apparatus as a plantain leaf for stencil plate, the colours, a black and brownish-red being suitably thickened. Though not of high quality, individually, they produce a very harmonious blend; and quite in accord with modern taste. In addition I found samples of Musa fibre well cleaned and of good length, and coir fibre with twine and rope made from the same; also twines of native manufacture worked into fishing-nets, made from the so-called van fibre. Although there is no mention in the "Handbook of the Colony" of any commerce in miscellaneous fibres, there can be no doubt that this branch of trade is capable of development in the Colony.

* Compare Prof. McNab's Report to the Commissioners.

AFRICAN COLONIES.

In the Cape Colony Section but little attention appeared to have been given to the subject of fibres. The only specimen inviting investigation was a fibrous bark (unnamed) in the exhibit of the forest department. This yielded on analysis 48 per cent. of cellulose; the ultimate fibres were of satisfactory length.

The raw material was exceptionally clean, and readily yielded to the action of weak alkalies: all these points considered, therefore, it may be looked upon as taking a place amongst paper-makers' raw materials.

NATAL COURT.—Amongst the fibres, which formed a somewhat prominent feature, I found a specimen which from its external characteristics alone was at once to be identified as belonging to the highest class of textile fibres. From the descriptions of the Exhibitors, General Bissett and Dr. Sutherland, it is known in the Colony as "Native Hemp," and is said to be obtained from a plant of the Hibiscus Order. At the time of writing this report the above description has not been verified; but the question of identification, with that of the source of supply, having been taken in hand by the Kew authorities—by whom, in fact, my attention was first directed to this fibre—it is unnecessary for me to say more on this point.

Chemical and microscopic investigation fully confirmed the impressions obtained on preliminary inspection. The following are the results: –

Moisture	...	...	9.4 per cent.
Ash	...	...	3.5 "
Hydrolysis (*a*)	...	...	13.7 "
" (*b*)	...	...	22.3 "
Cellulose	...	...	76.8 "
Mercerising	...	...	12.5 "
Nitration	...	...	117.0 "
Ultimate Fibres		Length / Diameter	25–80 mm. / 0.032 mm.

The constants for this fibre are in the main similar to those of flax, while the ultimate fibres are distinguished by even greater length. Although the number of ultimate fibres in the filament is larger, varying from two to fifty, the adhesion is but slight, and easily resolved. The raw fibre is, further, also distinguished by giving a violet reaction with Iodine (Schultze's solution), which is characteristic of fibres of only the highest class. Unfortunately the fibre had not been prepared with sufficient care to enable us to put it through a fine-spinning trial, on flax machinery. A certain proportion of bark still adhered to the fibre, and this would have made the heckling a very wasteful process. Having only a small quantity of fibre at command, we therefore put it through the special process, mentioned in the report on *Phormium tenax.* The fibre was first submitted to an alkaline treatment for the removal of bark, and after drying, was torn up into short staple fibre and spun on cotton machinery. The yarn obtained was of a greyish colour, bleaching easily, under the ordinary treatment, to a full white. It was remarkably soft to the touch, more nearly resembling an Angola yarn than flax or cotton. It is scarcely necessary to point out that the highest capabilities of the fibre are not brought out by such a treatment, but the trial was nevertheless useful as a demonstration of its spinning properties. The fibre has been submitted to flax-spinners of experience, and from inspection, together with the results of laboratory investigation, they have formed a high estimate of its value.

These are only preliminary results, but they are of sufficient importance to warrant an extended investigation of the fibre, with the view to its introduction to commerce.

In addition to the above there were specimens of *Fourcroya* and other Monocotyledonous fibres. I did not repeat upon these specimens investigations already completed upon other sections: and for information upon these fibres the special reports of the Indian and West Indian sections should be consulted.

WEST AFRICAN COLONIES.

In these sections I found specimens of very interesting nature. The textiles of native production are extremely ingenious aud tasteful in their combinations of colour. From amongst the raw fibrous materials the following were selected for special investigation:—

(*a*) Bast. Exhibited in the Gambia Section, but not further described. Used by the natives for a number of purposes. The fibre itself, when isolated, closely resembled jute in appearance, while from specimens showing the bast *in situ* (a stick stripped, the fibre remaining attached so as to form a species of whip), it appeared to be closely allied to the West Indian Mahoe.

The following determinations were made;—

Moisture	...	...	...	11.0 per cent.
Hydrolysis (*a*)	...	...	...	8.4 "
Cellulose	...	..	...	74.5 "
Nitration	...	...	...	121.0 "
Ultimate fibres		Length / Diameter	...	1–3.5 mm. / 0.02 m.m.

This fibre is very similar in composition, chemical and structural, to jute, and is capable of similar applications. From the specimens it was to be concluded that they were obtained from a perennial, from the main stem or more probably the branches. In regard to a probable commercial future for this fibre, the most favourable conditions of growth of the plant should be first determined. Questions of this nature are outside our province, but it scarcely needs to be mentioned that the authorities at Kew are always ready to advise and assist in the necessary investigations.

(*b*) A fibrous Bark, in the Gold Coast Section. A bale of this was exhibited by Dr. J. Esmond, of Accre, with a request that it should be put through a paper-making trial.

In external appearance it was not unlike the Adansonia, except in being comparatively free from medullary matter. The following determinations were made:—

Moisture	... ...	11.0 per cent.
Ash	... ...	7.6 "
Cellulose	... ...	66.5 "
Ultimate fibres.	Length	10.15 mm.

Not only in the relatively high yield of cellulose, but in the exceptionally great length of the ultimate fibres, this material is such as to command the attention of paper-makers. It only remains to add that the substance is easily treated, and that the resulting pulp bleaches under the ordinary treatment to a high colour.

Messrs. Joynson have kindly undertaken a paper-making trial of the substance, the results of which will be reported in due course.

(*c*) Grass (epidermal strips of *Ratia vinifera*) exhibited by Mr. A. Sibthorpe in the Sierra Leone Section, with specimens of straw plait illustrating its more usual application by the natives.* This specimen also proved itself on analysis to be worth the attention of paper-makers. The following determinations were made:—

Moisture	... ...	9·8 per cent.
Ash ...	... ...	2·7 "
Cellulose	... ...	60.8 "
Ultimate Fibres.	Length	1·5–2.5 mm.

It is needless to say that the raw material is particularly clean, in length of fibre, but more especially in yield of cellulose, it is superior to Esparto; it only remains, therefore, to determine the cost of production, and if within the limit, to introduce this raw material into European commerce.

Notwithstanding that, as is to be judged from appearances, but little attention has been bestowed upon the fibre exhibits in this section, results have been obtained which should stimulate inquiry into the undeveloped resources of these Colonies, in the department of miscellaneous fibres.

WEST INDIAN COLONIES.

In these Sections the exhibits of miscellaneous fibres are more prominent: and the matter is doubtless of first importance to the commerce of these Colonies. It is scarcely necessary to point out that there is a general resemblance between the flora of the tropical countries of the East and West hemispheres, sufficient to warrant our regarding India and the West Indies from a common point of view, and the results of our investigation of the Indian fibre exhibits will in a great measure apply to those of the latter.

In determining questions of commercial value, on the other hand, the conditions which have to be taken into account are very different in the two cases, and further are by no means uniform for the several members of the West Indian group. On these latter points I can only offer very general remarks, which I reserve until I have detailed the results of the special investigations which have been made.

Amongst the exhibits the Monocotyledonous fibres largely preponderated; indeed but little attention seems to have been bestowed upon the working of the bast fibres of indigenous Dicotyledons. From the various Courts I selected well-dressed specimens of the following:—Penguin (*Bromelia P.*) *Sanseviera Zeylanica*, and *Agave Keratto*. These are to be found in nearly all the exhibits of the various sections. In the St. Vincent Court I found a small specimen of the Groo-Groo (or Gri-Gri) fibres, contained from the *Acrocomia sclerocarpa*, which is distinguished from the other fibres of this class by its remarkable fineness and softness, and this superiority is confirmed by a comparison of the results of the analysis, which are as follows:—

	Penguin.	Sanseviera Z.	Agave K.	Groo-Groo.
Moisture ...	10.0	9.7	10.5	10.3
Ash ...	1.3	—	1.4	3.4
Hydrolysis (*a*)	12.6	12.0	10.0	7.6
" (*b*)	22.8	24.4	20.0	16.5
Cellulose ...	67.2	73.1	75.8	83.5
Mercerising ...	22.5	—	11.0	11.2
Nitration ...	103.5	105.6	109.8	118.3
Acid purification	3.1	4.5	0.4	0.7
Ultimate fibres. Length	1–2 mm.	1.5–2.5 mm.	2–8 mm.	1.5–3 mm.

* A further examination of this substance comparatively with Raffia, which still commands a high price among gardeners and nurserymen, showed that it was so closely similar as to be applicable to precisely the same uses, and such an application would of course take precedence of that above indicated. This fibrous material is well worthy of further attention.

Comparing tho lengths of the ultimate fibres, the Agave must be pronounced the superior fibre, whereas chemical analysis shows the fibre constituents of the Gri-Gri to be the more stable, and this fibre is to be preferred on account of its superior fineness. In discussing the subject of Phormium I have alluded to the general inferiority of the Monocotyledonous fibres, and the causes structural and chemical. If the above results be compared with the numbers there given, on the one hand, and with the analysis of a high-class bast fibre such as flax, which is also given, or the native hemp of the Natal Colony this class-similarity and inferiority will be the more emphasized. So also I have alluded to the question of yield of fibre from the green raw material, and to the superiority of Phormium in this respect to all other fibres of this class. In recommending any of the above fibres to the attention of West Indian cultivators, this question must be taken next in order ; after which there comes the question of the process of obtaining the fibre, together with those of supply and transport. Assuming a satisfactory decision on these latter points, attention should be confined in each locality to one, or at most two, of those which have been shown to be superior. Much time has been wasted by diffuse investigations in the province of fibres, and the cause lies in the absence of recognition of the precise criteria of value. It is quite certain that the conditions of European markets and manufactures are not such as to encourage any large increase in the *number* of vegetable fibres, more especially of the Monocotyledons. The struggle is severe, and only the fittest survive. There is no necessity for the future that the question of fitness should be left to work itself out. The application of criteria, now well established enables us to make definite selections on the basis of superiority.

The authorities in the several islands should decide generally that the growth and preparation of a fibre is desirable, then a particular fibre—the best for each locality—should be selected, and the trade in that fibre thoroughly organised. The importance of an organisation cannot be overestimated, and in support of this we may cite the case of the trade in jute. There are, as we know from the results of investigations, not a few fibres capable of replacing this particular bast, some in fact of the same class being superior in all essentials. Nevertheless the trade in jute holds its own unassailed, and the cause in so far as it does not reside in intrinsic superiority and commercial fitness, must be sought in the concentration of attention upon this fibre, and the resulting organisation of the trade. These facts deserve to be borne in mind by all who are contemplating the founding of any such enterprise.

In this report the subject can only be dealt with on general principles. In its special and local aspects the matter has been made the subject of exhaustive investigation by Mr. Morris of Kew, during his residence in the West Indies, and an excellent account of the results of his work are given in a lecture delivered under the auspices of the Institute of Jamaica, February 5th, 1884, and subsequently published. In this treatise there is a very full account of the Monocotyledonous fibres, and the practical questions involved are very effectively handled. Under the guidance of the recommendations therein given, and the results of scientific investigation of the isolated fibres, there should be no difficulty in arriving at clear decisions on the matter in its relation to the trade of the West Indies.

Coming now to the second group of fibrous substances, the Dicotyledonous bast fibres, we find that hitherto these have received but little attention in the West Indies, at least in regard to external commerce. The conditions of the competition with India in this field have been, and are probably still too severe for satisfactory commercial results. Into this question it is not for me at present to enter. Amongst the exhibits there were only a few fibres of this order ; of these the following were selected for investigation :—

Mahoe.—A very good specimen of this bast was exhibited in the Jamaica Court : the strands were about 9 feet in length, of a cream colour, clean, the fibres showing a fair degree of fineness and divisibility. A second specimen, exhibited in the Trinidad Court, under the name Maholtine, was also analysed.

The following are the results :—

		Mahoe.		Maholtine.
Moisture	...	10.7	...	11.5
Ash	...	1.6	...	1.5
Hydrolysis (*a*)	...	9.8	...	12.9
" (*b*)	...	14.2	...	15.4
Cellulose	...	73.8	...	72.7
Mercerising	...	9.6	...	9.0
Nitration	...	96.9	...	94.4
Acid purification	...	3.4	..	6 3
Carbon percentage	...	45.2	...	—
Ultimate fibres.	Length	1–1.5 mm.		1–1.5 mm.

There can be no doubt of the identity of these fibres. This bast is in the main similar to jute, superior in regard to resistance to hydrolysis, but apparently inferior in regard to the cellulose. These specimens were isolated presumably from a well-aged, free-growing plant. The results would justify an investigation of the modifications in the fibre, determinable by artificially modifying the conditions of growth of the plant. Being one of the most widely distributed throughout the West Indies, and the qualities of its fibre having been already tested by native applications, the question of a probable wider application of this fibre is worthy of investigation.

In addition to the Mahoe, which from its extensive distribution is presumably the most important, specimens of the following have been analysed :—

Pavonia Zeylanica, also a free bast, and capable therefore of textile application, and Sugar Bark (*Malvaviscus arboreus*), *Malva sylvestris*, and Daphnopsis, the three latter appearing from the analysis to be capable only of a possible application as paper-making fibres :—

		Pavonia Zeylanica.	Malva sylvestris.	Malvaviscus arboreus.	Daphnopsis.
	Moisture.	8.7	12.1	10.7	13.2
	Ash	3.4	2.7	4.9	4.5
	Hydrolysis (*a*)	11.0	19.2	19.9	27.0
	" (*b*)	12.8	27.6	24.5	31.2
	Pellulose	75.0	57.0	65.0	63.0
	Mercerising	14.2	...	...	...
	Nitration	107.6	92.8	79.3	...
	Acid purification	6.8	4.7	...	...
Ultimate fibres.	Length	1–1.5 mm.	5–12 mm.	1.5–2 mm.	5–7 mm.

On the above results the Pavonia is noticeable for the evidences of a "sound" chemical constitution, and *Malva sylvestris* for the satisfactory length of its ultimate fibres. If improved by cultivation these fibres would be doubtless capable of application

The *Mulraviscus* and *Daphnopsis* fibres might prove useful to the paper-maker : more especially the latter, by reason of the length of the ultimate fibre.

There are two fibres of this class which are deserving of general mention as having a probable future in West Indian Commerce, viz. : Rhea and Sida. The former has been so extensively discussed that it would be impossible to add anything of practical significance to what is already known ; the subject is moreover treated in its relation to the West Indies by Mr. Morris in the brochure already alluded to. *Sida rhombifolia*, which is also mentioned by Mr. Morris as indigenous to the Islands, has been discussed in the report upon the Queensland section, in which very excellent specimens were exhibited. It is unnecessary to repeat what has there been said. The fibre is certainly equally deserving of attention in the West Indies.

Reverting to the exhibits, we come to those included in the lowest class of raw materials.

In the Guiana section there are—in addition to fibres identical with those already described—a number of basts, of which I selected two for special investigation, as typical of the class. They are described under the native names, Enouroo and Kokoyoko. The following results were obtained on analysis :—

		Enouroo.		Kokoyoko.
Moisture	...	12.1	...	13.3
Ash	...	7.4	...	3.8
Cellulose	...	50.5	...	38.0
Ultimate fibres.	Length	1-2 mm.	...	3-4 mm.

These substances cannot be considered therefore as having any value for the European Markets.

Megass.—Some attention has been given to this refuse as a raw material for paper-making, and a good specimen of half stuff, rolled into sheets, is exhibited. In its general features the pulp obtainable from the sugar cane is similar to that yielded by the bamboo, as is only to be concluded from the close affinities of the plants. It is inferior, however, in containing more cellular *débris*, and in length of fibre the bast cells seldom exceeding 2.5 mm., whereas the average in bamboo is 3. Such a material cannot be recommended to paper-makers; and it is doubtful whether by any process it could be converted into a useful paper-making material, at a reasonable cost.

Banana.—Lastly, we have to consider a fibrous substance, also very low in the scale of raw materials, but which would be of great importance to these Colonies, provided it could be suitably and cheaply prepared, and an outlet found for the product, this substance is the refuse stalks of the edible Banana. The fibrous basis of these stems are ultimate fibres of fair length (2-3mm.) and of which the paper-making properties are well established : there are, moreover, easy of isolation. The specimen of "Musa Stock" exhibited in the Jamaica Court yielded on analysis 27 per cent. of cellulose. By long boiling in weak alkali, then bruising and washing to remove cellular matter, and bleaching in hypochlorite, *i.e.*, paper-maker's treatment, I obtained from the raw material 31 per cent. of a well-bleached clean tough fibre, a most useful basis for strong wrapping papers. On the other hand so low a yield must be regarded as prohibitory. Of course it would be perfectly easy to concentrate the substance, as I may term it, in removing the cellular matter by a simple treatment such as that above described ; and it is needless to say that a raw material yielding on treatment 50 to 60 per cent. of such fibre would command a fair price in European markets. The question of the preparation of the Banana stems into a paper material for export has been fully dealt with in its local aspects by Mr. Morris, in the pamphlet before alluded to. On this side of the question, therefore, we need say nothing. The commercial issue entirely depends upon the cost of putting down the treated material, at the several ports in such a condition that under the further treatment necessary for its conversion into a paper pulp the loss shall not exceed, say, 40 per cent. The value of such a raw material I should estimate, at present rates, at about £8 a ton. This matter should be thoroughly tested forthwith and a decision arrived at.

In this general account of the West Indies in relation to the subject it will be understood that British Guiana and British Honduras are, by their geographical and other circumstances, to be considered as included.

ST. HELENA.

Mr. Morris, in his report upon the resources of this island (1884), has pointed out the possible development of a supply to the European markets of Aloe and Phormium fibre. The latter is the more deserving of attention on account of the much larger yield in percentage of the green leaves. In the above-mentioned report it is, presumably by some mistake, stated at only 5 per cent., whereas in the reports of the New Zealand Commissioners it is returned at from 15 to 20; the difference between the condition of growth in the two islands cannot be such as to affect in so great a degree the structure of the leaf, *i.e.* development of fibre. The yield usually accepted being relatively large, and the conditions favourable to the growth of the plant, there would appear to be good ground for a further serious effort to establish a trade in Phormium.

CEYLON.

In this Court there were exhibited some especially fine specimens of *Sanseviera* and *Fourcræa* fibre. The latter was analysed with the following results:—

Moisture	...	...	...	12.0 per cent.
Hydrolysis (*b*)	...	...	...	11.75 "
Cellulose	...	...	...	69.6 "
Nitration	...	...	...	104.0 "
Ultimate fibres.	Length	...	...	3-7 mm.

This specimen, while showing a general agreement in composition with other Monocotyledonous fibre bundles, was at the same time of superior quality.

Coir fibre, as well as twine and rope, is an important feature of the commerce of the Colony, and was well represented in the exhibits. The Kitul fibre was also shown, both in the raw state and in the form of ropes.

MAURITIUS.

In this section we have an elaborate collection of fibres from the Botanical Gardens, interesting as a collection, but not opening up any questions of practical import to the commerce of the Colony. There are several exhibits of well-dressed Aloe fibre, in which, it is well known, the island has a well-founded and increasing trade. A full account of this fibre industry, as conducted in Mauritius, is given by Mr. Morris in his account already mentioned of fibre plants available in the West Indies. Those interested in the commerce of the island will no doubt find imformation in the present report, and in that on the Indian fibres in the Exhibition about to be published, which will be equally available in regard to local questions of fibre production.

BRITISH NORTH BORNEO.

The only fibre exhibited is the Manilla, the only one likely to be of importance in the immediate future. The close proximity of the Colonies to the Phillipines, the original home of the Plantain fibre industry, will necessarily induce a competitive trade, and the adoption of similar methods of preparation of the fibre. At the same time it is to be hoped that the resources of the Colony will be fully studied in relation to indigenous fibrous plants.

APPENDIX.

I have received from Messrs. Joynson satisfactory reports upon the papers made (*a*) from the Bas Strips, exhibited in the West African Section. They were treated by the (basic) sulphite process, and bleached to a good colour. The paper was reported to be of exceptional strength. (*b*). From Must Stock—West Indian Sections. The paper obtained was of a yellowish colour, and of quite peculiar characteristics: being *transparent*, and at the same time taking ink well (without sizeing), as, in fact, not only resembling a tracing paper in appearance, but available for such application.

New Processes.—It may not be out of place to direct attention, in the Colonies, to one or two of the more important of these, which are in prominent notice here and on the Continent.

Flax-dressing.—In this department certain new machines are making an important move. The special feature of the Cardon machine, which has been already mentioned, is the breaking up of the wood of the stem by means of piercing pins; these are set in frames which are disposed in pairs along the first portion of the machine.

The flax-straw, held by clamps, travels between the pins, being arrested at each pair while these travel at right angles to its line of motion, meeting in the centre across the straw which is thus pierced at every point; passing lastly to the second portion of the machine, the flax is lowered into a chamber, in which it comes between the rapidly revolving shaking-wheels, which effectually free the fibre from the comminuted wood. This improved treatment affects advantageously, not only the quantity, but the quality of the fibre obtained. I quote on these points from a report from Messrs. Combe, Barbour & Combe, of Belfast, with which I have been favoured:—

"The results of our trials, and we have now made a great many, have proved to us, that from exactly the same straw, about 40 per cent., more or less, increased yield of fibre is obtained, upon that scutched with the old handles."

The reports of spinners as to the quality of the "new" flax are equally satisfactory.

Mather-Thompson Bleaching Process.—This process, which is now well established, effects a very important simplification of the treatment for the bleaching of vegetable fibres and fabrics The principle of the system is the reduction of each essential treatment, alkaline hydrolysis (boiling) and whitening (or bleaching proper) to a *single operation*, rendered complete by special appliances, mechanical and chemical, and so avoiding the complicated repetitions of the old system. In the treatment of cotton goods, this is effectually accomplished; with linen goods, on the other hand, although owing to the peculiarities in the chemical composition of the fibre, the treatment cannot be reduced to such simplicity, the relative simplification is even greater. The chief feature of the system, practically, is not the chemicals employed, which are those of long standing, but the special apparatus and appliances by means of which they are brought to act upon the fibre or goods. A full account, with drawings, will be found in the "Textile Recorder," January 15, 1886, and the "Engineer," March 19, 1886, which should be consulted by those who wish for further information.

Hermite Bleaching System.—This is based upon the production of bleaching compounds by the electrolysis of solutions of chlorides, more especially of the chlorides of magnesium and calcium. The energy of the current causes the fixation of active oxygen, which is in this, as in all the bleaching solutions at present employed, the effective bleaching agent. It has been found, however, that the oxygen, fixed in this way, has a much greater bleaching activity than the oxygen of bleaching powder. The economy of the system comes to be calculated in the following way :—Units of current give units of oxygen measured by the ordinary chemical test. These quantities have then to be extended, the first into steam H. P. per annum, the latter into so much bleaching work accomplished. On such a calculation, all local circumstances taken into account, the advantages of the system are great, even for application in this country; but in those Colonies, where (1) bleaching powder is an "exotic," but supplies of the earthy chlorides are available (*e.g.* mother liquors from sea salt); and (2) where water-power is plentifully available, the advantages would be much greater. The matter is deserving the attention of technologists in the Colonies.

Having now completed the more special work of reporting upon the exhibits of fibres, and having in the investigation adopted a method which *might* be described as scientific as opposed to practical—though I have endeavoured to show that in this domain science and practice never should be at variance—I will in taking a brief concluding survey of our subject, keep to the more distinctly commercial aspects.

First it will be interesting to get a general idea of the amount and distribution of the Colonial and "foreign" trade in miscellaneous fibres and articles manufactured from them. On the next page is a tabular account of the statistics of this trade for the year 1885, for which I am indebted to the kindness of Mr. F. Bailey of the Board of Trade.

Table B contains returns which, though partial in character, will have a particular interest for the trades which they concern. They are of much less importance, in general bearing on the subject, in comparison with the statistics in Table A. These are a fairly complete account of our whole trade in these fibres, and the contrasts of the foreign and Colonial commerce are remarkable.

It is not difficult to see that there is an ample field for a Colonial trade in flax and hemp, at the expense of the foreigner. I have alluded to the exceptional agricultural circumstances which mark out Canada for successful competition in the production of these fibres; the Australasian Colonies may also participate in this new direction of commerce, which we may look upon as certain to be progressively realised.

In jute the disparity between the trade with foreign countries and with British possessions, which in other respects is simply enormous, is considerably modified; and it is not a little remarkable that the trade in this, the lowest of the textile fibres, should be greatest of all. I have shown cause for expecting this fibre to give way before others of the same class but of superior properties; but it is unnecessary to point out that to seriously alter the proportions of so gigantic a commerce will be no light undertaking.

In hemp substitutes and "unenumerated fibres" the West Indies now play an inferior part, but there can be no doubt that a large proportion of this commerce can be wrested by them from those who now hold it. In paper materials and half stuff, what strikes me as a weak point is the enormous trade in Esparto.

By weakness I mean, the absence of any claim on the basis of ultimate properties to occupy a position which at this time might well be regarded as unassailable. It is not an opportune moment to introduce controversial matter, and without further entering into a discussion of this point I simply express an opinion that well-selected basts will vindicate a certain position as paper-making materials to the displacement of Esparto which is now so prominently to the fore.

The general conclusion to be drawn is that, with the single exception of the Indian trade in jute, our Colonial commerce in fibres is insignificant, that on the other hand the producing capabilities of the Colonies are enormous, and such commercial disabilities as may have hitherto prevented the development of the trade, would no doubt disappear when seriously assailed.

Whether we view this branch of commerce in the light of statisties only, or from the more comprehensive point of view which I have endeavoured to take up, it cannot be doubted that in the future there will be, from time to time, large alterations in the volume and distribution of this trade. The more important factors of this redistribution will be: (1) the extension of fibre-manufacturing industries in the Colonies: and (2) changes in the aggregate, but still more in the relative consumption of the raw materials.

A.—MISCELLANEOUS VEGETABLE FIBRES.—STATISTICS OF IMPORTATION INTO THE UNITED KINGDOM, YEAR 1885.

FOREIGN COUNTRIES.

	Russia.	Belgium.		Total.
Flax. Dressed fibre and straw	1,884,399	687,498		2,854,064
Flax. Tow and waste	205,452	94,903		338,470
	Italy.	Russia.	Germany.	
Hemp. Dressed or un-dressed	377,124	346,367	312,389	1,046,003
Hemp. Tow and waste	18,524	33,162	42,974	95,858
	Philippine I.	U. S. America.		
* Hemp substitutes	664,565	49,835		778,611
	U. S. America.	Mexico.		
† Unenumerated fibres	51,520	20,420		86,951
	France.	Belgium.		
‡ Jute	1,792	1,177		5,063
	Germany.	Belgium.		
Paper making. Linen and cotton rags	207,909	84,569		460,936
	Tripoli.	Algeria.		
Paper making. Esparto	307,081	418,880		1,149,415
	Norway.	Belgium.		
Paper making. Other materials. Half stuff and wood pulp	277,698	73,903		631,199
			Total	£7,446,570
	Russia.	France.		
Cordage and twine cable yarn	64,548	64,007		188,058
				£7,634,628

BRITISH POSSESSIONS.

	Australia.	East Indies.		Total.
Flax. Dressed fibre and straw	1,734	...		1,734
Flax. Tow and waste	...	29		29
Hemp. Dressed or un-dresssed	—	—		—
Hemp. Tow and waste	—	—		—
	East Indies.	Straits Settlements.		
* Hemp substitutes	71,004	119,969		291,310
	East Indies.	Mauritius.		
† Unenumerated fibres	16,291	6,342		23,370
	East Indies. Bombay.	East Indies. Madras.	East Indies. Bengal.	
‡ Jute	1,285	2,305	3,232,139	3,235,733
	Channel I.	Australasia.		
Paper-making. Linen and cotton rags	4,289	765		5,992
Paper-making. Esparto	—	—		—
	East Indies.			
Paper-making. Other materials. Half stuff and wood pulp	7,579	...		9,271
			Total	£3,577,439
	East Indies.	Ceylon.		
Cordage and twine cable yarn	197,576	63,163		262,334
				£3,839.773

NOTES.—In this table the imports are specified only from the two or three more important countries in which the particular fibre is produced. The totals are the aggregate importation from all foreign countries or British possessions respectively.

The returns from which these statistics are compiled, are complicated by two circumstances—(1) "Trivial" names used to designate certain fibres, *e.g.* the term Hemp applied to Manilla, Sisal, and the like; and (2) "Indirect Importation," *i.e.* returns of trades in fibre with countries other than those in which they are produced. However, these complications, it is easy to see by inspection of the complete returns, do not really obscure the main lines of trade which lie directly with the producing countries.

* Included under Hemp, but the countries whence imported indicate Manilla, Sisal, and the like.

† Described as applicable to same uses as Flax or Hemp.

‡ In addition to the raw fibre there is an importation of yarn to the value of £297,326, of which ⅘ is from France.

B.—Some Statistics of Exports of Paper, Linen, and Cordage to British Possessions in 1885.

	Value in £ sterling. Paper.	Linen.	Cordage.
Bombay ...	83,514	25,888	...
Madras ...	25,381	...	...
Bengal ...	49,444	45,219	...
Straits Settlements ...	...	10,197	...
Ceylon ...	13,254	1,347	...
Hong Kong ...	...	13,271	...
West Australia ...	3,572	3,501	...
South Australia ...	67,414	35,575	11,015
Victoria ...	251,966	160,532	26,196
New South Wales ...	254,500	171,394	27,400
Queensland ...	60,904	53,327	...
Tasmania ...	16,117	4,907	3,107
New Zealand ...	121,013	60,379	14,272
Natal ...	13,244	9,609	4,302
Cape of Good Hope ...	38,887	17,673	...
Mauritius ...	4,323	2,442	...
West Indies ...	13,077	31,758	11,419
British Guiana ...	4,760	8,774	4,998
Canada ...	71,010	124,401	8,179
Newfoundland and Labrador	5,024	5,594	6,493

There is no possibility of forseeing, with the aid of science, the changes and developments of the first order; we can only anticipate the general tendency of progress in the Colonies from the one-sided commerce of early days, when trade is based on raw materials exported and manufactured goods imported, to the all-round activity of later days, which is influenced as much by the more complicated laws of general exchange, as by the special local features which exclusively moulded the earlier commerce.

How this progresive movement will affect the reciprocal relations of Colonies and Mother-Country in regard to this particular trade, I leave to others to determine.

The causes included under (2) are easier of measurement. I have endeavoured to illustrate, as the particular occasion arose, the application of a purely laboratory method to the valuation of a new fibre, this valuation resting upon the ultimate constitution of the fibre as revealed by investigation, on the one hand; and the comparison of this on the other hand, with standards taken from parallel investigation of the fibres which now rule the market. On the basis of this comparison I have shown, for instance, that the "native hemp" from Natal will compete in the flax class; Sida will compete with jute; the West Indian "Gru-Gru," as an exceptionally fine monocotyledonous fibre, is capable of applications of a higher order than is usual with fibres of this class, for which it may even come into competition with hemp. Phormium fibre, I have shown is susceptible of "refinement," by selection and chemical treatment, and when so modified may compete with the dicotyledonous fibres in certain applications. In the paper-making class I have shown the value of certain bast tissues and residues of monocotyledonous plants as raw materials.

In all these cases I have necessarily ignored the first commercial condition, *i.e.*, cost of production having no data at hand upon which it could be estimated. For these we must look to future investigation in the several localities where the raw materials in question have been, and, on a favourable estimate are to be produced.

Given this, and the results of a full laboratory examination of a specimen in a fair condition, and it is not difficult to forecast the probable future of the fibre. It may be objected to this statement that many predictions of commercial success, also based upon methodical investigation, have been falsified by results. The only reply to this is that the method upon which this report is founded is the outcome of recent investigations and a critical examination of antecedent publications on the subject from which whatever appeared valuable has been selected and retained. Like all others, it must be judged by its fruits. If it is to justify itself, it must condemn the unprofitable as it must assign a place in commerce to the useful.

In conclusion, I have the pleasure to acknowledge the substantial help of those who have been associated with me in the work of investigation: my partner Mr. E. J. Bevan; Mr. C. M. King who has done the whole of the microscopic preparations; and Mr. C. Beadle (of Messrs. Joynson), who has done the greater part of the chemical analyses. This report is, in fact, the product of our joint labours.

I have also to thank Dr. Watt of the Indian Section, Mr. McCarthy of the West Indian Section, and Mr. P. L. Simmonds of the New Zealand Section, in addition to those gentlemen whose names have been previously mentioned for many suggestions and much kind assistance.

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THE ONION IN JAMAICA.

Climate and soil vary so much in Jamaica, and the island is so favourably situated for supplying the fruit and vegetable markets of Canada and the Northern United States in winter and spring, that every district could doubtless produce some paying crop.

The Onion is the staple product of Bermuda, and His Excellency Sir H. A. Blake has directed that it shall be tried in Jamaica.

In Bermuda the seed is imported every year from the Canary Islands, and a supply is expected immediately for the Botanical Department from Messrs. Hamilton & Co. of Teneriffe, obtained through the medium of J. Hutton Dupuis, Esq., late H. B. M. Consul at that port. Some of the seeds will be sown in the Gardens at Hope, Castleton and Cinchona, and small amounts will be distributed at cost price to those who wish to try it in various districts and at different elevations. Excellent onions have already been grown in St. Ann, by Mr. J. C. Stephens at Radnor in the Blue Mountains, and by Mr. Palache, near Mandeville.

There are two varieties grown in the Canary Islands, the white and the red. The white Onion ripens sooner than the red, and therefore commands a better price. But as the white variety tends to lose its character and become red, except in the Island of Palma, the seed is obtained only from there, and is more than double the price of the red.

Mr Peter Henderson, Seed Merchant, New York, estimates the profit per acre as follows :—

"The average product of the Onion crop varies very much, ranging from 300 to 900 bushels per acre, the mean being about 600 bushels per acre. The price is variable like all perishable commodities, ranging from fifty cents per bushel, the price at which they usually wholesale in the New York market in fall, to $1 or $1.50 per bushel for winter and spring prices. The estimate, then, of profit per acre may be given about as follows :—

Manure per acre	$ 72.00
Ploughing, weeding, and harvesting crop, per acre ...	100.00
6lbs. Seed, average $2 per lb.	12.00
Rent or interest on land, per acre ...	9.00
Marketing crop, per acre	7.00
	$200.00
600 bushels per acre, at 50c.	$300.00
Cost	200.00
Profit	$100.00

This estimate is a moderate one; for if the crop is sold in spring, the chances are that the profit may be two or three times as much."

Sir F. von Mueller, Government Botanist of Victoria, thus speaks of its successful culture in Australia :—" The Onion, is a native of Turkestan, succeeds even in equatorial countries, maturing seed, fit to germinate, in the hottest desert-regions of Central Australia. As much as 20 tons of Onions have been harvested from an acre of land in the Bellarine district of Port Phillip. The import into the United Kingdom in 1884 represented £552,000. The export from Victoria during 1887 came to 6,036 tons, valued at £33,482."

The following notes may possibly be some guide to those who think of growing Onions :—

Soil.—A well drained soil is necessary; it should be light rather than heavy, though the latter is more suitable when the climate is very dry. A rich loam is the best soil, and the ground should be as level as possible. so that the Onions shall not be washed out by rains.

Rotation of Crops.—Onions should not be grown in the same spot for two successive years, but alternated with some other crop, such as corn or potatoes.

Manure.—Well rotted stable manure is better than any artificial manure, the sweepings of poultry and pigeon houses, and bat-manure are very useful; night soil well mixed with dry earth, or lime, or ashes, may be used with greater advantage. It should be dug or ploughed in 5 or 6 inches deep before sowing. It is an excellent plan to collect weeds and bush into a heap, burn them and scatter the ashes over the soil before digging or ploughing.

Preparation of Ground.—Whatever the nature of the soil, it is indispensable that it should be broken up fine. The ground must be dug over with a fork or spade, and then the surface made as smooth and level as possible by raking. It may be rolled, as Onions form best bulbs in firm ground. For cultivation on a large scale, it will be necessary to plough and harrow. After harrowing, it is recommended by Peter Henderson that the surface should be further levelled with some kind of "smoothing harrow" such as Meeker's Smoothing Disc Harrow, in which the revolving discs pulverise the soil to a depth of three inches much better than it can be done by raking, and the smoothing board which follows in the wake of the revolving wheels, makes the surface, if free from stones, smooth as a board, and far better than it can be done by raking.

Sowing the Seed.—In the Canary Islands, the seed is sown broadcast in October, and the seedlings transplanted in December during light rains, but transplanting weakens the plants for a time, and if there is dry weather, it is almost fatal. It is much better to sow by means of a drill, and afterwards thin out. In sowing the first row, a line should be stretched. The distance between the rows varies, but 12 inches is recommended. Every ninth row may be omitted to form a pathway. The seeds are sown thinly, and lightly covered by raking. About 8lbs. of seed may be used to the acre.

Cultivating.—Deep hoeing is not advisable, as the ground must be kept solid, but when the lines of young seedlings first make their appearance, a hand cultivator may be applied between the rows. Weeding and thinning should be done by hand. The distance between the Onions in the rows is from 4 to 6 inches. When the thinning and weeding is done, the *surface* should be thoroughly broken up by using a wooden rake *across* the rows.

Harvesting takes place in the Canary Islands during April and May. When the bulbs have attained their full size, the leaves are bent down at the neck of the bulb by the back of a wooden rake. This checks the flow of the sap, and causes the leaves to decay, and the bulbs to ripen more quickly. When the leaves wither, the Onions are taken up, and left lying for 3 or 4 days to dry in the sun with occasional turning over; they are then strung into ropes for sale.

FERNS: INTRODUCTORY NOTES.

On the terms used in describing Ferns.

Ferns are flowerless plants, bearing leaves (*fronds*), which before expansion are spirally coiled inward (*circinate*) and produce the fructification on the under surface or on the edges.

The fructification consists of microscopic seed-like bodies (*spores*), which are contained in great numbers in the spore-cases (*sporangia*).

The spore-cases are grouped in dots, lines, or masses; the groups are known as *sori*, and are sometimes provided with a special covering (*involucre*), and borne on a special *receptacle*.

The leaf is *simple*, when it consists of one piece, however much it may be cut. It is *compound*, when the cuts extend to the leaf-stalk, so that there are two or more separate pieces or leaflets (*pinnæ*). The leaf-stalk between the pinnæ is called the *rachis*. When the pinnæ are simple, and arranged along both sides of the rachis, the leaf is *pinnate*.

The leaf is said to be twice-pinnately-divided, when the leaflets *(pinnæ)* are themselves composed of secondary leaflets *(pinnules)*, and thrice-pinnately-divided, when the secondary leaflets are compound. When there is further division, or when the degree of division is variable, the leaf is said to be *decompound*.

Similarly, a simple leaf may be twice or thrice-pinnately-*parted*; the divisions being distinguished from pinnæ as *segments*.

The spores are sometimes only borne on special leaves, which are called the *fertile* leaves, the others being *barren*.

The spore-cases are provided generally with a *ring*, which passes round them in various definite directions, vertically, horizontally, obliquely, or is placed like a crown at one end.

FERNS: SYNOPTICAL LIST.

*Synoptical List, with description, of the Ferns and Fern-allies of Jamaica, by G. S. Jenman, Superintendent of the Botanic Gardens, Demerara.**

Spores of one kind—Microspores.

Order I. Filices—(numerous genera).
Order II. Equisetaceae. Equisetum.
Order III. Lycopodiaceae. Lycopodium.
Selaginella.
Psilotum.

Order I. Filices, Fern Family.

Fronds circinate (i. e., coiled like a watch-spring) in early growth, rarely straight; spore-cases of one kind, with or without a jointed ring, variously grouped on the back or edges of normal or contracted fronds.

Sub-Order I. Polypodiaceae. Fronds circinate; spore-cases free, with a complete, incomplete or rudimentary, medial, oblique, or coronal, jointed ring.

Series I. Involucratæ.—Sori subtended by involucres, except in Alsophila and Notholæna.

* A. Spore-cases orbicular or pear-shaped without stalks or only shortly stalked, ring medial, incomplete, vertical or obliquely vertical.

I. Spore-cases orbicular, without stalks, ring obliquely vertical.

Tribe I. Hymenophylleæ (Filmy-Ferns). Sori globose or columnar, on hair-like protruded marginal receptacles, and enclosed in valvate or urn-shaped involucres.

Genus I. Hymenophyllum.

Involucres bi-valved (like pairs of oyster shells).

a. Margins of fronds, and lips of the involucres spiny-toothed.

1. *H. Tunbridgense*, Smith.
2. *H. fucoides*, Sw.
3. *H. Houstonii*, Jenm.

* I have not given localities, except of rare or uncommon species. The altitudinal range is supplied from my own observation (chiefly in the eastern parishes, but extending also through the central parishes of St. Elizabeth) while residing in Jamaica during the six years, 1873–9. The descriptions and remarks have been made as short as seemed consistent with not sacrificing the object in view, viz., the identification of the species. References to works where the plants are described or figured, synonomy (except in necessary instances), general geographical distribution, collectors, and much else of interest I have omitted, to keep the matter within the limits necessary to the means of publication.
G. S. J.

Abbreviations:—ft.—foot; li.—line; (1-12th inch); w.—wide; br.—broad; l.—long; alt.—altitude.

aa. Margins plain, not spiny-toothed.
b. Fronds without hairs.
c. Fronds lobed or pinnately parted, segments simple, forked, or lobed
4. *H. abruptum*, Hook.
5. *H. asplenioides*, Sw.

cc. Fronds decompound.
d. Segments flat.
6. *H. paucicarpum*, Jenm. (n. sp.)
7. *H. polyanthos*, Sw.
8. *H. protrusum*, Hook.

dd. Segments undulate or crispate.
9. *H. clavatum*, Sw.
10. *H. undulatum*, Sw.
11. *H. axillare*, Sw.
12. *H. crispum*, H.B.K.

bb. Fronds hairy.
c. Fronds with margins nearly parallel.
d. Rachis winged.
13. *H. lanatum*, Fée
14. *H. hirsutum*, Sw.
15. *H. elegantissimum*, Fée.

dd. Rachis free or only winged at the top.
16. *H antillense*, Jenm.
17. *H. lineare*, Sw.
18. *H. sericeum*, Sw.

cc. Fronds oblong or lance-shaped.
d. Rachis winged throughout.
19. *H. ciliatum*, Sw.
20. *H. Boryanum*, Willd.
21. *H. microcarpum*, Desv.

dd. Rachis free at the base.
22. *H. hirtellum*, Sw.
23. *H. Catherinæ*, Hook.

1. *H. Tunbridgense*, Smith.

Fronds narrow with margins more or less parellel, tapering outwards, $1\frac{1}{2}$—3 in. l., $\frac{1}{4}$—$\frac{1}{2}$ in. w,,* twice or thrice-pinnately divided, rachis winged, lower pinnæ distant with the divisions single or forked, $\frac{1}{6}$—$\frac{1}{4}$ li. w., the margins inconspicuously toothed;
sori small, shortly stalked, inserted just above the pinnæ;
involucres ovate, deeply cleft, the lips indistinctly toothed.
In forests at 5,000 to 7,000 feet alt. on branches, decaying logs, &c., forming large patches.
It has a metalic hue in growth, and the texture though delicate is firm and wiry, as in *Catherinæ*.
It is of interest as being a British and very widely spread species.

2. *H. fucoides*, Sw.

Fronds oblong, tapering outwards, twice or thrice pinnately divided, 3—7 in. l., $\frac{3}{4}$—$1\frac{1}{2}$ in. w., rachis winged; pinnæ deeply divided, the segments simple or forked, $\frac{1}{2}$–1 li. w., 2–4 li. l., slightly hairy on rachis and ribs, margins toothed;
sori along each side of the rachis, 1 or 2 on the upper base of each pinna;
involucres variable in shape, lips toothed or occasionally plain.
Frequent in damp forests, near streams, at 5,000–6,000 ft. alt. and very variable.

3. *H. Houstonii*, Jenm.

Fronds 4—6 in. l. $1\frac{1}{2}$—2 in. w., thrice pinnately divided, rachis winged, pinnæ 1–$1\frac{1}{4}$ in. l $\frac{1}{2}$ in. br., cut into divisions forked 1 to 3 times, final divisions $\frac{1}{2}$ li. br. 1—2 li. l., margins toothed and slightly crisped.
Collected only by Sloane, among whose plants it is in the British Museum, p. 140.

4. *H. abruptum*, Hook.

Fronds 1—2 in. l. $\frac{1}{4}$—$\frac{3}{4}$ in. w., pinnately divided, rachis winged, pale yellowish green, pinnæ simple or casually forked, blunt, 1 li w.
sori large, 1– 3, confined to the top of the abruptly terminated fronds; involucres partly immersed, lips rounded, receptacles protruding.
Frequent on decaying logs, &c., in forests and coffee plantations at 2,000–3,000 ft. alt.
Marked by short, simply divided, pale fronds, and few large terminal sori.

5. *H. asplenioides*, Sw.

Fronds pendent, tapering, finger-shaped, or sometimes oblong, 2—6 in. l. $\frac{1}{2}$—1 in. br., lobed, or pinnately divided with a broadly winged rachis, primary divisions again lobed, becoming simple in the upper part of the frond, final lobes 1 li. w. and deep, and mostly bearing the sori at the end;
involucres rather compressed, nearly orbicular, attached by the full width of the base, lips rounded, quite plain, enclosing the small sori at the base.
Common above 4,000 ft. alt. on tree trunks, forming large and very beautiful patches.

6. *H. paucicarpum*, Jenm. (nov. sp.)

Fronds $\frac{1}{2}$—3 in. l., $\frac{1}{4}$ – 1 in. w. terminating abruptly, thrice-pinnately-divided, rachis winged, pinnæ crowded and overlapping, or in other cases more or less open, final divisions $\frac{1}{4}$ li. w.

* Throughout this genus the blade only of the frond, excluding the stalk, is referred to in the length given.

involucres large, few or several, confined to the top of the frond, receptacles often slightly inserted.

In forests, 2,000—6,000 ft. alt., on logs, trees, &c.

There are two forms or varieties,—one, small with densely crowded divisions, the other much larger and lax in habit. In leaf and cutting it resembles small forms of *polyanthos*, and in fruit *abruptum*. In some cases the sori are so crowded that they occur to form a double row across the truncated top of the frond.

7. *H. polyanthos*, Swartz.

Fronds 2—6 in. l., 1—2 in. w., variously shaped, pendent or somewhat erect, thrice or four times pinnately divided, rachis winged; pinnæ $\frac{3}{4}$—2 in. l., $\frac{1}{4}$—$\frac{1}{2}$ in. br., final divisions $\frac{1}{3}$—$\frac{1}{2}$ li. w., 1-2 li. l.;

sori numerous;

involucres spherical or ovate, flat or convex, usually rather wider than the leaf-divisions, the lips rounded or acute.

Most abundant from 1,500 ft. alt. up to the highest peaks.

Very variable. In the typical form, the fronds are weak and pendent, of varying form, with flat, nearly circular involucres; in variety *H. sanguinolentum*, Swartz, which is equally common, they are stiffer, erect or curved, broadest at the base and uniformly tapering upwards to a long point, the sori numerous in the upper half or third of the frond, the involucres ovate and acute, the valves convex.

8. *H. protrusum*, Hook.

Fronds pendent, 3—6 in. l., 1—2 in. w., oblong shaped, thrice or four times pinnately-divided, rachis winged; pinnæ $\frac{3}{4}$—$2\frac{1}{2}$ in. l., $\frac{1}{3}$—$\frac{2}{3}$ in. w. final division $\frac{1}{4}$—$\frac{1}{2}$ li. w., colour tan-green;

sori numerous in the upper half of the frond;

involucres longer than broad, hardly wider than the leaf division, the lips generally open, receptacles in part exserted, often considerably.

Infrequent in the same situation and over the same range as the preceding species, which it resembles in leaf and cutting, presenting a parallel series of forms, differing in colour, and specially marked by the protruding hair-like receptacles.

9. *H. clavatum*, Swartz.

Fronds somewhat erect, thrice or four times pinnately divided, lance-shaped, tapering to a long point, 3—7 in. l., $\frac{3}{4}$—$1\frac{1}{2}$ or 2 in. w., rachis winged, pinnæ spreading, often nearly horizontally, $\frac{1}{2}$—1 in. l., $\frac{1}{4}$—$\frac{1}{2}$ in. w., tapering outwards; final divisions $\frac{1}{4}$—$\frac{1}{2}$ li. w., generally with wavy margins;

sori nearly spherical, stalked, situated on the lower contracted lobes of the pinnules, few or numerous, generally confined to the upper half of the frond, lips of the involucres open, rounded.

Common in forests, &c. at 5,000 ft. alt. and upwards.

Easily distinguished by the spherical, shortly stalked and often reflexed sori, which suggested the name *clavatum*. In some cases the sori are so numerous as to quite cover the under side of the frond. *H. sphærocarpum*, V.D.B. and *H. myriocarpum*, Hook. represent forms of varying habit of the same species.

10. *H. undulatum*, Swartz.

Fronds oblong, little if any reduced at the base, 2—4 in. l., $\frac{1}{2}$—$\frac{3}{4}$ in w., thrice or four times pinnately divided, rachis winged pinnæ nearly horizontal but the outer part generally up-curved, close and overlapping, $\frac{1}{4}$ in. w., $\frac{1}{2}$ in. or less l. all the parts crowded, final divisions, $\frac{1}{2}$ l. w. or less, with wavy crispy margins, the wings of the rachis narrow and wavy;

sori spherical, numerous, shortly stalked;

involucres open, cleft to the base, lips rounded.

Collected only by Swartz. From its character probably found at a high altitude.

It is smaller, but otherwise resembles the denser states of *clavatum* from which it is very doubtfully distinct.

11. *H. axillare*, Swartz.

Fronds pendent, weak, narrow with margins nearly parallel, 3—9 in. l., $\frac{1}{2}$—$\frac{3}{4}$ in. w., thrice-pinnately divided, rachis winged, pinnæ crowded $\frac{1}{4}$—$\frac{1}{2}$ in. l. (sometimes irregularly extended to much more), 2—4 li. w., final division $\frac{1}{4}$ li. w., apex blunt, margins of fronds and wings of rachis wavy or crispy;

sori very small, numerous, spherical or compressed;

involucres as wide as the leaf-divisions, closed or open.

Very abundant on rocks and banks in forests and by waysides about 5,000 ft. alt.

The long narrow pendent weakly fronds, and abundant, very small sori, well mark this species. *H apicale*, V.D.B. is a form of the same.

12. *H. crispum*, H.B.K.

Fronds pendent, narrow with margins nearly parallel, 2—6 in. l., $\frac{1}{2}$—$\frac{3}{4}$ in. w., thrice-pinnately divided, rachis winged, of a bright yellowish-gold colour; pinnæ $\frac{1}{4}$—$\frac{3}{4}$ in. l. (occasionally more by irregular extension), 2—4 li. w., close or crowded, final divisions $\frac{1}{4}$ li. w., margins very crispy;

sori small, generally numerous spherical, occupying most of the divisions;

involucres with lips rounded and crispy.

Frequent in coffee plantations and forests above 2,000 ft. alt., growing on logs.

It is so densely crispy that the margins appear as if toothed, by which character and its yellow colour it is easily distinguished.

13. *H. lanatum*, Fée.

Fronds pendent, soft and thin, narrow with margins nearly parallel, $\frac{1}{2}$—$2\frac{1}{2}$ in. l., $\frac{1}{4}$—$\frac{1}{2}$ in. w., uniform in width or tapering upwards, apex blunt, base wedge-shaped, regularly pinnately-divided, rachis winged, divisions simple, but an odd one casually forked, 2—4 li. l., $\frac{1}{2}$—1 li. w., greyish in colour, with hairs arranged more or less in groups;

sori terminal on the upper divisions, rarely on all;

involucres nearly spherical, base immersed, valves rounded and densely margined with grouped hairs.

Frequent in forests, and on wayside banks, above 5,000 ft. alt.

Distinguished from the rest by its smaller size, and the uniformly simple division of the fronds.

14. *H. hirsutum*, Swartz.

Fronds pendent, pale or dark grey, covered with hairs arranged more or less in groups, soft and thin, narrow with margins more or less parallel, tapering upwards, apex blunt, 3—5 in. l., ¼—1 in. w., twice-pinnately-divided, rachis winged, pinnæ somewhat fan-shaped and divided, base wedge-shaped, divisions fertile at the ends, less than 1 li. w.;

involucres rounded, base immersed, covered with hairs arranged in groups.

Abundant, forming larger patches above 4,000 ft. alt.

The fronds vary in cutting, but typically the pinnæ are triangular in outline.

H. latifrons, Fée, is a broad state, in which the lower part of the frond especially is suspended.

15. *H. elegantissimum*, Fée.

Fronds lax, soft, pendent, of a uniform width to near the apex, thrice-pinnately-divided, 3—7 in. l., ½—1 in. w., dark brown, thin, with a few hairs or none, margins wavy or crispy; pinnæ apart, often distant, ¼—½ in. l., ¼ w., each comprising 3—6 narrow diverging divisions which are ½—1 li. w., 2—6 li. l., with blunt apex, the same width as the winged rachis;

sori small, variable in quantity, terminal on the divisions;

involucres circular, attached by the full width of the base, lips rounded, hairy.

Common, forming large patches on trunks of trees at 5,000 ft. alt.

The very lax habit, and wavy crispy margins clearly mark this species.

16. *H. antillense*, Jenm.

Fronds soft, pendent, greyish, covered with hairs arranged more or less in groups, twice pinnately-divided, 3—8 in. l., ½—¾ in. w. at the base, thence tapering gradually to the apex which is 2—3 li. w., rachis margined inconspicuously above, the lower part quite free, pinnæ variable, the upper ones composed each of 2–4 divisions, the lower with few or several lobes on each side, which are 1–3 li. l., ½ li. w., blunt;

sori small, terminal, occupying the majority of the lobes;

involucres immersed at the base, lips rounded and densely covered with grouped hairs. (*H. lineare*, var. *antillense* Jenn., Journal of Botany, 1879, p. 258.)

Infrequently in large masses on trees of the highest ridges, 7,000 ft. alt.

It is exactly intermediate in character between *hirsutum* and *lineare*, marked from the former by the rachis being few in the lower part, and from the latter by its being winged in the upper part. It has also been found on the slopes of Mt. Roraima, British Guiana.

17. *H. lineare*, Swartz.

Fronds pendent, soft and very delicate of texture, twice or thrice-pinnately-divided, pale or rusty-gray, covered with grouped hairs, 3—6 in. l. ¼—¾ in. w. (sometimes much more by the frond-like extension of the pinnæ), usually of nearly a uniform width to the top, the hair-like flexuose rachis free throughout, pinnæ variable, near or distant, composed of 2 or 3 diverging divisions, 2—6 li. w., divisions 1—3 li. l., ½ li. w.;

sori terminal, few or plentiful;

involucres broader than deep, the base immersed, lips rounded densely covered with tawny hairs.

Very common on trees in matted, tangled masses, above 5,000 ft. alt.

The fronds appear to extend indefinitely, the older pinnæ dying and dropping away, leaving the naked, hair-like rachises. Pulled from the tree, it seems a mass of tangled hair.

18. *H sericeum*, Swartz.

Fronds pendent, flaccid, 6—18 in. l., 1—1½ in. w., about the same width throughout, the surface striped, tawny-gray, and densely covered with woolly hairs, pinnate below, the rachis winged upwards, pinnæ very numerous, close, ¾—1½ in. l., ¼ in. w., mostly somewhat curved and tapering to an acute or blunt point, the margins cut, the segments ½—1 li. w., simple or the basal ones united, veins pinnate, forked or simple, oblique;

sori small, mostly confined to the outer segments;

involucres roundish, immersed over half their depth, lips rounded and very densely covered with hairs.

Common in the mid-region of the great mountain ranges in forests, coffee plantations, and by sheltered waysides, growing from the sides or undersides of branches, sometimes reaching to 2 ft. l., the older pinnæ being dead, and partly dropped away as in *lineare*.

19. *H. ciliatum*, Swartz.

Fronds oblong or oblong-lance-shaped, tapering to a fine or to a blunt point, twice pinnately-parted, dark-brown, covered with hairs especially on the margins, 1½—3½ in. l., ½—¾ in. w, the rachis broadly winged, pinnæ close or near, regularly pinnately-parted, ⅓—½ in. l., ¾ in. w., the incised end obtuse or rounded, segments 3—5 to a side at an acute angle, the free part 1—2 li. l., ½—1 li. w., obtuse;

sori terminal, usually confined to the upper half of the frond;

involucres spherical, rather large, attached by the breadth of the base, the lips densely covered with hairs.

Generally distributed above 2,000 ft. alt., growing on mossy logs, rocks, &c., in moist forests.

It differs from the species most nearly allied to it by being more hairy, with smaller fronds, and larger involucres.

The variety *crispatum*, Baker, has wavy margins.

20. *H. Boryanum*, Willd.

Fronds oblong or ovate-lanceolate, twice or thrice-pinnately parted, dark-brown, covered with soft, rusty-coloured hairs, $2\frac{1}{2}$–4 in. l., $1\frac{1}{4}$–2 in. w., rachis winged, pinnæ close or somewhat distant, $\frac{1}{2}$–1 in. l., 4–6 li., w., oblong, deeply pinnately-parted, the inner divisions being again twice or thrice cut, final segment narrow, 2–3 li. l., $\frac{1}{3}$–$\frac{1}{2}$ li. w., blunt;

sori small, terminal on the lateral divisions of the upper segments;

involucres ovate-oblong, the base shortly immersed, lips rounded, hairy. (*H. gratum*, Fèe, Fil, Ant., t. 30, fig 2.)

Infrequent in forests of the eastern parishes at 2,000 ft. alt. and upwards.

Intermediate in size and general character between *ciliatum* and *hirtellum*. The involucres are so thin as often to appear reticulated from the pressure of the sporangia within.

21. *H. microcarpum*, Desv.

Fronds ovate lance-shaped, broadest at the base, tapering to a long point, thin and elastic, dark, more or less hairy or without hair, 3–7 in. l., $1\frac{1}{2}$–$3\frac{1}{2}$ in. w., thrice or four times pinnately-parted, rachis winged, segments close, oblong-lance-shaped, tapering to a long point, the base expanded on the upper and cut away on the under side, 1–$2\frac{1}{2}$ in. l., $\frac{1}{2}$–$\frac{3}{4}$ in. w., divisions close, oblong, deeply cut into several, close, narrow lobes which are 1–2 li. l., $\frac{1}{4}$–$\frac{1}{2}$ li. w.;

sori very small, terminal on the lobes of the outer part or of all the segments;

involucres small, ovate, broader than the constricted end of the leaf-segment, lips pointed or acute, base wedge-shaped, not hairy.

Frequent on rocks, banks, &c., between 3,000 and 6,000 ft. alt.

The size and surface of the frond vary a good deal, and the largest and least clothed plants seem to grow at the higher elevations.

22. *H. hirtellum*, Swartz.

Fronds ovate, tapering to a long point, dark, and covered with rusty-coloured grouped hairs 3–6 in. l., $1\frac{1}{2}$–3 in. w., thrice or four times pinnately divided, rachis winged upwards, free below, pinnæ close, lance-shaped, mostly with tapering points. 1–2 in. l., $\frac{1}{2}$–$\frac{3}{4}$ in. w., twice-pinnately-divided, divisions ovate-oblong, 4–6 li. l., 2–3 li. w., without stalk and adherent at the base to the rachis, deeply pinnately-divided, ultimate divisions narrow, close, 3–5 to a side, $\frac{1}{4}$–$\frac{1}{2}$ li. w., the free part 1–2 li. l.;

sori terminal, spherical;

involucres nearely spherical, immersed about half their depth, covered densely with woolly, grouped hairs.

Common, chiefly in the middle altitudes, from 1,000 ft. upwards, in forests and wayside banks.

The spherical involucres, usually dense hairiness, and absence of membrane to the base of the rachis distinguish it from *microcarpum*.

23. *H. Catherinæ*, Hook.

Fronds stiff and wiry, very thinly membranous, hairs in sparse groups, dark, $1\frac{1}{2}$ – 3 in. l., $\frac{1}{2}$ – 1 in. w., oblong-lance-shaped, thrice pinnately divided, rachis very narrowly margined in the upper part, pinnæ spreading $\frac{1}{2}$ – $\frac{3}{4}$ in. l., $\frac{1}{2}$ in. w., without stalks, close, pinnately divided or twice-pinnately-divided, oblong or ovate, the divisions simple, forked. or pinnately divided, final divisions very narrow $\frac{1}{6}$ $\frac{1}{4}$ li. w., 1 – 2 li. l., lax;

sori minute, terminal on the lobes of the upper half of the frond, few or many;

involucres conspicuously wider than the leaf-segment, lips hairy, open, often much exceeding the sori, and wavy.

Common on trees in forests above 4,000 ft. alt.

Though exceedingly slender in all its parts and much divided, this is the most wiry and stiffest species of all. The valves of the involucres often gape considerably, occasionally turning quite down from the sori within.

(*To be continued.*)

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CONTENTS:

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JAMAICA:
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1890.

SUGAR CANE SEEDLINGS.

The attention of Proprietors and Overseers of Sugar Estates is directed to the subject of seedling canes. It is probable that we shall be able to obtain improved varieties from seedlings by careful selection of those which give the best results in weight of cane and in juice.

Mr. Jenman, Superintendent of the Botanic Gardens, Demerara, has given a full account in his last Report of his success in growing seedlings. The following notes, gathered from the Report, may prove of use to those who intend to undertake the improvement of their canes.

The arrow produces an exceedingly small number of ripe seeds, and these are so minute and so tightly attached to the chaff that they have escaped notice until lately when the fact that the seed has produced mature sugar canes has been demonstrated by Messrs. Harrison and Bovell at Barbados.

The seeds are ripe when the arrow begins to break up. In those varieties in which the arrow does not protrude much beyond the sheath, the breaking up takes place immediately after they appear; in other varieties in which the arrow pushes well up out of the sheath, it may last 5 or 6 weeks before ripening. As soon as the arrow begins to break up, it should be gathered, and rubbed so that all the chaff comes off. As it is impossible to separate the seed, the whole must be sown, and that immediately, or the seed will lose its power of germinating. It is necessary to sow in boxes with only a slight sprinkling of soil over the chaff. In fact it is almost better not to cover with any soil, if provision can be made for preventing the chaff blowing away, for the seedlings can push their roots down into the soil, but can not force their tender leaves up through it. The seed boxes should be protected from heavy rains by being placed under cover. In 4 or 5 days the seed germinates, and those that survive grow only 2 or 3 inches for the first 3 months; then they spring up quickly, and can be planted out in another 2 or 3 months time.

The following paragraphs by Mr. Jenman which appeared in the "Demerara Argosy" are interesting as being a notice of the first mature seedling cane:—

"The oldest of our seedling canes, the plant which I have mentioned before in these columns as having been received when only two or three inches high from Mr. Bovell, Dodd's Botanical Station, Barbados, last April twelve-months, and which was planted out when two feet high, four months later, has now grown to a massive plant, and it occurred to me lately that I might have it analyzed, to compare the composition now with that at the end of the year when the plant will be mature, and I hope, will also have flowered. The stool contains at present about a dozen canes which are 15 or 16 feet high, and more than as many more younger ones of various heights, coming on, and which will mature before the end of the year. That cut for analysis was the original first shoot, and therefore the oldest on the stool, though it was not the largest. The variety is quite distinct from any other known to me, but its affinity is obviously with the Selangore and Elephant group, between which two canes mentioned, in fact, it is nearly intermediate in general character, partaking rather more perhaps of the Selangore. This alliance, shown by general external characters, was confirmed by the results of the chemical analysis. It tillers plentifully, and the growth is quite erect. The color of the canes is pruinose while they are young, but this tint disappears with age, and the color passes to a white-green, blotched here and there where sun exposed with pink or carmine, and with a soiled suffusion immediately below the nodes. In wet weather the nodes produce a fringe of roots, which, from the pressure of the sheath of the leaf of the next lower node, grow straight down the cane, not extending however in length much beyond the next node These roots are strong and fresh and healthy while enclosed by the leaf sheath, but they gradually dry up and perish in dry weather after the leaf embracing them drops away. The foliage is heavier than in most other varieties, and as a rule drops readily while still green, aided, however, in this by the pressure of the node-roots. The buds are prominent, and disposed to vegetate where borers have injured the cane. Like those of the Elephant, the canes are often hollow between the nodes. The single cane cut for analysis was six inches in girth and 17½ feet long over the foliage, about half of which length was matured cane. Cane and foliage together weighed 11½ lbs., the cane alone being 8½ lbs. of the total weight. The leaves were 6½–7 feet long and four inches wide. Allowing for the tapering at the top, each leaf contained 288 square inches of surface=two square feet. There were 16 leaves on the cane when it was cut, six of which, removed from the stalk, weighed 1lb. There were also 56 nodes from which the leaves had dropped, thus making 72 leaves in all to the cane, weighing 12 lbs., possessing a superficial area of 144 square feet. Most of the other canes on the stool either are, or promise to be larger than the one cut for analysis, but taking the data which the examination of that has yielded, in the autumn, when the stool is mature, the 25 ripe canes which it will then bear will have produced in the course of their growth 1,800 leaves, weighing 300 lbs., covering a superficial area of 3,600 square feet; and 212½ lbs. of grinding canes, or with the foliage and tops on, 287½ lbs. Including the weight of the leaves that had dropped the gross yield in weight would be 520 lbs. An acre planted eight feet by eight feet would contain 681 plants, from which the yield would be on the above basis 17,025 canes, 1,225,800 leaves, weighing 204,300 lbs., covering a superficial area of 2,451,600 square feet, and 144,712½ lbs. of grinding cane; or with the foliage and tops on, of 195,787½ lbs., or including the foliage dropped, a gross yield of 354,120 lbs. In tons the yield would be: of grinding cane, 64 tons 12 cwt. 8 lbs., and the gross yield in weight, including foliage 158 tons 1 cwt. 88lbs. This is about double the average yield of ordinary canes, but the weight of grinding cane per acre has been exceeded here by several of the older varieties, such as (taking the names as they are used though some of them are synonyms) the Bourbon, Caledonian Queen, Mani, Lahaina, Cuban, etc. and several others have come nearly up to it.

The following is Mr. Harrison's very complete and highly interesting analysis of this cane:—

Government Laboratory, May 29th, 1890.

Result of the Examination of a Seedling Sugar Cane grown at the Botanical Gardens.

Actual length of Cane	... ...	17 feet 5 in.
Length of Cane proper	... ...	9 feet.
Actual weight	... ...	11 lbs. 7¾ ozs.
Weight of Cane proper	... ...	8 " 6 "
Number of joints in Cane	... ...	56
Average length on one joint	... ...	1·9 inches.

Composition of the Juice extracted from the Cane.

	Cane, ripe joints.	Cane, white upper joints.	Whole Cane as sent.	Cane Top.	Leaves.
Percentage extracted ...	64· 3	73· 6	66· 1	61· 5	12· 6
Specific gravity ...	10·57	10·35	10·53	10·26	10·21
Water ...	86·00	91·20	86·91	93·30	94·60
Sucrose ...	12·55	5·13	11·25	1·49	·51
Glucose ...	·38	2·74	·79	3·04	1·30
Ash ...	·43	·39	·42	·60	1·48
Organic matter ...	·64	·54	·63	1·57	2·31
	100·00	100·00	100·00	100·00	100·00
Coefficient of Purity ...	89·64	58·29	85·94	22·24	5·74
Glucose per 100 of Sucrose	3·03	53·41	8·02	240·27	419·35

The yield of sugar would be about four tons per acre, but the Bourbon cane, yielding the same of cane would give from five or six tons per acre."

Very many thousands of canes will have to be tested in this way in order to guide in the proper selection of varieties, if any improvement is to be secured.

THE GOLDEN WATTLE.

The bark of the Wattle Trees of Australia is a valuable tanning material. There is a large number of species, varying in the percentage of tannic acid contained in their bark, and varying also in their suitability for different soils and climates.

In Jamaica the probability is that all good soil, where other conditions are favourable, will in the near future be devoted to the cultivation of fruits and vegetables, together with sugar and coffee. But no opportunity should be lost of testing the capabilities of even our worst soils and our dryest situations The Sisal Hemp plant is now in process of trial, but as it requires machinery for the extraction of the fibre, it is quite possible that this fact may deter some from entering upon the cultivation. To these, the "Golden Wattle" Tree may be commended, for while the cultivation is of an equally simple nature with that of the Sisal Plant, no machinery is required.

Seeds have just been received from Kew of the "Golden Wattle" of South Australia and Victoria (Acacia pycnantha.) Mr. Morris in forwarding the seeds remarks that this tree "seems to afford the richest tanning bark known. It contains sometimes even more than 40 per cent. of tannic acid."

The seed was sent to the Director of the Royal Gardens, Kew, by Mr. J. H. Maiden, Curator of the Technological Museum, Sydney, who writes as follows :—"The seed is remarkably fine, owing to the good season, is quite fresh, and has been gathered from selected, thick-barked trees. As you are quite aware, this Acacia yields the richest tan bark in the world, and is eagerly sought after. I beg to refer you for full particulars, to my pamphlet "Wattle and Wattle-barks." In Australia this Acacia flourishes best in warm dry situations, with rainfall not much exceeding 20 inches. The tree flourishes in the poorest soil." The pamphlet mentioned is "the practical outcome of many years of research and observation" on the subject by Mr. Maiden. It has been prepared, at the request of the Department of Public Instruction, New South Wales. The following extracts are taken from this valuable pamphlet, which can be purchased from the Department, Sydney. A small quantity of seed can be obtained for trial on application to the Director of Public Gardens and Plantations, and further supplies can be forwarded from Australia.

WATTLES AND WATTLE-BARKS.

Extracts from a Pamphlet, by J. H. Maiden, F.L.S., F.C.S., *&c., Curator of the Technological Museum, Sydney.*

Demand and Supply.

As regards the importance of a supply of wattle-bark to European manufacturers, and the remote possibility of the market being over-supplied, I quote the following, by a correspondent of Mr. J. E. Brown, Conservator of Forests of South Australia :—"The matter of supply and demand can be compressed into small compass. British and Continental tanners are languishing for ample and continuous supply and South Australia exports in such driblets that very many of the large firms in Great Britain have given over using it, falling back on Valonia and other barks more *fully* and *regularly* supplied. I may be allowed to remark here, reliable leather cannot be produced by intermittent and inadequate supply of bark, on which the tanner relies when laying down his hide; indeed, in large yards, such as with 50,000 hides always in the pits, it becomes a very serious difficulty, attended with anxiety and loss, not to be able, through want of sufficiency of bark of a class, to work them through successfully. It therefore becomes a matter of necessity that the exports of bark may be abundant and regular to such an extent as tanners may confidently rely on. To such low export of wattle-bark have your growers now arrived at, that *one yard* could manage to take fully *one-fourth*—say 1,000 tons—of all the bark shipped from your ports to England in 1882, and about one-third of the shipments for 1883. . . . . I am aware French and German tanners highly approve of the wattle for tanning purposes." (Report to S. A. Legislative Council, 1884.) . . . .

Mr. F. Donovan, representative of the Tanners and Curriers' Union of Melbourne, in giving evidence before the Royal Commission on Vegetable Products, states that for the bark which in 1872 cost £3 15s. per ton, £8 or £9 was paid in 1887, and he is very emphatic on the necessity of wattle culture on a large scale. Mr. Dunn, a tanner, gave evidence to the effect that in 1872 wattle-bark was selling from £2 10s. to £3 a ton. In 1879 the price had gone up as high as £9 10s., and since then it has varied from £8 10s. to £11; in 1887 the best bark was £10.

The best Sydney bark has fetched £10 this season, and this appears to be the top price on the average.

Cultivation of Wattles.

(a.) Soil.

There is a consensus of opinion that wattles will grow on the poorest soil, and thus it is that land can be utilized in this industry when it can scarcely be put under any other cultivation, and where not even grass grows. At the same time, bark richer in tannic acid and maturing earlier, may be obtained from trees growing on richer soil. . .

In preparing the land, if it be virgin soil, unencumbered with scrub and of a light nature, breaking up of the surface, sowing the seeds, and harrowing is all that is necessary. If the land be covered with scrub or other vegetation these should be cut down, burnt, and the land prepared in the usual way. It must not be understood that any careless kind of cultivation will do for wattles, although when once started, they will thrive with scarcely any attention, but like other crops, the better the system of cultivation adopted, the better the yield and therefore the greater the profit.

(b.) Moisture.

Wattles like a moderate amount of moisture, say from 18 to 20 inches. (F. Abbott.)

Mr. J. E. Brown has grown wattles successfully with 10 inches of rainfall, but ordinary cultivators will not usually succeed with less than 16 to 20 inches per annum.

On the other hand, it is not good for wattle-trees to have an unlimited supply of water, as they then tend to throw out too much leaf, and the bark becomes flabby and deficient in tannic acid.

(c.) Sowing and Germination of the Seed.

The outer covering of the seed is of great hardness, and under ordinary circumstances it will remain in the ground for many years before germination. . .

Bush-fires, however, usually hasten matters; and it is well known that perfect forests of young wattles spring up in many places after these occurrences. The operations of nature are threfore assisted in practice by means of heat, and this heat may be either dry or moist. For the first, Mr. J. E. Brown recommends a quantity of brushwood to be burnt down to the condition of expiring embers. "In this residuum of the fire the seed is placed and mixed up with the ashes and charred coals, and the whole is then allowed to remain until cooled down. The seed is now ready for sowing. If the intention be to sow it singly, by dibbling or in some other way, it will have to be cleaned and separated from the residue of the fire by riddling, or by the aid of an ordinary grain-winnower. If, however, the seed is to be sown broad-cast, it will be sufficient if the embers are raked off the heap, and the remainder, containing both ash and seed, stored ready for sowing. The advantage claimed for this method of preparation is that the seed can be sown either broad-cast upon the ground without covering, or dibbled in the soil in the ordinary way, at any season of the year, and especially before the winter rains set in." Care will, of course, require to be exercised to prevent loss by over-burning. A frying-pan* is used by some people for roasting wattle seed.

Secondly, the method of treatment by boiling, or hot water. Mr. Brown has recommen ded that the seed be placed in a vessel, water *almost boiling* poured upon it, and left to soak for one or two days; the seed is then taken out and kept damp in a bag until swelling takes place. The only drawback to this system is that, when sown, the seed must of necessity be covered with soil, and that the operation be carried out in the winter season only.

Unless the seed be covered as it is put out, so as to keep up the necessary supply of moisture to complete germination, a change of dry weather would undoubtedly result in its entire loss." Nevertheless, this is the method which Mr. Brown recommends growers, especially beginners, to adopt. . .

Following are extracts from a leaflet, giving a few simple directions in regard to wattle cultivation, which has been issued by the Superintendent of Technical Education, under the direction of the Minister of Public Instruction. Some of the points have already been touched upon :—

"*Nursery.*—If there be only a small area to be planted with wattles it is best to raise seedlings in a nursery. Whilst young they can be easier looked after and protected. Wattles will not stand transplanting at every season of the year with any degree of success; therefore they should be planted in small flower-pots or bamboos, in which they can be readily taken to the open ground. If grown in flower-pots. three or four seeds in each will be sufficient. When the plants are up, weed out all but the strongest one. After they are a few weeks old the pots will be found to be full of root; they

* The danger of over-heating will be minimised if a little water be put into the frying-pan.

should then be removed to their permanent home. To take them out of the pots turn them upside down, and by placing a finger in the drainage hole at the bottom of the pot the plant with its roots can be easily taken out, and will suffer nothing by removal.

In the State Nursery at Gosford the seeds are sown in boxes containing peaty loam, mixed with clean, sharp sand, the soil being kept always moist. When the seedlings are sufficiently established they are transferred to the open ground.

"*To sow broad cast or in drills.*—If the seeds have been assisted in their germination by means of hot ashes, rake or sift out the larger coals and sow the ashes with the seeds. If the germination has been commenced by the hot water process, mix the seed thoroughly with dry ashes or sand—this will prevent the seeds from sticking together—then sow broad-cast or in drills in the usual way.

"If the seeds are to be dibbled they must be freed from the ashes. Whichever method be adopted for sowing, the seed should be well covered, and in the case of those that have been soaked in water this is essential, for a few hot and dry days would effectually check all further growth. Three or four seeds at about *three feet* apart is the distance required ; this will allow for thinning.

"Do not cover the seeds too deeply ; about an inch underground will be ample.

"Sow sparingly ; this will save a lot of thinning afterwards."

(e.) *Thinning.*

Wattle-trees are sometimes recommended to be pruned. "The advantages of this are larger dimensions of individual trees, and hence more bark in proportion ; cleaner stems, easier stripping at less expense, less liability to disease, and quicker returns, because the tree will arrive at the stripping stage ooner by having its vitality confined chiefly to the stem."—(J. E. Brown)

Mr. A. L. Thrupp however deprecates pruning in warm northern exposures, as too much sun would be admitted to the stem of the tree.

Mr. F. Abbott recommends that wattle seedlings be thinned out, as soon as they are big enough to handle, to 10 feet apart. This is perhaps a fair distance, but authorities do not agree as to the precise distance. It rather resolves itself into a matter of common sense, for one must on the one hand avoid having wattles too close to each other, otherwise "leggy" trees are the result, and on the other hand trees too bushy are not desirable.

Wattle-trees should be transplanted with a moderate amount of care, as they are not the hardiest of plants to stand moving.

Profits to be derived from Wattle Cultivation.

Wattle cultivation is in its infancy, and as far as I know, no wattle-grower has favoured the world with a peep at the item "Wattle Cultivation" in his ledger.

We are, therefore, chiefly dependent on estimates in lieu of statements of results attained, but those which follow are as trustworthy as can be supplied. Wattle conservation and cultivation have been little taken up in our own Colony, but we are already taking steps to remedy this.

Following are the opinions of gentlemen in the several Colonies on the prospect of profit in wattle-planting. They are culled from the reports of the Victorian Royal Commission on Vegetable Products.

New South Wales.—Mr. Charles Moore, F. L. S., Director of the Botanic Gardens, Sydney:—"They are a very profitable crop indeed."

Tasmania.—Mr. F. Abbott, Curator of the Botanic Gardens, Hobart :—"I have not the shadow of a doubt that they are a valuable crop to any farmer ; they come on in a very short period, and there is always a revenue from them."

South Australia.—Mr. J E. Brown, F. L. S., Conservator of Forests, Adelaide :—"With regard, however to the wattles, there can be but one opinion as to their cultivation being the means of a large and most valuable source of revenue both to individuals and to the State."

Victoria.—Mr. I. Hallenstein, Tanner, Currier and Leather Merchant, Melbourne :—"I do not think a farmer or anyone with the means could produce any crop more valuable than the wattle-bark. We have got faith in it, or we would not have gone to the expense of putting 800 or 1,000 acres under cultivation." The following evidence was given by Mr. W. Ferguson, Inspector of State Forests, Victoria:—"I calculated that from the time the seed was sown at the Majorca Plantations, Ballarat, in seven years we should get about 10 tons to the acre of bark. That is, off the trees that were fit for barking at that time, and at the rate—of the present rate of bark—it varies from £8 to £10 per ton. "You would get 10 tons to the acre ? Yes. "From trees that have been how many years growing ? Seven years.

"That would average £10 a ton ? Yes, at the present, and it is likely to be more.

"That is, £90 per acre ? Yes.

"That will be about £13 per acre per annum ? Yes. "Would that take all the trees or leave a portion remaining ? No, only the first thinning out. How many thinnings would that plantation admit of year after year ? For years and years to come, because you will find them in all stages of growth. But I calculated that from the first thinning-out.

"And would that yield as much each succeeding year ? It would yield as much each succeeding year.

So that you might get 10 tons per acre in each succeeding year ? Annually for years to come, if they are judiciously thinned, but not as they are thinning (destroying) them in the forest. If they are properly cultivated—cultivated for profit.

"Can you mention any other crop grown in Victoria more profitable than that ? No, and it is grown on such poor land, where neither grass nor anything will grow. In Rodney, where I mention, there is not a bit of grass to be seen, and there the wattles come up thick."

At the irrigation farm at Islington, near Adelaide, Mr. J. E. Brown planted 40 acres in wattles. "The seed was simply soaked in hot water and broad-casted, and the soil afterwards harrowed with brush harrow; altogether, the whole expense of seed, preparation of the ground, and putting the seed in cost about £15. Four years afterwards the wattles were simply thinned, and the bark of the thinnings realized £25, thus more than refunding the original outlay. Next year I hope the thinning will realize something like £3 per acre. In three years time from this we purpose stripping the whole crop, when I am certain it will realize at least £50 per acre.

Detailed Estimates.

1. The following statement showing the profit to be derived from the systematic cultivation of wattles, was compiled from the evidence given before the Board of Enquiry on Wattle Cultivation, Melbourne, 1878, and forms an appendix to their report. (The Board recommend A. *decurrens* * and A. *pycnantha*).

Receipts derivable from a Wattle Plantation of say 100 acres, planted in the manner proposed—

Each acre planted with wattles, 10 feet apart, would carry 400 trees; at the end of fifth year, trees would yield say 56lbs. matured bark; stripping only every third tree 333 tons would be obtained off 100 acres; this, at £4 per ton, would give at first stripping ...	£1,332	0	0
In the sixth (or following) year, a similar number of trees would be stripped, the bark having increased in weight say 14lbs., the increased yield of second stripping would therefore be 400 tons at £4, making ...	1,600	0	0
In the seventh year the remaining trees would be stripped, from which a still greater increase would be obtained, say 480 tons at £4, making ...	1,920	0	0
The aggregate yield of bark during the first eight years, 1,215 tons, amounting in value to ...	£4,852	0	0

Estimate of Expenditure on a Wattle Plantation of 100 acres during eight years—

Rent of 100 acres for eight years, at 6s. per acre per annum ...	£240	0	0			
Ploughing 100 acres in drills 10 feet apart ...	25	0	0			
Sowing Wattles and actual cultivation, including cost of seed ...	37	10	0			
Supervision for eight years, say £10 per annum ...	80	0	0			
Pruning the trees, taking off useless wood, &c., (only necessary for 2 years) 10s. per acre ...	50	0	0			
Incidental and unforeseen expenses ...	27	10	0			
Interest on the whole amount expended during eight years ...	240	0	0	700	0	0
Actual cost of stripping and carting, as shown below† ...	1,515	0	0	1,515	0	0
‡ Profit balance, exclusive of improvements or supplementary sowings ...	£2,637	0	0	2,637	0	0
				£4,852	0	0

2. The following estimate is by Mr. J. E. Brown, and is taken from a Report by that gentleman to the South Australian Legislative Council in 1884. (Mr. Brown recommends A. *pycnantha*):—

Revenue.

To value of property increased and improvements, say ...	£400	0	0
" value of 500 tons of bark, at £5 per ton ...	2,500	0	0

Expenditure.

By purchase of 100 acres, at £3 per acre ...	£300	0	0
" cost of substantial fence all round, say 1½ mile at £50 per mile	75	0	0
" ploughing 100 acres, at 8s. per acre ...	40	0	0
" of 30 lbs. of seed, at 1s. per lb ...	1	10	0
" labour, sowing the seed in rows, say, at 5s. per acre	25	0	0
" scarifying between the rows twice, at 4s. per acre	20	0	0
" thinning and pruning for two years, at 10s. per acre per annum	100	0	0
" forming fire-breaks during the third to seventh year, say, £5 per annum	25	0	0

* A decurrens var. mollis—A. mollissima, this so called variety having again been raised to the rank of a species. J. H. M.

† The cost of stripping would not exceed 15s. per ton, on account of the facilities presented by the regularity of the trees, while carting would represent another 10s. per ton. These combined charges would be 25s. per ton, and on 1,215 tons would be £1,515, leaving a clear profit on 100 acres (after allowing for primary expenditure) of £2,637.

‡ In addition to the bark taken off the land, a fresh supply would be available in two years afterwards, as the Board recommend that every tree stripped should be replaced by another sowing. All improvement effected may be calculated as additional profit.

By sundries ...	£ 50	0	0			
" interest on money expended during the seven years, say	280	0	0			
" cost of stripping 500 tons of bark, at 25s. per ton	625	0	0			
" cost of carting same to market, at 10s. per ton	250	0	0			
Balance, being clear profit	1,108	0	0			
	£2,900	0	0	£2,900	0	0

Notes on above Estimate.— At the distances apart which I recommend the trees to be grown, namely, 4 to 6 feet, there will be an average of 1,200 trees to the acre. In order, however, to make due allowance for blanks, I base my calculations upon there being 1,000 only to each acre £5 per ton is only two-thirds of the present selling price of bark. I give 5 tons as the probable yield per acre. That this is a low estimate will be admitted, when it is considered that this only allows for 10lbs. of bark to be taken from each tree. (J. E. Brown).

3. Estimate of Expenditure upon and Revenue from a Wattle Plantation of 100 acres, during a term of seven years, by Mr. G. Perrin, Conservator of State Forests, Victoria, 1889.

He recommends the cultivation of the broad-leaf wattle (A. *pycnantha*); broadcast sowing.

EXPENDITURE.

				£	s.	d.
To rent of land at 4d. per acre under Wattle Cultivation Bill				1	13	4
" fencing, say, 1 mile and 3 quarters, at £40 per mile				70	0	0
" ploughing (and harrowing twice) at 14s. per acre				70	0	0
" purchase of seed, 1lb. per acre, 100lbs., at 1s.				5	0	0
" ploughing and burning of fire-breaks, four blocks of 20 acres each, with 20 feet roadway between each block, three furrows on each side at £10 per annum				70	0	0
" vermin destruction, and unforeseen expenses, say				50	0	0
" first pruning and thinning at end of second year after sowing, say 10s. per acre ...				50	0	0
" final pruning about fourth year (superficial only) at 5s. per acre ...				25	0	0
" interest on seven years' rental ...	£3	15	0			
" interest on expenditure, say ...	206	10	0	210	5	0
" stripping 100 acres of wattles (1,200 trees to the acre) producing 12lbs. of the bark per tree, or 642 tons in all, 25s. per ton				802	10	0
" cartage to a railway station, say 5s. per ton				160	10	0
				£1,514	18	4

RECEIPTS.

By 100 acres of wattle-bark from 1,200 trees to the acre, each producing 12lbs. of bark—642 tons, £7 10s. per ton ...	£4,815	0	0
Less expenditure ...	1,514	18	4
Profit ...	£3,300	1	8

Table to aid in the comparison of the more important items contained in the three foregoing estimates.

A.—Out-goings.

———	Victorian Board.	Mr. Brown.	Mr. Perrin.
Cost of land per acre ...	...	£3	...
Rent per acre per annum ...	6/	...	4d. under Wattle Cultivation Bill.
Fencing, per mile	...	£50	£40.
Ploughing	£25	£40	£79 (includes harrowing).
Scarifying, per acre ...	...	4/	...
Fire breaks	...	£25	£70 (fuller specification).
Seed and sewing	£37 10/	£26 10/	£5 (seed only).
Pruning, &c., per acre ...	10/	10/	10/
Stripping, per ton	15/	25/	25/
Carting, per ton	10/	10/	5/
Supervision for eight years ...	£80	...	...
Interest on money	£240 (8 years)	£280 (7 years)	£210 5/ (7 years).
Contingencies	£27 10/	£50	£50.

B.—Income.

——	Victorian Board.	Mr. Brown.	Mr. Perrin.
Yield of 5th year trees each ...	56lb.	10lb. from each tree admittedly a low estimate.	12lb.
Yield 6th year ...	70lb.		
Yield 7th year ...	84lb.*		
Value of bark, per ton ...	£4	£5	£7 10/.
Total yield in tons ...	1,215 (8 years)	500 (7 years)	642 (7 years).

Harvesting Wattle-Barks.

(*a*). *Time of Year for Stripping.*

Wattle-barks are often gathered all the year round, whereas they should only be stripped for three or four months in the year; (the months recommended are September, October, November, and December)† out of that season there is usually a depreciation of tannin in the bark. In these months, also, the sap usually rises without intermission, and the bark is easily removed from the tree. The impression appears to have prevailed amongst bark-strippers that whenever the bark would strip it possessed full tanning properties, but this is erroneous. After a few days of rain during other seasons of the year, a temporary flow of sap will cause the bark to be easily detached from the trunk, but then it is greatly inferior in quality. (*Report Victorian Board.*)

Mr. A. L. Thrupp, in a paper read in March, 1890, before the Congress of Agricultural Bureaux in Adelaide, carefully warns tanners and others against receiving wattle-bark damp, pointing out that bark in that state engenders mould "of a most virulent form," is liable to spontaneous combustion if stacked in the hold of a vessel, and, while bark received green will tan hides as fast as bark received dry, still, there is the undeniable fact, in nine cases out of ten, that leather produced from bark so received, so stacked, and used for tanning purposes is spotted, and therefore of second rate or third rate value. . . . Mr. Thrupp states that if the bark of a wattle-tree of three or four years be slit down on the south side with a sharp knife, from root to first branch the increase in the bulk of the bark will be considerable. This has been tried in the Montacute District of South Australia successfully for years. Spring is the proper time for this work. (*Journal, South Australian Bureau of Agriculture, November*, 1889.) A correspondent of mine, engaged in wattle cultivation in the Blue Mountain, has also practised this method with success. He has instituted comparative experiments, and is convinced of the advantage of the process in increasing bulk of bark. He performs the operation in the early winter (May or June). . .

(*b.*) *Age and size of Trees.*

Wattle-bark should only be procured from mature trees, i.e., from those whose bark possesses the full natural strength. The Victorian Board states, as has already been noted, that bark-stripping may profitably commence at the end of the fifth year, and returns undoubtedly commence not later than this period.

Mr. J. E. Brown strips his wattles at about 6 years of age, but the exact period can only be decided by the cultivator's common sense. Mr. A. Bucknell mentions that wattle trees mature in seven years in the Majorca plantation, Ballarat. Mr. W. Ferguson of Victoria makes the general statement that none should be cut under five inches in diameter,—a reasonable suggestion which might be enforced, on Crown lands, by legislative enactment.

Some people fell their wattles before stripping, and use the wood for fire-wood.

Bark-strippers as a rule leave about a third of the bark on the tree, besides leaving unsightly dead trees. It should also be borne in mind that dead and decaying trees are a source of danger to the plantation, owing to the harbour they give to insect pests. The matter of utilizing the bark on the twigs, &c., will be alluded to below. . .

(*c.*) *Export, Packing, &c.*

In regard to the preparation of bark for export, the following letter from a well-known London firm of brokers, which appeared in the *Leather Trades' Circular and Review* of the 8th March, 1887, is valuable:—

"In reply to a question as to the best form in which to ship mimosa (wattle) bark, we beg to state that the trade, as a rule, prefer it ground, so long as they can be sure it is not adulterated. Some few, however, cannot be satisfied unless they grind it themselves. We should recommend shipments of well-ground, with a few parcels chopped or crushed in *bags*, but, as we know that freight is heavier on the latter, and buyers expect a reduction of from 10s. to 20s a ton to cover cost of grinding, the former will generally be most satisfactory to shippers. We think that the strength is better preserved in the chopped than in the ground, but there is nothing we can suggest as an improvement on the best stan-

* An extravagant estimate, except for picked trees. Every third tree stripped.

† No fixed time, applicable to all parts of New South Wales and to varying seasons, can be given. Farmers and others will have to find the best time from their own experience, supplemented, of course, by assays of bark stripped at various periods.

dard marks of Adelaide ground. If shipments of chopped be made it should on no account be shot loose in the ship's hold."

Barks are sent into commercial in one or more of four forms:—

1. In the bundle.
2. Chopped, i.e., into pieces a few inches in length.
3. Ground, forming a substance something like "tow;" and
4. Powdered, that is of course, if the bark is not too fibrous to permit of this being done.

It is not desirable to push the process of grinding too far, as wattle-bark is no exception to the generality of powders, in forming "balls" when thrown into water when too finely gronnd.

A SHORT ACCOUNT OF THE METHODS OF CULTIVATION AND PREPARATION OF RICE IN BENGAL.

Reprinted from the Journal of Agri-Horticultural Society of India, Vol. VIII, Part IV, New Series.

In November last an application was received from Mr. A. C. Stewart, Acting Emigration Agent for British Guiana, asking, on behalf of the Honble the Immigration Agent, George Town, for information as to the culture of rice in India, and more particularly as to the preparation it undergoes before being shipped, and for copies of any pamphlet dealing with the subject. A search was accordingly made for such a paper, but, so far as the writer knows, no complete general account has been published in a form now accessible. Concise accounts of the cultural methods in different parts of the country, and also of special local methods have been published in the Society's Journal and elsewhere, including a summary prefixed by Mr. Leotard to his memorandum regarding the introduction of Carolina rice into India, and Messrs. Duthie and Fuller's Field and Garden crops of North India; but a more detailed account, such as is here given, does not fall within the lines of these works, and other writers dealing with the subject have found it unnecessary to go into such particulars. It has therefore been requisite to prepare a separate memorandum, and the writer is indebted to the Honble Rajah Pary Mohan Mookerjee, C.S.I., and to Mr. T. N. Mukerjee of the Economic Department, Indian Museum, for the assistance they favored him with.

The varieties of rice cultivated in India are so numerous, and are further so complicated by having different names in different localities, that no attempt can here be made to deal with this portion of the subject. In passing it may be mentioned that there are 1,400 samples of this grain in the economic portion of the Indian Museum, all of which are said to differ from each other.

The whole of the innumerable varieties of rice can be classed under three heads, viz., Aus, Amán and Boro.*

Aus rice is in Bengal sown in April and May, at which time there is usually enough rain to admit of the land being ploughed and sown. The crop is sown in higher lands than are selected for other kinds of rice, and is grown in rotation with sugarcane, jute, potatoes, &c. The field is ploughed and thoroughly cultivated and the grain sown broadcast, but in districts where the rainfall is deficient the seed is sown in beds, and transplanted by hand when the favorable season arrives, as in the case of the Amán crop hereafter referred to. The *Aus* does not, however, require the land to have water lodging on it, and hence is known by Europeans as "dry rice" in contradistinction to "wet rice," *i. e.*, that grown on wet land. There are indeed certain varieties of this rice which grow best in dry soils such as the *Jetka* and *Chally* cultivated in Bankura.

The *Aus* rice ripens very quickly, some varieties in only sixty days, hence the name *Sathi*, and it brings an early supply of food to the peasantry, as also to the cattle in the shape of straw.

The Aman Paddy is the staple crop of the Province. The soil in which it is grown must have at least an inch or two of water lodging on it. This class of paddy is usually grown in nurseries and transplanted. In marshy lands it is sown broadcast.

The Boro Paddy is sown on low lands subject to high inundation, on the edges of rivers after the high inundations have retired, and in similar situations. It is sown either broadcast or transplanted. It is cultivated in parts of the districts of Hooghly, Nuddea, and the 24-Pergunnahs, but principally in Jessore.

Cultivation of the land and treatment of the crop.—As mentioned above, the paddy is either sown broadcast or transplanted. In the former case the low land in which it is grown is generally baked hard by the hot weather sun, and cracked and fissured in all directions, so no cultivation can be attempted till rain has fallen in sufficient quantities to moisten it thoroughly, it is then at once ploughed, the furrows being left open till another shower admits of further operations. In this manner the land is ploughed several times till the surface is thoroughly broken to a depth of several inches. The implement used being more a cultivator than a plough, making but small shallow furrows.

When rain falls sufficiently to give enough moisture for the seed to germinate it is sown broadcast on the plough, and the surface roughly harrowed either with a wooden beam, slightly hollowed so as to catch and break clods, or with an implement resembling a light ladder made of bamboos; either of which are drawn crosswise across the furrows. The quantity of seeds sown varies in different localities, but may average about 10 lbs. to a Bengal bigga of 14,400 square feet, or say 30 lbs. to an acre.

* There is also a variety of wild rice which is self sown and cannot be harvested in the ordinary way, as the grain is shed as soon as it ripens. The grain is collected by poorer classes. In Bengal, wild rice is of fine quality to look at, but when cooked it becomes very coarse, and would not be recognised as the cooked state of such a fine rice. Roxburgh describes the wild rice found in the Circars as "remarkably white, palatable and reckoned very wholesome, so that it sells dear. The rich esteem it a dainty, and to make it still more delicate they boil it only in steam."

The field requires no further attention. As the rains set in the land gets gradually flooded, but as long as there is no very sudden increase to the depth of the water the plant continues to grow so that the ear is not submerged. The usual height of the plant is from three to four feet, but the variety sown where there is deep water continues growing, and the ear tops the water even when 15 to 20 feet deep. In deep water the grain is harvested in boats, merely the ear being gathered. When the water retires the straw is either burned on the spot, or used for cattle bedding and similar purposes, being unfit for other use after its immersion.

By far the largest number of varieties of paddy, as well as the largest quantity, are first sown in nurseries and then planted out by hand. This ensures a greater regularity in the crop, is a saving of seed, and also admits of some latitude in selecting the most favorable time for planting out. The nursery is prepared on higher lands, which not having been flooded and then exposed to the severe hot weather sun, remain friable during the whole year.

The soil is well ploughed and harrowed, the light wooden plough and the wooden beam or light frame of bamboo being invariably the only implements. The ground is hand-weeded and a fine seed-bed prepared, and the seed is sown about two months before the rains set in.* In the case of some varieties the seed is subjected to a germinating process before being sown, being steeped in water, allowed to dry, and again moistened till they begin to swell. This practise is not universal.

The seed-bed for a bigga of land (14,400 sq. ft.) is less than ½ a cotta in extent, or say 360 feet, and is sown with 2½ lbs. of seed; for an acre of land the area of the seed-bed would approximately be 1,080 feet and the quantity of seed 7½ lbs.

The field is cultivated, as in the previous instance; with the addition of further ploughings when the water lodges on the land, provision being made to keep the water from draining off the field by means of the network of embankments with which the face of the country is covered.

The field being well puddled is ready to receive the seedlings which are by that time about a foot and more high. The seedlings are uprooted with a small spud, the earth shaken off the roots, and planted three or four together by hand about 9 inches apart, the roots being simply pressed by hand into the puddled soil. The seedlings can be kept after being uprooted for a day or two, and in cases where seed-beds have failed through want of rain or other causes, seedlings are taken considerable distances.

As the rainy season advances, the amount of water in the field is regulated, and should it be insufficient recourse is had to irrigation, the water lifts being of the most simple construction. Irrigation is, however, only a temporary measure, as, should the rain fail altogether and more especially at the season when the ear should be filling, the crop can seldom be saved by such means. Should the season be favourable there will, at all times, be water in the fields varying in depth from two or three inches to a foot and more. After the crop has been planted out, beyond a few hand weedings, it requires no further attention.

With the cessation of the rains and the advent of the cold weather, the water begins to dry off the land and the crop ripens, it is cut with the small reaping hook of the country. In the parts of the country where the paddy straw is used for thatching houses, the reaping is carefully done, the straw being kept straight and orderly. In other districts where labour is scarce, or fodder for cattle plenty, and straw otherwise of little account, only the ears are cut off.

The crop is allowed to dry on the field for a day, and is then carried to the threshing floor on their heads by the reapers, who are generally paid in kind, the proportion they receive varying in different districts. For threshing two methods are employed. Where it is requisite to keep the straw straight and unbroken, the grain is beaten out by handfuls over a block. In other places where straw is used only for fodder and not for thatching, it is trodden out by cattle.

Winnowing is done by shallow baskets of the grain being shaken out from a height, the chaff flying to one side and the grain forming a heap.

These operations are mostly conducted in the open air, the settled weather at that season obviating the necessity of barns for this purpose.

The grain is not subjected to any special drying process beyond the exposure to sun and air it receives during the foregoing operations. The climate even in Lower Bengal is at that season very dry, and the sun remains powerful enough to drive off much of the moisture.

As a marketable article the paddy can be, and frequently is, sold off the threshing floor, but it is considered less wholesome than old rice for immediate consumption. When threshing is completed, the

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* Properly speaking rice can be cultivated all the year round if sufficient water is available, . . . the operations, two each month, may be shewn as follows :—

Month.	Sown.	Reaped.
January	Boro	Marsh Aman.
February	do.	do.
March	Aus and Marsh Aman.	——
April	do.	Boro
May	do.	Boro & Aus.
June	do.	Aus.
July	Aman (transplanted)	do.
August	do.	do.
September	—	do.
October	Boro	Lowland Aman.
November	do.	do.
December	do.	do.

T. N. M.

grain is put away in graineries constructed of straw twisted into ropes and wound round bamboo uprights planted in a eircle, the whole being raised from the ground on a rough platform of posts, a couple of feet high, as a proteetion against damp and rats. The structure is earefully thatched; the outside is plastered over with clay, the inside lined with mats, and it is when complete, quite weather-tight and substantial.

Rice.—The operation of husking the paddy and transforming into rice is done generally by women. Two kinds of implements are used, the process being in both instances to pound the grain until the husk is detaehed.

The implement most eommonly used in Lower Bengal is the *Dhekoli*; this is a heavy log of wood about 8 feet long weighing about 2 or 3 cwt. into which a short staff, shod with iron, is fitted at right angles at one end; a cross bar passes through the log about half way on which it rests horizontally on two short uprights, the iron shod shaft resting in a wooden cup imbedded in the ground. This implement is worked by one, or more frequently two women, by depressing the free end of the log with their feet; a cross bar is fixed breast-high on which the women lean, standing on one foot and depressing the log with the other; the end on which the shaft is fixed is thus raised and let fall into the cup in which the grain is colleeted and the operation is repeated until the charge is all pounded when the husk is winnowed out. The operation is slow and laborious, and there is considerable waste by grain being broken.

The other implement for husking riee is the *Ukhli*, a block of wood about two feet high and a foot and a half aeross, hollowed out to half its depth, and roughly shaped; the paddy is placed in this mortar and pounded with long shafts made of heavy wood, about three inches in diameter shod with iron. The shaft is about 5 feet long and is grasped in the middle, the shod end poised over the mortar, it is raised to the full extent of the arm, and then dashed into the grain. Usually two, and sometimes even three women stand round the mortar pounding the paddy alternately, and keeping time so that the instruments do not clash.

There is considerable waste by either process above described, as the broken rice is winnowed out with the husk and dust. This broken grain is eaten only by the poorest people.

The winnowing is done also by women. A small quantity of rice is placed in a flat tray-like basket called a "*Soop*," whieh is shaken and manipulated with great skill so that the solid grain separates entirely from the husk and dust. This work is, like the rest, very slow and tedious, but it is well done the woman being exceedingly expert in the use of the *Soop*.

Although the process of preparing riee is slow, it is preferred by natives to the European Mill, as they consider that more riee is broken and wasted by the mills than by their own process; and also as the work is done by the cultivators family the cost is not ealculated, whereas milling has to be paid for.

The greater part of the riee prepared for the market passes through a steaming and soaking process before being husked, the husk separating more readily after this proeess, and there being less broken and wasted grain than when the unboiled and more brittle grain is pounded. The paddy is steeped in water for two days, less or more aceording to the variety, and is then put into an earthen vessel with a small quantity of water and placed over the fire, the water being merely suffieient to steam the whole contents of the vessel. This proeess lasts about half an hour, after which it is dried over fire, exposed to the sun for two days and then pounded.

The rice so treated is considered much more wholesome than rice husked without boiling; the use of the latter is confined almost wholly to Hindu widows and to Europeans; the former in accordance with Caste rules, and the latter beeause the rice is whiter in appearance, hence it is called "table rice," and has not the smell which soaked grain has.

Although the process of boiling and sunning described involves additional labour, the rice so prepared is cheaper than rice not so treated; the labor involved not being a consideration, and the differenee being due to one being a less wasteful method than the other, and also because of the increase in weight due to moisture.

The riee shipped to the West Indies is almost all rice that has been treated as above described, that being the kind used by the emigrants. It is purchased in the open market and without any further special treatment bagged and shipped. The quantity of white, or table rice, sent to the West Indies is infinitesimal compared to the other kind.

R. B.

V

No. 20. December, 1890.

BULLETIN

OF THE

BOTANICAL DEPARTMENT,

JAMAICA.

CONTENTS:

PRICE—Two-pence.

JAMAICA:
GOVERNMENT PRINTING ESTABLISHMENT, 79 DUKE STREET, KINGSTON.
1890.

GAMBIER.

Gambier is the Malay name for an astringent, earthy-looking substance, used principally in tanning and dyeing under that name, and also in much use under the name of *Catechu pallidum*, pale Catechu.

The botanical name of the plant from which it is obtained is *Uncaria Gambier*. the generic name being derived from *uncus*, hooked, in reference to the stalk of the flower-buds, which, as soon as the seed-vessels have ripened and fallen, curve downwards and harden into strong hooks. By means of these hooks the plant, with its slender weak stem, is enabled to cling to other plants and grow upward towards the light, and also away from the parent root, so that the falling seeds scatter on fresh soil.

Uncaria belongs to the same orders as Coffee and Cinchona,—*Rubiaceæ*, in which the petals are united, and the leaves are opposite and connected by small leafy processes. The leaves are ovate, 3 or 4 inches long. The pinkish corolla of the flower consists of a slender tube half an inch long, expanding into a shallow cup with 5 segments, from which the long pistil protrudes. The narrow tubular corolla implies cross-fertilisation by a butterfly or other insect with a tongue of such a length as to enable it to reach the honey at the bottom of the tube ; and this fertilisation of one flower with the pollen from another is the more readily effected by the flowers being clustered into globular heads at the end of stalks an inch long. About the middle of the stalk there is a joint marked by a whorl of tiny leaflets, and it is at this point that the head of ripened seed-vessels falls away, leaving the lower part to grow into a thick curved hook. In cultivation the plant is allowed to grow 8 to 10 feet high, and each plant is stripped of its leaves three or four times a year. An average plantation containing 70,000 or 80,000 shrubs can be worked by 5 labourers, and is said to yield "daily" 55 to 65lbs. of gambier easily. The plant will grow where Cacao and Bananas flourish.

Gambier is the extract prepared from a decoction of the leaves and young shoots of the plant. After boiling for about an hour the leaves are placed on a trough sloping into the pan in which they were boiled, and are squeezed so that all the liquor runs back. The liquor is evaporated to a syrup, and is then agitated by means of a stick placed in a slanting direction and worked with an up and down motion. The whole gradually thickens into a clay-like mass of a light yellowish-brown colour. It is then put into shallow boxes, and when hard enough, it is cut into cubes of an inch, and dried in the shade. This is the account given by Jager in his "Singapore, Malacca und Java" Berlin, 1866; but it appears that now most of the Gambier is prepared by means of pressure into blocks.

From its earth-like appearance, and the supposition formerly that it came from Japan, it used to be known as *terra japonica*, but in fact it is a native of countries bordering the Straits of Malacca. As it appears to be exceedingly difficult to cultivate it except in the neighbourhood of Singapore, the planters there have at present a monopoly of it. Having applied both to Singapore and to Kew some two or three years ago for plants. the Department has at length just received two cases from Kew, and it now remains to be seen whether Gambier can be cultivated in Jamaica.

Gambier, in medicine, is said to be valuable, combined with opiates and chalk mixture, in chronic diarrhœa and dysentery ; it is also a remedy for relaxed conditions of the uvula and palate.

It is very much more largely used for tanning and dyeing. It contains about 40 per cent. of tannin.

The following letter was received from Mr. Morris, Assistant Director, with the cases of plants :—

Royal Gardens, Kew, 8th November, 1890.

DEAR SIR,

We are forwarding to your address by this mail a consignment of plants of the Gambier—*Uncaria Gambier*, Roxb., a full account of which is given in the *Kew Bulletin* for October, 1889, p. 247.

2. These plants have been obtained at Kew after many years of persistent effort and they are probably the most valuable of any economic plants distributed from this establishment in recent years.

3. We have taken great care in packing and the shipment of these plants. They will come out under my personal care as far as Barbados, and we hope they will reach you in good order.

4. It may be mentioned that the Gambier has always proved difficult to send in Wardan cases and several attempts to get it from the Straits Settlements have hitherto failed. The present lot of plants was raised from seed, but seed according to Mr. Ridley cannot as a rule be depended upon and hence the success at Kew in the present instance is exceptional and may not be capable of being repeated. It is important, therefore to do all that is possible to secure the safety of the present plants.

5. Mr. Watson gives the following account of the treatment of the Gambier at Kew. "This plant has proved somewhat delicate under artificial cultivation. We find it thrives best when grown in a moist tropical atmosphere and shaded from bright sunshine. It likes a moderate amount of moisture at the roots, but anything approaching constant saturation causes the leaves to turn yellow and fall off. The soil we have found most suitable for it is a mixture of 2 parts turfy loam to 1 part leaf mould and 1 part silver sand. Sudden changes of temperature or atmospheric moisture are hurtful to it."

6. It is recommended to plunge the pots containing the plants in soil or fibre after being unpacked in the West Indies and to keep them in the shade for some little time ; after planting out they should be watered very sparingly until they are quite established.

I am, Dear Sir,

Very sincerely yours,

D. MORRIS, Assistant Director.

EXPERIMENTS IN THE CULTIVATION OF VEGETABLES.

English Vegetables have been grown in Jamaica for many years, and with great success. But the cultivation has been on a very small scale, and the experience gained by the individual has been lost to the community, on account of a want of record of results attained. It is proposed now to put on permanent record in the pages of the Bulletin the results that are obtained from time to time by experiments in the various Botanic Gardens.

The following is a first instalment of results obtained at Cinchona by Mr. W. Cradwick. Superintendent. Attention will be directed to the time of year, the rainfall, and the number of days during which rain fell. It is also important to note what variety is the best suited to our climate, or the particular elevation at which they are grown. The produce of the seeds sown is noted as a guide to determine whether the particular culture is likely to pay commercially. A series of experiments during one year must be supplemented by others in other years in order to get a fair average, and should be carried on by sowings at short intervals. At present not very much is attempted; during the following year probably attention will be paid only to onions, peas and tomatoes, and if it is found that the experiments are helpful, more will be done.

PEAS GROWN AT CINCHONA.

Name of Pea.	Date of sowing.	First bloom.	Days from planting.	Pods of edible size.	Days from planting.	Days fit for table use.	First seeds ripe.	Days from planting.	Last seeds ripe.	Days from planting.	Quantities sown in pints	Quantities reaped in pints.	Height in feet.	Shape.	Colour.	Average Number in a pod.	Rainfall during period of growth.
																	Inches.
Blue Peter ...	23.1.90	3·3	39	4·4	71	14	26·5	122	12·6	139	⅔	7	1	round smooth	green	4	31·56
Dr. McLean ...	23.1.90	23·3	59	29·4	96	30	13 6	141	30·6	148	½	10	5	marrow wrinkled	blue	7	31·66
Best of All ...	23.1.90	No di	ffere	nce	betw	een	this a	nd	Dr.	Mc	Le a	n, yi	eld a	nd time	simila	r.	31·66
Sangsters No. 1 ...	5.2.90	1 4	56	24·4	83	9	31·5	120	6·6	126	⅔	6	2½	round	blue	4	25·50
Sangsters No. 1 ...	4.6.90	19·7	43	2·8	57	7	16·7	71	2·8	83	½	1	2	round	blue	3	1·88

It will be seen from the above that the earliest pea was Sangsters No. 1, sown on 4th June, but the earliest bearing was gained by a sacrifice in the yield, and was produced by the dry weather. The best bearing peas, viz: Dr McLean and Best of All, were the finest flavoured, most tender and of the very best appearance when cooked; these are the peas I would recommend to be grown in the hills; I believe they are not a success on the plains, where however it is difficult to procure sticks. Blue Peter is the best to grow, as it is dwarf, and is very good in flavour. W. C.

CABBAGES GROWN AT CINCHONA.

Names.	Dates of Sowing.	First head formed	*Number of plants survived.	Average of heads formed by surviving plants.	Average diameter of heads.	Average weight of heads in ounces.	Day from sowing	Mean average Temperature.	Rainfall.	Number of days on which rain fell.
Cabbage Little Pixio ...	21.1.90	2.8.90	About 15 o/o	100 o/o	4 in.	13·	118	62·9	27·68	60
" Cocoanut ...	21.1.90	19.8.90	15 "	90 "	5 in.	15·	135	62 9	28·63	69
" Tom Thumb ...	21.1.90	6 6.90	15 "	10 "	4 in.	12·	92	63·5	26·36	47
Savoy Little Pixie ...	21.1.90	30.6.90	15 "	100 "	3 in.	12·	116	64·0	27·5	52

*The great mortality of the plants was due to their being cut through by a small black grub.

NOTE.—The very best of the Cabbages was tho Savoy. These produced heads which, although small, were simply perfect. They were very hard and close, nearly the whole of the leaves turning to head and being edible. When cooked they were of a beautiful golden colour and as tender as the very best winter cabbage I have ever seen in England. I should recommend this cabbage for cultivation in the hills of Jamaica before any other I have seen. Being small, they should be planted about a foot apart (6 inches closer than for most cabbage). The other two Cabbages, Cocoanut and Little Pixio, were far before the ordinary cabbage grown in Jamaica but not nearly equal to the Savoys. Tom Thumb cabbage was a failure, nearly all running to seed without forming a head. W. C.

English Greens grown at Cinchona.

Names.	Dates of Sowing.	Mean Avg. Temp.	Rainfall.	No. of Days on which Rain fell.	—
Kale Scotch ...	21.1.90	66.7 F.	in. 47.22	87	None of these Greens bore at all. The *sprouts*, the edible portion of them, were not produced and made no signs of production up to the 16th of October when they were removed to make room for the onion seeds from Canary Islands. I am afraid they would never pay to cultivate when they had no frost on them. The Broccoli also, being distinctly winter vegetables, I think would not pay to grow. W. C.
Kale Cottagers ...	21.1.90	66.7 F.	47.22	87	
Broccoli Purple Sprouting ...	21.1.90	66.7 F.	47.22	87	
" Penzance Early ...	21.1.90	66.7 F.	47.22	87	
Snows White ...	21.1.90	66.7 F.	47.22	87	

		First Head.	Days from planting.	Avg. Diam. of Heads.	Avg. Temp.	Rainfall.	Number of Days.	Avg. of Heads.
Cauliflower Veitch's— Autumn Giant ...	21.1.90	7.8.90	167	7 inches.	66.7	47.22	87	14 per cent.

During May, June, and July only 3.74 inches of rain fell on 19 days I think this had a very bad effect on the cauliflower; in an ordinary season I think it is very probable the percentage of heads would be much higher, as the average rainfall for the three months stated was for 5 years previous, 32.72 inches.

Carrots grown at Cinchona.

Names.	Date of sowing.	Of edible size.	Number of roots pulled.	Average weight in ounces.	Mean avg. temp.	Rainfall.	Days on which rain fell.	Days from planting, Carrots of edible size.
Janus Intermediate	21.1.90	12.6 90	12	18	62.7	30.58	49	122
Long Surrey	21.1.90	These	were lon	g and to	ugh and	were ne	ver fit to	eat.
Early Short Horn	None	came to	edible si	ze, grubs	destroye	d three	sowings.	

CULTIVATION OF CACAO.

The following notes on Cacao in Colombia by Mr. R. B. White, written in 1883, and published in one of the Kew Annual Reports, are valuable. With regard to the question of Shade-Trees, planters are anxious to find a substitute for the brittle *Erythrina* (Madre de Cacao); probably the best substitute would be the Jac Fruit tree, the timber of which is very valuable, or the Kola tree. Questions are sometimes asked as to the desirability of growing Bananas and Cacao together permanently, and the advice given is that while it is important to grow Bananas for shade for 2 or 3 years, they should then be cut down. It is to be noted that Mr. White is of the same opinion.

"*Soil.*—The Cacao tree exhausts the soil very rapidly. It requires a good rich and thick stratum of vegetable soil, which should overlie gravel or some open substratum. Stagnant moisture round the roots is prejudicial to Cacao At the same time it requires so much moisture that sloping ground does not suit it. In dry seasons and dry climates irrigation should be judiciously employed.

Diseases.—In Antioquia, United States of Colombia, South America, the Cacao plantations have been nearly ruined by a fungus which attacks the tree in a similar way as Hemileia vastatrix does the coffee. The leaves appear spotted, then turn brown, shrivel up, and finally the tree looks as if it had been scorched. If the tree is in flower, the buds fall off, but if it is already in fruit, the pods shrivel and wither and the beans become mouldy and dry up. Hundreds or perhaps thousands of acres of plantations have been destroyed by this plague. No remedy has been found. The planter's resource is to clear the ground, lime it well, and then replant from new and sound seed, taking great care afterwards to prune away and destroy every branch or tree in which the disease may appear. It is believed that the disease was first induced by careless and indiscriminate irrigation during a season when the air was more humid than usual.

The Cacao is such a delicate tree that the growth of the finest mosses and lichens on its bark affects its health. At the proper season the stem and branches should be cleaned by wiping them with a rough cloth or sacking. Parasitic plants are very fond of the Cacao, and are, of course, fatal to it. They should be exterminated.

Shade.—The reason why *Erythrina* is preferred as a shade tree for the Cacao, is because it abstracts

Var. *T. pellucens*, Kze.

Rootstock simple, and free-creeping; rachis flatter; frond scarcely hairy except on the rachis, substance very pellucid.

Exceedingly abundant above 2,000ft. alt. in forests, coffee-fields, and half-open places, growing on decaying logs, &c.; the variety being most common at the higher elevations.

One of the commonest and best marked species, but variable in most of its features. *T. procerum*, Fée, is a large variety 1–1½ or 2 ft. l. quite erect, not at all crisped, very pellucid, and with an upright rootstock. *T. plumula*, Presl., ascribed by Grisebach to Jamaica, is marked by its dense hairiness, and fronds gradually tapering from the middle downwards to the very short stalk.

15. *T. lucens*, Swartz.

Stalks 1–2in. l., not margined, tufted from a short erect rootstock, densely clothed with shaggy, reddish, hairs; fronds prostrate ½–1½ ft. l., 1–2 in. br., long-pointed, pellucid, membranous and flaccid, hairy, pinnate, pinnæ very numerous spreading, rather curved, the upper close or overlapping, ½–1¾ in. l., ¼–½ in. w, at the expanded, free base, tapering to the acute apex, without stalks, cut throughout halfway or more to the ribs into crisped lobes, a line or less deep and wide and overlapping; veins pinnate in the lobes with 1 or 2 simple branches on each side;

sori copious, one to each lobe;

involucres fully immersed, expanding from the base upwards, receptacles usually much protruding.

Not uncommon in forests of the higher slopes above 5,000ft. alt., growing under the shelter of rocks and stumps. A particularly fine and beautiful species, most clearly marked by its reddish, shaggy hairs, and abundant, very fertile, crisped pinnæ.—*(To be continued.)*

LIST OF PALMS CULTIVATED IN THE BOTANIC GARDENS, JAMAICA.

In the following enumeration the genera are classed, as in a former Kew Report, under the Tribes and Subtribes adopted in the "Genera Plantarum."

TRIBE I. Arecеæ.

Leaves pinnate, leaflets with the sides reflexed before unfolding. Flowers unisexual, often in threes (one female between two males).

Subtribe I. Euareceæ.

Spadix flowering below the leaves; spathes 2, rarely 3. Flowers monœcious, males unsymmetrical with hardly imbricate sepals; females with imbricate petals. Ovary 1-celled, 1-ovuled. Fruit with terminal stigmas. —Unarmed palms of the old world.

Genus I. Areca, *Linn.*

1. A. Aliciæ, *F. Muell.*
Tropical Australia.
2. A. Catechu, *Linn.* "Betel nut Palm."
Tropical Asia and its Islands, cultivated as far north as the Eastern Himalaya.
3. A. glandiformis, *Giseke.*
Moluccas.
4. A. triandra, *Roxb.*
Bengal and Assam from the foot of the Himalayas to Burma and the Andaman Islands.

Genus II. Pinanga, *Blume.*

5. P. Kuhlii, *Blume.*
Java.
*6. P. ternatensis, *Scheff.* (*Areca gigantea*, Hort).
Moluccas.

Genus III. Kentia, *Blume.*

*7. K. costata, *Beccari.*
New Guinea.

Genus IV. Hydriastele, *Wendl. & Dr.*

*8. H. Wendlandiana, *W. & D.* (*Kentia Wendlandiana*, F. Muell.)
Tropical Australia.

Genus V. Hedyscepe, *Wendl. & Dr.*

*9. H. Canterburyana, *W. & D.* "Umbrella Palm." (*Kentia Canterburyana*, F. Muell.)
Lord Howe's Island.

Genus VI. Archontophœnix, *Wendl. & Dr.*

10. A. Cunninghamiana, *W. & D.* (*Seaforthia elegans*, Hook. Bot. Mag. t. 4961, excl. figs. 9-11; *Ptychosperma Cunninghamiana*, Wendl.)
Queensland and N. S. Wales.
*11. A. Alexandræ, *W. & D.* (*Ptychosperma Alexandræ*, F. Muell.)
Queensland.

Genus VII. Rhopalostylis, *Wendl. & Dr.*

*12. R. Baueri, *W. & D.* (*Areca Baueri*, Hook. f.; Bot. Mag. t. 5735.)
Norfolk Island.

Genus VIII. Dictyosperma, *Wendl. & Dr.*

*13. D. aureum, *W. & D.* (*Areca aurea*, Hort)
Rodriguez Island (Mauritius group).
14. D. album, *W. & D.* (*Areca alba*, Bory. *A. borbonica*, Hort.)
Mauritius and Bourbon.
15. D. rubrum, *W. & D.* (*Areca rubra*, Hort.)
Mauritius.

Subtribe II. Ptychospermeæ.

Characters of *Euareceæ*, but male flowers symmetrical, with broad rounded widely imbricate sepals.—Unarmed palms of the old world.

Genus IX. Ptychosperma, *Labill.*

*16. P. gracilis, *Lab.*
New Ireland.
*17. P. Macarthurii, *Wendl.* (*Kentia Macarthurii*, Hort.)
Tropical Australia?
*18. P. Seemanni, *Wendl.*
Fiji Islands
*19. P. lævigata.

Subtribe III. Oncospermeæ.

Spadix flowering below the leaves; spathes 2. Flowers monœcious; males not symmetrical, with broad or small sepals, females with imbricate petals. Ovary 1-celled 1-ovuled. Fruit with excentric lateral or basal stigmas.—Old and new world palms, often spinous.

Genus X. Oncosperma, *Blume.*

*20. O. fasciculatum, *Thwaites.*
Ceylon.

Genus XI. Euterpe, *Gærtn.*

*21. E. edulis, *Mart.* "Assai Palm."
Tropical America.
*22. E. oleracea, *Mart.* "Mountain Cabbage Palm." (*Areca oleracea*, Hort.)
Tropical America.

Genus XII. Oreodoxa, *Willd.*

*23. O. oleracea, *Mart.* "Cabbage Palm."
West Indies.
*24. O. regia, *Kunth.* "Royal Palm."
West Indies.

Subtribe IV. Linospadiceæ.

Spadix unbranched, flowering amongst the leaves; spathes 1 or 2. Flowers monœcious; males symmetrical with broad imbricating sepals; females with imbricating petals. Ovary 1-celled, 1-ovuled. Fruit with the stigmas terminal.—Unarmed palms of the old world.

The Palms marked thus (*) are not for distribution.

Genus XIII. HOWEA, *Beccari.*

*25. H. Forsteriana, *Becc.* "Flat, or Thatch-leaf Palm." *(Kentia Forsteriana,* F. Muell.; *Grisebachia Forsteriana,* Wendl. & Dr.)
Lord Howe's Island.

*26. H. Belmoreana, *Becc.* "Curley Palm." *(Kentia Belmoreana,* F. Muell.; *Grisebachia Belmoreana,* Wendl. & Dr.
Lord Howe's Island

SUBTRIBE V. MALORTIEÆ.

Spadix flowering amongst the leaves, digitately branched; spathes 2. Flowers monœcious; males subsymmetrical with broad imbricate sepals; females with imbricate petals. Ovary imperfectly 3-celled, 3-ovuled. Fruit 1-seeded with terminal stigmas.—Dwarf unarmed palms of America with acuminate often confluent or perforated leaflets.

Genus XIV. MALORTIEA, *Wendl.*

*27. M. speciosa.
Central America.

SUBTRIBE VI. IGUANUREÆ.

Spadix flowering amongst the leaves; spathes 2. Flowers monœcious; males with broad imbricating sepals; females with imbricate petals. Ovary 1–3-celled, 1–3-ovuled. Fruit 1-seeded, with excentric lateral or basal stigmas.—Armed or unarmed palms of the old world.

Genus XV. HETEROSPATHA, *Scheff.*

*28. H. elata, *Scheff. (Metroxylon elatum,* Hort.)
Amboyna.

Genus XVI. STEVENSONIA, *Duncan.*

29. S. grandifolia, *Duncan. (Phœnicophorium sechellarum,* Wendl.; *Areca sechellarum,* Hort.)
Seychelle Islands.

Genus XVII. VERSCHAFFELTIA, *Wendl.*

*30. V. splendida, *Wendl. (Regelia Princeps,* Hort.)
Seychelle Islands.

Genus XVIII. DYPSIS, *Noronh.*

*31. D. madagascariensis, *Hort.*
Madagascar.

32. D. sp.,?
Madagascar.

SUBTRIBE VII. CHAMÆDOREÆ.

Spadix flowering amongst or below the leaves; spathes numerous. Flowers usually diœcious; male, calyx minute; female, petals valvate or imbricate. Ovary 3-celled, 1–3-ovuled. Fruit small with basal stigmas.—Unarmed, or rarely armed, palms of the old and new worlds.

Genus XIX. CHAMÆDOREA, *Willd.*

*33. C. graminifolia, *Wendl.*
Costa-Rica.

Genus XX. HYOPHORBE, *Gærtn.*

*34. H. amaricaulis, *Mart. (Areca speciosa & Hyospathe amaricaulis,* Hort.)
Round Island (Mauritius group)

35. H. Verschaffeltii, *Wendl.*
Rodriguez (Mauritius group.)

Genus XXI. CHRYSALIDOCARPUS, *Wendl.*

36. C. lutescens, *Wendl. (Hyophorbe indica,* Gærtn. *H. Commersoniana,* Mart.; *Areca lutescens,* Bory.)
Mauritius and Bourbon.

SUBTRIBE VIII. GEONOMEÆ.

Spadix flowering amongst the leaves; spathes 1–2, rarely more. Flowers diœcious, or if monœcious on separate spadixes; perianth dry; males unsymmetrical, much compressed, petals connate below; females with imbricate petals. Ovary 3-celled, 3-ovuled. Fruits small with basilar stigmas.—Unarmed palms of the old and new worlds.

Genus XXII. GEONOMA, *Willd.*

*37. G. gracilis, *Wendl.*
Costa Rica.

Genus XXIII. CALYPTROGYNE, *Wendl.*

38. C. Swartzii, *H. F.* "Mountain Thatch Palm." *(Calyptronoma Swartzii,* Gr. & Wendl.)
West Indies.

SUBTRIBE IX. CARYOTIDEÆ.

Spadix flowering amongst the leaves; spathes usually many. Flowers monœcious in the same or separate spadixes; male with free or connate imbricate sepals; female with valvate petals. Ovary 3-celled, 3-ovuled. Fruit 1–3-seeded with terminal or excentric stigmas.—Unarmed palms of the old world, with often cuneate leaflets.

Genus XXIV. WALLICHIA, *Roxb.*

*39. W. caryotoides, *Roxb.*
Eastern Bengal, Chittagong, & Burma.

*40. W. densiflora, *Mart.; Bot. Mag. t.* 4584.
E. Nepal.

Genus XXV. DIDYMOSPERMA, *Wendl & Dr.*

*41. D. distichum, *Hook. f. (Wallichia disticha,* T. Anders.)
Sikkim Himalaya.

Genus XXVI. ARENGA, *Labill.* (SAGUERUS, *Rumph.)*

*42. A. saccharifera, *Labill.* "Gomuti Palm"
Malay Archipelago & Moluccas, Burma.

*43. A. Wightii, *Griff.*
Malabar.

Genus XXVII. CARYOTA, *Linn.*

*44. C. Blancoi, *Hort. Veitch.*
Philippine Islands.

45. C. Cumingii, *Lodd.*
Philippine Islands.

46. C. furfuracea, Bl.
Java.

47. C. sobolifera, *Wall.*
Aracan & the Andaman Islands to Malacca.

48. C. urens, *Linn.* "Wine Palm"
E. Bengal & Malay Peninsula.

ANOMALOUS GENERA OF ARECEÆ.

Genus XXVIII.* MANICARIA, *Gærtn.*

*49. M. saccifera, *Gærtn.* "Bussu Palm."
N. Brazil to Central America.

Genus XXIX. PHYTELEPHAS, *Ruiz & Pav.*

*50. P macrocarpa, *R. & P.* "Ivory nut Palm."
New Grenada.

TRIBE II. PHŒNICEÆ.

Leaves pinnate, leaflets with the sides inflexed before unfolding. Spadix flowering amongst the leaves; spathe 1. Flowers diœcious; males with valvate petals; females with imbricate petals. Ovary of 3 distinct carpels. Fruit of one 1-seeded carpel with a terminal stigma. Old world palms.

Genus XXX. PHŒNIX, *Linn.*

51. P. acaulis, *Roxb.?*
Central India, Bengal to Burma.

52. P. dactylifera, *Linn.* "Date Palm."
N. Africa.

*53. P farinifera, *Roxb.*
The Deccan.

*54. P Hanceana, *Naud.*
China.

*55. P. reclinata, *Jacq.*
S.E. Africa.

*56. P. rupicola, *T. Anders.*
Sikkim Himalaya.

*57. P. spinosa, *Thon. (P. leonensis,* Lodd.)
West tropical Africa.

*58. P. sylvestris, *Roxb.* "Khajoor."
India.

*59. P. tenuis, *Hort. Lind.*
Hab.?

? Genus XXXI. PSEUDOPHŒNIX, *Wendl.*

*60. P. Sargenti, *Wendl.*
Florida.

The Palms marked thus (*) are not for distribution.

TRIBE III. CORYPHEÆ.

Leaves fan-shaped, plaited, many-cleft, divisions with the sides inflexed before unfolding. Spadix flowering amongst the leaves; spathes numerous. Flowers hermaphrodite or polygamous, rarely diœcious. Ovary of 3 free or more or less connate carpels. Fruit 1–3-celled and seeded, with distinct or connate terminal or basal styles.

Genus XXXII. CORYPHA, *Linn.*

*61. C. umbraculifera, *Linn.* "Talipot Palm."
S. India & Ceylon.

Genus XXXIII. SABAL, *Adans.*

62. S. Adansoni, *Guerns.* "Dwarf Palmetto."
Southern U. States.

*63. S. cærulescens, *Hort.*
West Indies?

*64. S. glaucescens, *Lodd.*
Trinidad.

*65. S. mauritiæformis, *Griseb. & Wendl.* "Savannah Palm."
Venezuela, Trinidad.

*66. S. Palmetto, *Lodd.* "Cabbage Palmetto." (*Chamærops Palmetto*, Michaux.)
Southern U. States.

67. S. umbraculifera, *Mart.* (*S. Blackburniana.* Kirke.)
West Indies.

Genus XXXIV. CHAMÆROPS, *Linn.*

*68. C. humilis, *Linn.* (*C. elegans*, Hort.)
S. Europe and N. Africa.

Genus XXXV. ACANTHORHIZA, *Wendl.*

69. A. aculeata. *Wendl.* (*Chamærops stauracantha*, Hort. *Trithrinax aculeata*, Liebm.)
Central America,

Genus XXXVI. SERENOA, *Hook. f.*

*70. S. serrulata, *H. f.* "Saw Palmetto." (*Sabal serrulata*, R. & S.)
Southern U. States.

Genus XXXVII. COPERNICIA. *Mart.*

*71. C. cerifera, *Mart.* "Carnauba or Wax Palm."
Brazil.

Genus XXXVIII. LICUALA, *Thunb.*

72. L. elegans, *Blume.*
Sumatra.

73. L. horrida, *Bl.*
Java?

*74. L. peltata. *Roxb.*
Bengal, Assam, Burma, Tenasserim, Andaman Islands.

Genus XXXIX. LIVISTONA. *Br.*

*75. L. australis, *Mart.* (*Corypha australis*, Br.)
Eastern Australia, temperate and tropical.

76. L. chinensis, *Mart.* (*L. mauritiana*, Wall. *Latania borbonica*, Lamk.)
South China.

77. L. Hoogendorphii, *Teysm. & Binn.*
Hab.?

*78. L. humilis, *Br.* (*L. Leichardtii*, F. Muell.)
Tropical Australia.

79. L. olivæformis, *Mart.*
Java.

*80. L. rotundifolia, *Mart.*
Malay Islands, Moluccas, Penang.

81. L. subglobosa, *Mart.*
Java.

Genus XL. RHAPIS, *Linn. f.*

82. R. flabelliformis, *Ait.* (*R. aspera*, Wendl.)
China

Genus XLI. THRINAX, *Linn.*

*83. T. argentea, *Lodd.* "Silver-Thatch Palm."
West Indies.

*84. T. barbadensis, *Lodd.*
Barbados and Guadeloupe.

85. T. excelsa, *Lodd.*
Jamaica.

*86. T. parviflora, *Swartz.* (T. elegans, Hort. Herren.)
West Indies.

*87. T. radiata, *Lodd.* (*T. elegans & T. elegantissima*, Hort.
West Indies.

TRIBE IV. LEPIDOCARYEÆ.

Leaves pinnate or fan-shaped, segments or divisions with the sides reflexed before unfolding. Spadix terminal or flowering amongst the leaves; spathes many, rarely one or few. Flowers hermaphrodite, monœcious or diœcious. Ovary completely or incompletely 3-celled, 3-ovuled. Fruit clothed with reflexed hard shining closely appressed scales; stigmas terminal.—Armed or unarmed palms, chiefly of the old world.

SUBTRIBE I. CALAMEÆ.

Leaves pinnate. Ovary incompletely 3-celled.—Usually climbing armed palms of the old world

Genus XLII. CALAMUS, *Linn.* "Rattan canes."

*88. C. palembanicus, *Blume,*
Sumatra.

Genus XLIII. PLECTOCOMIA, *Mart.*

*89. P. Andersonii.

SUBTRIBE II. RAPHIEÆ.

Leaves pinnate. Ovary completely 3-celled.—African, and tropical American armed or unarmed palms.

Genus XLIV. RAPHIA, *Beauv.*

*90. R. Ruffia, *Mart.*
Madagascar.

*91. R. tædigera,
Cent. America.

SUBTRIBE III. MAURITIEÆ.

Leaves fan-shaped. Ovary completely 3-celled.—Erect palms of the new world.

Genus XLV. MAURITIA. *Linn.*

*92. M. flexuosa, *Linn. f.* "Ita Palm."
Brazil and Guiana

TRIBE V. BORASSEÆ.

Leaves fan-shaped, plaited, many-cleft, divisions with the sides inflexed before unfolding. Spadix flowering amongst the leaves; spathes numerous Flowers diœcious; males minute, clustered in cavities formed between the closely imbricating bracts of the spadix, emerging one by one; females large, scattered along the branches of a very stout spadix Ovary 3-celled, 3-ovuled. Fruit large, 1–3 seeded; stigmas terminal.—Tall robust unarmed palms of the old world.

Genus XLVI BORASSUS, *Linn.*

*93. B. flabelliformis, *Linn.* "Palmyra Palm."
Tropical Africa (cultivated in India).

Genus XLVI. LATANIA. *Comm.*

*94. L. Commersonii, *Linn.* (*L. rubra*, Jacq.)
Mauritius & Bourbon.

*95. L. Loddigesii, *Mart.* (*L. glaucophylla*, Hort.)
Round Island (Mauritius group)

*96. L. Verschaffeltii, *Linn.* (*L. aurea*, Hort.)
Rodriguez Island (Mauritius group)

TRIBE VI. COCOINEÆ.

Leaves pinnate; leaflets with the sides reflexed before unfolding. Spadix flowering amongst the leaves; spathes 2. Flowers monœcious on the same spadix. Ovary 3 rarely 4–6-celled, cells 1-ovuled Fruit 1–rarely 2–or more–celled and–seeded, endocarp marked with as many pits as there are cells to the ovary of which 2 cells are usually suppressed, and the third marks the position of the embryo in the fertile cell.—Armed or unarmed, almost exclusively new world palms.

SUBTRIBE I. BACTRIDEÆ.

Spinous usually slender palms of the new world. Endocarp with 3 pores at or above the middle of the fruit.

Genus XLVIII. BACTRIS, *Jacq.*

*97. B. minor, *Jacq.* "Peach Palm." (*Gulielma speciosa*. Mart.)
W. Indies.

Genus XLIX. DESMONCUS, *Mart.*

*98. D. granatensis, *Hort. Bull.*
New Grenada.

*99. D major, *Cruger.*
Trinidad.

Genus L. Astrocaryum, *G. W. Mey.*

*100. A. filare, *Hort. Bull.*
Hab. ?

101. A. mexicanum, *Liebm.*
Mexico.

102. A. vulgare, *Mart.*
Brazil.

Genus LI. Acrocomia, *Mart.*

103. A. sclerocarpa, *Mart.* "Macca-Fat Palm." "Gru-Gru Palm."
Brazil & W. Indies.

Genus LII. Martinezia, *Ruiz. & Pav.* (*Aiphanes,* Willd.)

104. M. caryotæfolia, *Humb. & Kth.*
New Grenada.

*105. M. disticha, *Hort.* (*M. leucophæa,* Hort.?)
Hab. ?

Subtribe II. Elæideæ.

Unarmed palms of Africa and America, endocarp with 3 pores above the middle of the fruit.

Genus LIII. Elæis, *Jacq*

106. E. guineensis, *Jacq.* "Oil Palm."
West tropical Africa.

Subtribe III. Eucocoineæ.

Unarmed palms of the new world (except *C. nucifera,* which is also of the Old.) Endocarp with 3 or more pores towards the base.

Genus LIV. Diplothemium, *Mart.*

107. D. caudescens, *Mart.* (*Ceroxylon niveum,* Hort. Lind.)
Brazil.

*108. D. sp.

Genus LV. Cocos, *Linn.*

109. C. australis, *Mart.*
S. Brazil.

110. C. botryophora, *Mart.* (*Attalea grandis,* Hort).
Brazil.

*111. C. flexuosa, *Mart.*
Brazil.

112. C. nucifera, *Linn.* "Coco-nut Palm."
Tropics.

*113. C. plumosa, *Lodd.*
Brazil.

*114. C. Romanzoffiana, *Cham.*
S. Brazil.

*115. C. Weddelliana, *Wendl.* (*Glaziova elegantissima,* Mart. *G. Martiana,* Glaz. *Leopoldina pulchra,* Hort.)
Brazil.

Genus LVI Maximiliana, *Mart.*

*116. M. Martiana, *Karst.* (*M. regia,* Mart. *Attalea Marapa,* Wendl.)
N. Brazil & Guiana.

Genus LVII. Attalea, *H.B.K.*

117. A. Cohune, *Mart.* "Cohune nut."
Honduras to Guiana.

The Palms marked thus (*) are not for distribution.

from the soil different elements to those which the Cacao requires. In fact it is used on the same principle as that on which alternative crops are employed. The Guango or *Inga* is as moderate in its demands upon the soil as *Erythrina*, but it spreads too much in proportion to its height. *Erythrina* throws out its branches well above the Cacao trees. Bananas should only be employed for a couple of years after the Cocoa is planted out. They exhaust the soil and harbour damp. In adopting a tree like *Manihot* for shade, the above considerations ought not to be lost sight of.

Climate.—Although Cacao will grow in a hot and very damp climate like Guayaquil or the Atrato Valley, yet it is found in Colombia that it grows best where the temperature (mean) is 26° Centigrade, and where the two dry and two wet seasons are well marked in the year. It is possible or probable too, that a dry season affords a better opportunity of preparing the bean for the market."

OCCASIONAL NOTES.

Cave Earth.—On a recent visit to Vere, I visited the Portland Caves, and brought back some of the Cave Earth, which Mr. Bowrey was good enough to analyse for me. He tells me that it is a mixture of phosphate of lime and sulphate of lime. This, I think, ought to be a very useful manure to apply to Sugar Cane in conjunction with cattle manure. The red Cave Earth appeared to be washed down through cracks in the roof of the Cave, probably resulting from a decomposition of the limestone by the action of rain water, and accumulating by the wash in certain portions of the floor of the interior. The constant deposit of bat-manure on the earth would account for the phosphate.

Deep Well Pumps.—It is remarkable to find water close to the surface in the alluvial soil in Vere in sufficient quantities to give a continual flow from pumps worked by windmills. It appears to me that, though there is not sufficient water at a depth of 30 feet for the purpose of irrigation, an increasing quantity would probably be found at lower depths and even enough to supply the large quantity necessary for irrigation. A series of tube wells driven at intervals with deep-well pumps attached might bring up a flow large enough for irrigation. The immense value of irrigation is evident to anyone who sees the parched look of the canes this year after the continuous drought, and knows what the land will produce with good seasons. At any rate the experiment of a deep well pump would be worth making.

Salinas.—Much of the waste land of the Salinas would seem to be well suited to the growth of the Wattle.

Orange Trees.—When visiting an Estate lately, orange trees were pointed out that had been planted for years, making growth for a short time and then dying off at the head. They presented a most wretched appearance, and scarcely ever bore fruit. More trees were however being planted in new situations in hopes that some at least would thrive. But all attempts at orange cultivation are doomed to failure in such a locality, for the water rose to within a few inches of the surface. Orange trees require perfect drainage, and that is one of the reasons why they do so well on limestone. It was astonishing to see their vitality even with their roots in the water. This was a spot for the cocoanut to flourish and give profitable returns, but the orange needed higher ground with good drainage.

Kola, or Bissy.—There is a great demand in the London market at the present time for Kola. Inferior, mouldy nuts have been selling at two shillings a pound, and even three shillings have been paid. Applications for seed for planting have been received by the Director of Public Gardens from Ceylon, and the planters there are evidently alive to the commercial value of the nuts.

Dr. James Neish called attention to this product in a public lecture delivered at the Jamaica Institute three years ago. The lecture was published and plants were prepared at the Botanic Gardens in anticipation that a demand would have been created by the lecture and the notice of the subject in the press at the time. One planter has with commendable foresight planted out some thousands of seedlings, and, considering the present state of the market, it is considered advisable again to invite attention to the advantages, commercial and dietetic, to be derived from the Bissy. Mr. Prudencio Bravo, chocolate-maker, King Street, Kingston, has been experimenting for the Department for some time in the manufacture of Kola in the form of chocolate, and has now succeeded in making a very agreeable preparation. Dr. Neish's lecture is still to be had at the Institute of Jamaica, price one shilling. A valuable article on the subject has just appeared in the Kew Bulletin for November.

Lace Bark.—At the present rate of destruction this most interesting product of Jamaica will soon be exterminated. Any one who has an opportunity of collecting seeds is earnestly requested to send them to the Director of Public Gardens, by whom all reasonable expenses incurred in gathering them will be paid.

Seeds of Onion and Golden Wattle.—Seeds of both are still available, and information on cultivation appeared in Bulletins 18 & 19. W. F.

FERNS: SYNOPTICAL LIST: II.

Synoptical List, with description of the Ferns and Fern-allies of Jamaica, by G. S. Jenman, Superintendent, Botanical Gardens, Demerara. (continued.)

Genus II. Trichomanes.

Involucres urn-shaped, or occasionally tubular.

a. Fronds small, mouth of the involucres two-lipped.

b. Fronds entire.

c. Fronds under $\frac{1}{4}$in. l. with a solitary terminal sorus.

1. T. setiferum.

cc. Fronds under $\frac{1}{2}$ in. l., sori one to several.

2. T. punctatum.

bb. Fronds entire, or irregularly lacerated, or lobed; $\frac{1}{4}-1$ in. l.

3. T. apodum.

4. T. sphenoides.

bbb. Fronds $\frac{1}{2}-1$ or 2 in. l., lobed or regularly pinnately-parted.

5. T. pusillum.

6. T. reptans.

bbbb. Fronds 1 – 2 in. l., pinnately-parted, or twice-pinnately-parted.

7. T. Kraussii.

aa. Fronds entire or almost entire; edged with circular scales attached by the centre.

8. T. membranaceum.

aaa. Fronds entire or lobed, margins lined by a pellucid streak.

9. T. muscoides.

aaaa. Sori in a copious lateral uniserial row; fronds pinnated (rarely entire or twice-pinnately-parted), often rooting and producing young plants at the end of the fronds.

b. Fertile fronds not contracted.

10. T. pinnatum.

bb. Fertile fronds contracted, of a different form.

11. T. spicatum.

aaaaa. Fronds lobed, pinnately-parted, or pinnate.

b. Fronds lobed.

12. T. sinuosum.

bb. Fronds lobed or pinnately-parted.

13. T. pinnatifidum.

bbb. Fronds pinnately-parted or pinnate.

c. Pinnæ entire.

14. T. crispum.

cc. Pinnæ dentate, lobed, or pinnately-parted.

15. T. lucens.

16. T. crinitum,

17. T. Kaulfussii.

18. T. alatum.

19. T. Bancroftii.

aaaaaa. Fronds many times pinnately-parted.

b. Fronds small or medium size.

20. T. pyxidiferum.

21. T. tenerum.

22. T. trichoideum.

bb. Fronds a span long or over.

23. T. scandens.

24. T. radicans.

25. T. rigidum.

1. *T. setiferum*, Bak.

Fronds abundant, scattered on the thread-like, diffuse rootstock, 1 – 4 li. l., $\frac{1}{2}-2$ li. br., varying in shape from ovate-roundish to narrow, tapering or rounded at base and apex, marked with fine lines, membranous, pellucid, on dark thread-like stalks $\frac{1}{4}-1$ li. l. veins fine close, forked, spreading, midrib more or less distinct to the apex, margins entire, sometimes uneven, of young fronds, hairy;

sorus solitary at the end of the midrib;

involucres immersed to the neck, lips rounded and dark-edged, closed or open, receptacle enclosed or sometimes protruding.

Rare on wet rocks in forests at 5,000 – 6,000 ft. alt. Discovered by Messrs. Nock and Jenman near Morse's Gap, growing with *Antrophyum subsessile*. Both sterile and fertile fronds vary a good deal in form. (It seems to me conspecific with *T. exiguum*, Bedd. of Southern India and Ceylon, which name has priority. G. S. J.).

2. *T. punctatum*, Poir.

Fronds overlapping or scattered on the thread-like, diffuse, hairy rootstock, round or ovate-oblong, the base cordate, rounded or tapering, $\frac{1}{4}-\frac{1}{2}$ in. br. each way, membranous, marked with fine lines, bright rather glossy green, surfaces without hairs, margins of young fronds hairy, even or somewhat uneven, rarely split into partial lobes; veins, close, fan-shaped, midrib disappearing above base

involucres immersed or free, with rounded lips.

Infrequent, on rocks or trees, below 2,000 ft. alt.

The species is best distinguished from those near it by the more rounded form, shorter stalk, clearer green colour, and somewhat thinner substance, though in nearly all these characters it varies a good deal. Some of the very fertile fronds appear to be lobed from the projections of the involucres.

3. *T. apodum*, Hook, and Grev.

Fronds scattered on the thread-like, scurfy, diffuse rootstock, $\frac{1}{4}-\frac{1}{2}$ in. br. each way, on stalks $\frac{1}{4}-\frac{1}{2}$ in. l., rounded, lobed, base cordate, marked with fine lines; veins close, spreading; midrib distinct upwards; margin uneven with hairs at intervals;

involucres with rounded lips, more or less free.

Rare, gathered by Swartz a century ago, from whose specimens in the British Museum my description is taken, but not distinguished by him from the allied species, as to which see Grisebach's Flora of the British West Indies, p. 657, where the identity and synonymy are discussed.

4. *T. sphenoides*, Kze.

Fronds numerous, firm, membranoous, marked with fine lines, $\frac{1}{4}$ – $\frac{3}{4}$ in. l, $\frac{1}{4}$ – $\frac{1}{3}$ in. br., margins entire or more or less freely split into segments, of young fronds hairy; outline, base, and stalk varying much; veins repeatedly forked, fan-shaped, curved from the rudimentary midrib at the base;

sori 1 –12;

involucres with rounded lips, immersed or free, receptacle enclosed or protruding.

Frequent among the lower hills on rocks and banks by rivers or streams. The best character whereby to recognise the species is the splitting of the fronds. *T. reptans*, Syn. Fil. p. 74. *Didymoglossum laceratum*, Fée, Fil. Ant. t. 32. f. 1. *T. linéolatum*, Hook., is the form figured by Fée.

5. *T. pusilum*, *Sw.*

Fronds plentiful, of various forms, oblong, or with margins parallel, forked with projecting divergent lobes at the top, or more or less fiddle-shaped or pinnatiform, $\frac{1}{4}$ - 1 in. l., 1 - 6 li, w., thin, cloudy-green, hairy on margins; venation varying with the form of the frond, a simple midrib running to the top, or into the projections, the veins very fine, mostly forked, spreading;

sori terminal and single on the lobes, or in the simple fronds the tube of the involucres more or less immersed, lips rounded. *Didymoglossum angustifrons*, Fée, Fil. Ant. t. 28; f. 5.

Infrequent, in damp mountain forests. Very variable in form; the broader and narrower states, looked at alone, might well be thought distinct, but they are seen to run one into the other even on the same root-stock. On referring to Swartz's types and his original descriptions in the British Museum, I find that this and the next species, *reptans*, had been transposed in books and herbaria; they are here restored as he used them.

6. *T. reptans*, *Sw.*

Fronds copious, irregular in outline, oblong or lance-shaped, margin wavy, lobed, or pinnately divided to the broad wing of the midrib, $\frac{1}{2}$-2 in. l., $\frac{1}{6}$ $\frac{3}{4}$ in. w, the apex generally abrupt, or in the narrower fronds rounded, the basis tapering to the stalks which are 1-8 li. l., thin and translucent, pale green, without hairs on the surface at any rate in the adult frond, margins hairy; veins open, simple in the smaller and pinnate in the larger lobes, midrib distinct to the apex;

sori few or several on the outer or terminal lobes;

involucres tubular, free or partly immersed, lips conspicuous, rounded.

Var. *quercifolium*, Hook. and Grev.

More uniform and regularly pinnately divided, reduced at the base, segments 1-1$\frac{1}{2}$ li. w., 4-6 li. l.; sori clustered at the top of the fronds.

Abundant on rocks in damp forests at 5,000-6,000 ft. alt., both type and variety very variable in form and cutting, but at the same time well individualised and distinct. The colour is a pale, rather yellowish-green.

7. *T. Krausii*, Hook. & Grev.

Fronds plentiful, forming large patches, oblong or lance-shaped, 1 – 1$\frac{1}{2}$ or 2 in. l., $\frac{1}{3}$ – 1 in. w. base and apex very little narrowed, without hairs on surface at least in the adult form, membranous, light or dark green, margin hairy in the angles, stalks varying from hardly any to $\frac{3}{4}$ in. l, deeply and regularly pinnately divided to the wing of the rachis, or twice-pinnately divided: pinnæ copious $\frac{1}{4}$ – $\frac{1}{2}$ in. l., 1 – 2 or 3 li. w.; veins simple in the lobes;

sori terminal, chiefly on the lobes of the upper part of the frond;

involucres margined, or the base immersed, but the greater part of the tube free, the lips rounded, conspicuous.

Common on the trunks of trees by rivers among the lower hills up to 1,000 ft. alt.. This is the most compound of all the foregoing species. It may be readily distinguished from its allies by its larger size, and pinnæ, regular and mostly toothed or lobed. *Hemiphlebium pinnatifidum*, V. D. B.

8. *T. membranaceum*, L.

Fronds overlapping in growth, variable and diverse in form, 1-2 in. l. from a line to 1 or 2 in. w. dark green, without hairs, firm but membranaceous, the margin entire or variously broken, and fringed with minute, circular, membranaceous scales attached by their centres; stalks short or hardly any; veins fine, close, repeatedly forked, fan-shaped;

sori along the outer margin;

involucres tubular, more or less immersed, the mouth with two very small lips or none.

Common on wet banks and rocks by rivers and streams below 3,000 feet alt., spreading and forming large patches.

The curious fringe of scales is continuous in the barren round fronds; in the fertile it is placed at slight intervals.

9. *T. muscoides*, Sw.

Fronds copious, variable in shape and lobing, tapering at the base, rounded at the apex, sometimes lobed or tapering, the margins wavy, or more or less deeply lobed; thin and translucent, without hairs; stalks varying from hardly any to $\frac{1}{2}$ in. l., veins pinnate, open and few, erect-spreading, branched, connected by a marginal streak;

sori confined to the lobes of the outer part of the frond;

involucres immersed to the mouth, which is much expanded and indistinctly two-lipped; receptacles protruding or not.

Var. *major*.

Fronds pendent, 2-3 in. l., $\frac{1}{4}$ - $\frac{3}{4}$ in. w. with broadly rounded lobes along the sides, plain and tapering at the base to a stalk $\frac{1}{2}$ – 1 in. l., very pale green, thin and translucent.

Var. *cordifolium.*

Fronds cordate—rounded, rarely oval or oblong, $\frac{1}{4}$-$\frac{3}{4}$ in. diameter, mostly entire. *Didymoglossum cordifolium,* Fée, Fil. Ant., t. 28., f. 4.

Var. minor.

Fronds lance-shaped or oblong, 1 – 3 or 4 li. l., entire, with a single terminal sorus.

Common among the lower hills in damp shade growing on the stems of trees, tree ferns, and rocks; very variable but easily recognised in any of its forms by the marginal streak. The large variety grows on the trunks of *Cyathea elegans,* and is most beautifully thin, translucent, and pale-green.

10. *T. pinnatum,* Hedw.

Stalks tufted, 2—8 in. l., narrowly margined above, fronds pinnate or pinnately divided, membranous, naked, variable in size and in the number of the pinnæ, 3—6 in. l. or more, 2-3 or 4 in. br., pinnæ finely toothed 1 – 2 in. l., $\frac{1}{4}$ – $\frac{1}{3}$ in. br., spreading, upper decurrent on the inferior base, the superior side free, terminal pinna like lateral, or changed into a long rooting whip-like extension; veins very close, simple or forked;

sori very copious, along both margins and descending the decurrent base;

involucres small, free, stalked, close, cylindrical, the mouth blunt, or rather contracted or dentate; receptacles protruding.—*Neuromanes Hedwigii,* V.D.B.

var. *T. floribundum,* H.B.K.

Much larger; pinnæ 6—9 in. l., $\frac{1}{2}$ in. w., the terminal one sometimes changed and rooting.—*T. pennatum,*Klf.

var. T. Vittaria, D.C.

Barren fronds pinnate, prostrate; fertile entire, lance-shaped, erect, 1-2 ft. l., $1\frac{1}{2}$ in. w.

The only specimens of this I have seen ascribed to Jamaica are in the Kew Herbarium. These belong to the type, but Van Den Bosch also ascribes the var. *floribundum* to Jamaica. Both, I think, require confirmation.

11. *T. spicatum,* Hedw.

Sterile fronds, deeply pinnately—divided, 3—6 in. l., $1\frac{1}{4}$—$1\frac{1}{2}$ in. br. on wiry stalks that are about 1 in. l.; fertile fronds simple, rachi-form, barely $\frac{1}{4}$ in. w., 2-5 in. l. on stalks of equal length;

sori very close;

involucres free to the base, oblique, the mouth blunt or two-toothed; rachis devoid of connecting membrane to the involucres, or with only a very slight marginal wing; receptacles protruding. *Feea polypodina,* Bory.

"Rare in the Portland woods, near Golden Valley, July, 1843." Purdie. "Retreat plantation, 3,500 ft., John Crow Hill, near Bath, in rivulet courses, stiff yellow clay, moist and shaded." There is no collector's name to the last note, attached to Jamaica specimens in the British Museum, but it was probably collected by Wilson, formerly Curator of theBath Garden. A specimen I possess myself was gathered near Bath, and the species has since been found, I believe, in Portland by Mr. Syme, late of the Botanical Department. In *T. elegans,* Rudge, of Trinidad and Guiana, the involucres are connected their full depth by membrane.

12. *T. sinuosum,* Rich.

Stalks $\frac{1}{2}$-$1\frac{1}{2}$ in. l., scattered on a thread-like free-creeping rootstock; fronds pendent, thin, membranous, pellucid, pale-green slightly hairy on the ribs and margins, the hairs of the latter star-shaped, 3-9 in. l., $\frac{1}{2}$-1 in. w., cut to the broad wing of the rachis into short angular oblong lobes, which are $1\frac{1}{2}$-3 li. w.; veins lax, pinnate in the larger lobes, branches few simple, very oblique;

sori 1-3 on the outer part of the lobes, which are slightly and obtusely toothed;

involucres immersed to the rim of the broadly dilated mouth, receptacles generally protruding.

Infrequent, in moist forests, on the stems of tree-ferns, 1000-2000 ft. alt., and though sparse in quantity, widely spread through the island. In the eastern parishes it seems to grow only on the trunks of *Cyathea elegans.* The fronds are finger-shaped, one to two sori to a lobe, rarely more; colour very pale, and substance so thin that the veins show as a conspicuous feature.

13 *T. pinnatifidum,* V. D. B.

Stalks on a slender wiry rootstock, 1-2 in l, winged upwards, fronds oblong, or oblong-lance-shaped, widest at or above the base, thin and membranous, pellucid, pale or gray-green, 2-4 in. l., $1\text{-}1\frac{1}{2}$ in. br., pinnately-divided, the rachis broadly-winged; pinnæ oblong, spreading, $\frac{1}{2}$-1 in. l., blunt, lobed on each side as is also the attenuated top of the frond; veins pinnate, branches 4-6 to a side, rather distant;

sori 1—3 to a pinna, on the superior side, sub-axillary, or on the lobes of the top of the fronds;

involucres fully immersed to the broadly dilated mouth.

Collected by March, whose specimens are in the Kew Herbarium, but have no specific locality. It very closely resembles the preceding in texture and colour, but in form is broader and more deeply lobed, and the sori are in, or near, the axils of the lobes of the pinnæ, or in the smaller lobes more terminal.

14. *T. crispum,* L.

Stalks 2-6 in. l., rusty tomentose, not margined, more or less tufted on a strong, fasciculate, tomentose, shortly creeping rootstock; fronds 6-10 in. l., $1\frac{1}{2}$-3 in. w., oblong-lance-shaped, broadest near the base, more or less hairy, with rusty coloured velvety hairs on the rachis, membranous but firm; pinnately divided, the rachis very slightly margined with membrane; pinnæ close, sometimes overlapping, horizontal, oblong, $1\text{-}1\frac{1}{2}$ in. l., $\frac{1}{4}$-$\frac{1}{3}$ in. w.; margins crisped and with rounded teeth; veins repeatedly forked;

sori several, on the outer part of (usually) the upper pinnæ;

involucres cylindrical, immersed, the mouth slightly two-lipped, or more expanded, and the corners somewhat projecting; receptacles sometimes protruding and sometimes not.

No. 21. JANUARY, 1891.

BULLETIN

OF THE

BOTANICAL DEPARTMENT,

JAMAICA.

CONTENTS:

PRICE—Two-pence.

JAMAICA:
GOVERNMENT PRINTING ESTABLISHMENT, 79 DUKE STREET, KINGSTON.
1891.

AGRICULTURAL SHOW.

In the Bulletin for November, 1888, attention was directed to the importance to small settlers of such a competition as the Committee of the Agricultural Show is anxious to arouse amongst them; and an appeal was made to the Clergy, Schoolmasters, and others interested in their welfare to do what they could in inducing them to send up Exhibits. At the Shows in December 1888 and 1889, the number of exhibits by small settlers had largely increased, and it is hoped that the Show to be held on 28th February next during the Exhibition will be much more successful in this respect, supplementing the exhibit of various products in the Exhibition Building.

The Committee will grant free tickets of admission to all those who will undertake to bring in the exhibits mentioned in the subjoined list, if they enter them on the regular Entry Forms and return the same to the Secretary, Agricultural Show, Kingston P. O.:—

Class.		Prizes. 1st. £	s.	d.	2nd. £	s.	d.
	SUGAR AND RUM.						
105	Best Sample of Sugar—1 barrel	4	0	0		...	
106	Vacuum Pan Sugar, white 25lbs.	1	0	0		...	
107	ditto ditto ditto Yellow 25lbs.	1	0	0		...	
108	Centrifugal ditto 25lbs.	1	0	0		...	
109	Muscovado ditto 25lbs.	1	0	0		...	
110	Small Settlers 25lbs.	2	0	0		...	
	Note—The Polariscope test to be used in judging Sugars, in case of dispute.						
111	Best Sample of Rum, 1890-91, 2 quarts	2	0	0		...	
	COFFEE, PIMENTO, CACAO, &c.						
112	Best Sample of Jamaica Coffee, 100lbs. ...	4	0	0		...	
113	Coffee grown and prepared at elevation of 2,000 feet and upwards, 10 quarts	1	0	0	0	10	0
114	Ditto at an elevation of under 2,000 feet, 10 quarts ...	1	0	0	0	10	0
115	Ditto grown and prepared by small settlers, 10 quarts ...	1	0	0	0	10	0
116	Cured Pimento, 2 quarts	0	10	0	0	5	0
117	Cacao pods, not less than 12	0	10	0	0	5	0
118	Kola or Bissy Pods, not less than 12	0	10	0	0	5	0
119	Best Sample of Cured Cacao, Jamaica grown, 100lbs. ...	4	0	0		...	
120	Cacao, grown and prepared by small settlers, 25lbs. ...	1	0	0	0	10	0
	Note—All samples of above exhibits must have been grown and manufactured by the Exhibitor.						
121	Chocolate prepared for use, 2lbs.	0	10	0	0	5	0
122	Kola prepared for use, 2lbs	0	10	0		...	
123	Sample Tea, 1lb.	0	10	0		...	
124	Cinchona, best sample of Bark	0	10	0		...	
	MINOR PRODUCTS OF NATIVE GROWTH OR MANUFACTURE.						
125	Maize or Indian Corn, not less than 50 ears ...	0	10	0	0	5	0
126	Cornmeal (Native grown and prepared) six quarts ...	0	10	0	0	5	0
127	Essential Oils—Best complete Exhibit of not less than two of any of the following, viz: 1. Pimento Seed Oil; 2. Pimento Leaf Oil; 3. Lemon Grass Oil; 4. Seville Orange Oil; 5. Lemon Oil; 6. Sweet Orange Oil; 7. Juniper Cedar Oil; 8. Blue Gum Oil; 9. Moringa Oil; 10. Cashew Nut Oil	1	0	0		...	
128	Prepared Dry Ginger, not less than 10lbs ...	0	10	0	0	5	0
129	Nutmegs cured and ready for market, not less than 3lbs. ...	0	10	0		...	
130	Sarsaparilla, not less than 5lbs.	0	10	0	0	5	0
131	Cocoanut Oil, not less than 2 quarts	0	5	0	0	2	6
132	Castor Oil, ditto ditto	0	5	0	0	2	6
133	Pindar Nut Oil, not less than 1 pint	0	5	0	0	2	6
134	Cocoa Oil, ditto ditto	0	5	0	0	2	6
135	Meals—Complete Exhibit of not less than two of any of the following, viz: 1. Cassaava Meal, not less than 10lbs.; 2. Arrowroot ditto ditto; 3. Banana Meal ditto ditto; 4. Plantain Meal ditto ditto; 5. Breadfruit Meal ditto ditto	0	10	0		...	

Class.		Prizes. 1st. £ s. d.	2nd. £ s. d.
136	Starches, Cassava—complete exhibit of not less than two of any of the following samples, to be not less than 10lbs; Cassava, Negro Yam, White Yam, Coco, or Sweet Potato	0 10 0	...
137	Tapioca, not less than 10lbs.	0 10 0	...
138	Brl. or box of Oranges packed for exportation	0 16 0	0 8 0
139	Banana, not less than 5 Bunches	1 0 0	0 10 0
140	Oranges—Exhibit not less than 100	0 10 0	0 5 0
141	Limes—Exhibit not less than 200	0 5 0	0 2 6
142	Lemons—Exhibit not less than 100	0 5 0	0 2 6
143	Citrons—Exhibit not less than 50	0 5 0	...
144	Pine Apples—Collection not less than 6	1 0 0	0 10 0
145	Collection of any fruits, 6 varieties	0 10 0	...
146	General collection of Vegetables, 6 varieties	0 10 0	0 5 0
147	Yam, 10lbs.	0 10 0	0 5 0
148	Sweet Potatoes, 1 bushel	0 10 0	0 5 0
149	Irish Potatoes, 1 bushel	1 10 0	...
150	Best sample of Jamaica Tobacco cured, 25lbs.	1 0 0	...
151	Cigars, made of Jamaica Tobacco, 3lbs.	1 0 0	0 10 0
152	Best Basket 12 Fowls' Eggs	0 5 0	...
153	Fresh Butter, 1lb.	0 10 0	...
154	Mountain Butter, 2lbs.	0 10 0	...
155	Salted Butter, 2lbs.	0 10 0	...
156	Preserved Fish, 15lbs.	0 10 0	0 5 0
157	Salted Beef, 10lbs.	0 10 0	0 5 0
158	Bacon, 6lbs.	0 10 0	0 5 0
159	Honey, 1 gallon	0 10 0	0 5 0
160	Wax, 10lbs.	0 10 0	0 5 0
161	Vinegar, 1 gallon	0 5 0	0 2 6
162	Lime Juice, 1 gallon, *prepared for export*	0 7 6	...
163	Lime Robe. 2lbs.	0 5 0	...
164	Cayenne Pepper, 1 pint	0 5 0	0 2 6
165	Cassareep, 2 quarts	1 0 0	...
166	Annatto, 10lbs.	0 5 0	...
167	Pickles, not less than four varieties	0 5 0	...
168	Syrups, from native fruits, 2 varieties	0 10 0	0 5 0
169	Jellies and preserved Jamaica Fruits, not less than 2 varieties, 2lbs. each	0 10 0	0 5 0
170	Fibre Plants, 6 varieties	1 0 0	...
171	Commercial samples of manufactured Fibre, not less than 60lbs., 6 samples	1 0 0	...
172	Mule Cart	1 10 0	1 0 0
173	Wain	1 10 0	1 0 0
174	Dray	1 10 0	1 0 0
175	Wheel barrow	0 10 0	0 5 0
176	Hogshead	0 10 0	0 5 0
177	Puncheon	0 10 0	0 5 0
178	Barrel	0 5 0	0 2 6
179	Tub	0 5 0	0 2 6
180	Ox-Bows, half dozen	0 10 0	0 5 0
181	Yoke	0 10 0	0 5 0
182	Field Gate	0 15 0	0 10 0
183	Open Baskets, 3 sizes	0 6 0	0 3 0
184	Dozen Walking Sticks, 6 varieties	0 6 0	0 3 0
185	Hats, Jipijapa Straw, 3 samples	0 10 0	0 5 0
186	Hats, any other description	0 5 0	0 2 6
187	Hampers, pair	0 5 0	0 2 6
188	Truss of Hay	0 10 0	...
189	Native made Oil, or Cattle-feed Cake, 25lbs.	1 0 0	...
190	Native made Artificial Manure, 1 cwt.	1 0 0	...

Note.—No prize will be awarded in any class unless there are at least two exhibits in same.

Note.—The sum of One Shilling will be allowed to unsuccessful exhibitors in the Minor Product Class towards defraying expenses.

JAMAICA INDIA RUBBER.

The subject was discussed in Bulletin No. 10. During the past year more of the milk was collected for the Department through the kindness of Mr. Pengelly, and despatched to Kew. The following letter states the result of examination by Messrs. Silver, the great manufacturers of India Rubber.

I have made some experiments to determine the best mode of coagulating the caoutchouc when fresh. I found that acetic acid which is useful in collecting some rubbers, had no appreciable effect; that the caoutchouc would slowly coagulate with the heat of the hands; and quickly and effectually with fire heat. Mr. Bowrey, Island Chemist, has experimented with the liquor collected by Mr. Pengelley, and kept in bottle for some months. He found that the addition of alcohol at once caused complete coagulation to take place; but he arrived at the same conclusion as myself that the best method was to heat all that had been collected during one day in a pot over a fire. Careful watching is necessary in order to remove the rubber, as soon as coagulation is complete, to prevent burning; and probably it would be well to add water as coagulation takes place. The rubber should be well washed in water after taking from the pot.

W. F.

3, York Gate, Regents Park, N. W.,
24th October, 1890.

Dear Mr. Morris,

I attach at foot a copy of the Report received from Silvertown upon the milk of the *Forsteronia floribunda*, which is accompanied by the following remark :—"The results are satisfactory, samples enclosed, estimate of market value of the rubber obtained from this milk 3s. 2d. per pound."

Yours, etc.,
(Sgd.) S. W. Silver.

Report.

The india-rubber had in this case coagulated similarly to the sample reported on October 17th, 1888. The yield of rubber was a little over 2 oz. from 3 bottles, which contained about one quart. This is very small compared with what was previously found, viz., 22 oz. In the writer's opinion, however, there is no cause to regret so small a yield as this, for it is not improbable that the time of collecting as well as the condition of the plant, may help to explain this difference.

The favourable opinion previously expressed on this rubber is fully supported by what was obtained in the present case.

Considering how easy it is to obtain rubber from this milk and the disadvantage of keeping the same in an offensive and putrescent liquid, steps should be adopted to recover the rubber on the spot.

Samples enclosed of washed and vulcanized rubber with a few small pieces for testing the strength and thorough vulcanization of the product.

Silvertown, October, 1890.

CINCHONA BARK PROSPECTS.

The following letters have been received from Kew, and are here published, as the information they give of the prospects of the Cinchona Bark Market may be of interest to Cinchona Planters in Jamaica.

Copy.

c/o S. Rucker & Co.
12, Great Tower Street, E. C.,
3rd November, 1890.

Dear Sir,

I am in receipt of your favour of this day's date, enquiring about Cinchona propects. In London the statistical position is better as these figures will show, viz:—

Landings.

From 1st January to 31st October.

1890.	1889.	1888.
48,563 packages.	55,964 packages.	57,127 packages.

Deliveries.

From 1st January to 31st October.

1890.	1889.	1888.
48,563 packages.	49,662 packges.	59,404 packages.

Stocks.

First of November in each year.

1890.	1889.	1888.
52,631 packages.	63,105 packages.	57,237 packages.

Last month the landings were 3,928 packages, and the deliveries 4,795 packages, an improvement which if maintained would soon increase the value of Bark. Unfortunately we have not only to reckon with the London market now, as nearly all the Java bark is sold in Amsterdam, and as you know the output from Java keeps increasing. The falling off in the supplies from Ceylon has been quite neutralized by the exports from Java. I do not see how any rapid improvement can take place in view of these increasing exports of fine bark from Java, but that there will be a slow improvement in spite of these I still think as the supplies of bark put on the market now are to my mind insufficient to produce the quantity of quinine required for the world's consumption. Meantime it is to be hoped that some absorption of the surplus stock of quinine is taking place. It seems unlikely in view of these facts to expect any movement of importance in the bark and quinine trade (unless some new factor intervenes) within the next year.

I shall be very interested to hear some particulars of the Jamaica plantations if you will kindly furnish me with them on your return.

I have &c.,

(Sgd.) John Hamilton,

D. Morris, Esq.

Copy. 21 Mincing Lane, E.C., 3rd November, 1890.

Sir,

We beg to acknowledge the receipt your letter of the 3rd November.

We are pleased to hear of the cultivation of bark by private planters in Jamaica, and hope some day that the prices this market will pay them for their consigments will be much more satisfactory than at present.

We do not see that the outlook for the year 1891 will be better than this one.

In our opinion the unit of quinino will rulo from 1½d. to 2d. for the next fourteen months.

The immediate future of Cinchona is not reassuring.

Thanking you for your letter. We are, &c.,

(Sgd.) Jenkin & Phillips.

Mr. D. Morris.

ORANGES: CURING AND PACKING. ORANGE WINE.

The following extracts are taken from a Treatise on Citrus Culture in California by Mr. B. M. Lelong, presented to the Department by Capt. Forwood.

Enquiries are sometimes made about the manufacture of Orange Wine, and the recipe here given has been successfully tried in Jamaica.

Curing and Packing.

Picking Oranges.—The tree should never be picked clean; only the ripe fruit should first be picked, thus lightening up the trees. The clean, bright colored, smooth, fine skin, and firm oranges will always command the best prices.

Orange Curing.—The fruit should be handled with care. It is better to stem-cut than to pull the orange, as in pulling there is danger of tearing the skin. The fruit should not be packed fresh from the tree, as when packed it will heat and sweat in the boxes at an ordinary temperature, and as the entire contents in the box becomes damp, there is great danger from rot and decay. The fruit should be picked in boxes and left under the tree three or four days, to allow the rind of the fruit to shrink and to lose the surplus moisture in the rind. Another way is to place them in heaps in a dry room. Unless the weather is very cool they go through a natural sweat, in which the surplus moisture escapes and the rind becomes tough and pliable, many unseen imperfections, such as slight bruises, etc., will develop into spots and permit a more certain selection of the perfect fruit for market. When the weather is too cool the oranges do not sweat naturally; they are then covered with blankets, etc. During the sweating process the fruit should be carefully examined from time to time; the doors should always be kept shut, and a current of air should not be allowed to pass through the room. In three or four days a slightly sticky appearance will be noticed on the rind; then the fruit is wiped dry and put into boxes, filling them half full, and are left in the room until dry; then they are ready for packing. They should be in such a condition that when they are packed they will not become loose, so that every time the car shakes they will knock one against the other; this is the great secret of loss in fruit, especially when shipped to the eastern market.

Points in Packing.—The fruit should be carefully assorted as to size and color. Small and large oranges should never be put into the same box. The wrapper should be careful to reject every bruised or otherwise injured orange. The packer should be careful not to put different varieties in the same box in packing. The oranges should be placed one by one, closely together in layers, so that there can be no sliding or rolling of the fruit in the box. The top layer should project not less than one half inch nor more than three quarter of an inch above the side of the box, so that the top, when nailed on, should hold the layers firmly in their places even after there has been some shrinkage of the fruit.

Wrapping.—The fruit paper used for wrapping should contain as little oil as possible so that it will readily absorb and throw off moisture. Wrapping oranges is regarded by many as being useless and unnecessary. Experience has taught the orange growers in the last few years that it is better in every way to wrap the fruit, for it carries better, especially when the fruit is to be transported a considerable distance by rail.

Size of an Orange Box.—The standard size orange box is twelve inches by twelve, by twenty-six and a half, outside measurement, with a partition exactly in the middle. They should be made of light and well seasoned material, neatly and strongly put together.

Standard Counts.—The standard counts to the box are eighty, ninety-six, one hundred and twelve, one hundred and twenty-eight, one hundred and forty-six, one hundred and sixty-four, ono hundred and seventy-six, two hundred, two hundred and twenty-six, two hundred and fifty, and two hundred and eighty-two. When the fruit is graded to these sizes and properly packed in regular layers, they fit and fill up the box in the best possible manner. The number of oranges and brand should be marked on each box. This is important as buyers always prefer to know just how many oranges they are buying. The number contained in the standard box also gives an exact idea of the size of the fruit.

Orange Wine.

Take one part orange juice well strained; one part water; three pounds sugar per gallon. Any kind of sugar will do, and the darker the sugar the richer will be the color of the wine. For each ten gallons put up keep about one gallon of the same for refilling the casks during fermentation. Lay casks on the side, fill full, and leave bung open. Do not let it be exposed to much cold. Fill up the casks very day, from the quantity kept out, as the scum is thrown off, and watch closely until the wine passess through the stage of alcoholic fermentation. This will usually require from ten to twenty days, or longer if the weather is cool, and can easily be determined by scum ceasing to rise, and the cessation of brisk fermentation. When it arrives at this stage, place the bung in loosely. Watch closely for a few days, and as active fermentation ceases, put the bung in fast. Let it stand two months, then rack off carefully into clean casks. If perfectly clear, seal and let it stand six months, when it may be bottled. If not clear, it should be racked off a second time in two months after the first time, and sealed for six months before bottling. Be sure your casks are full, for contact with the air will cause the wine to pass into acetic fermentation. Considerable wine from oranges has been manufactured in Florida, and the demand for it has been very good at $5 per gallon. The wine continues to improve with age.

FIBRES AND FIBRE PLANTS.

A case of fibres has been received by the Botanical Department from Kew Gardens for the Jamaica Exhibition. It is a very fine and complete set of commercial fibres as they come into the London market, obtained by Mr. Morris from the celebrated Fibre Brokers, Messrs. Ide & Christie.

Mr. Morris writes :—" Some of the fibres now sent out are quite new. For instance the 'China Jute' and the 'Manila Aloe Fibre' were not represented until quite lately in our Museums; and no doubt you will be interested to see the 'Quilot' variety of Manila hemp about which you wrote to us last year."

Messrs. Ide & Christie are kindly sending their Trade Circulars every month, so that the market prices will be known to date.

The following is a list of these fibres. The numbers and common names are those attached by the Brokers; the scientific names were added at Kew; the rest of the information is given, as it may be convenient to have it at hand.

Abutilon Avicennæ, Gaertn.

China Jute, No. 16.

Native of N. Asia, extending to S. Europe and N. America.

An annual herb, with yellow petals and rounded leaves with long points. It belongs to the same family as Hibiscus (*Malvaceæ*).

Great attention is being paid to the cultivation of this plant in the United States, and the fibre produced there is called American Jute. It would probably do well on all the higher grounds in Jamaica. Abundance of water is necessary for retting, which might also be utilised for running the machinery. "It is stated that an acre of ground will produce 5 tons of stalk, and about 20 per cent. of pure fibre is obtained after preparation."—(*Christy.*)

"*China Jute,* in sympathy with hard Hemps, is dearer, and 17s. [per cwt.] paid in public sale for a choice parcel of small bales: private sales have been made as low as 14s. 6d.; tendency is to higher prices." "15th Dec.—All importers have cleared out, and the last figure marked was 16s. 9d. A large business has been done, and dealers now demand 20s."—*(Ide & Christie's Circular.)*

Agave heteracantha, Zucc.

Mexican Fibre. No. 5.

Native of Mexico.

An agave with short leaves (1 ft. to 1½ ft.), the edges of which have a horny border of the same texture as the spines.

It grows in great abundance on rocky limestone.

"The fibre is quite unique as a vegetable substitute for animal bristles, and is used in the manufacture of cheap brushes of all sorts. The range of value of late years has been from £22 per ton to £50 per ton."—(Ide and Christie in Kew Bulletin).

"*Mexican Fibre* —15th Dec. Dull. Extra long......32s. Fair......29s. Common......28s.
(*Ide & Christie's Circular.*)

Agave rigida, Mill., var. Sisalana, Perr.

Sisal Hemp, No. 23.

Native of Central America, naturalized in Florida.

An agave with glaucous leaves, with or without prickles.

Dry, rocky soil suits this plant best. Information on Sisal Hemp will be found in Bulletin No. 15.

Retting is not required for the Agaves. Sisal Hemp resists the action of wet, and is therefore useful for cables, rigging-cordage, &c.

"*Sisal Hemp.*—15th Nov. Smartly up £6 to £8 per ton, but buyers looking on.

				1st Nov., 1890.	1889.	1888.	1887.
London	Deliveries, Jan.-Oct., 1890	150 tons	Stock	38	12	19	nil tons.
	Imports "	200	Spot value	33s.			
			Arrival "	32s.			

		Imports.			Stock, 1st Nov.	
Liverpool	Jan.-Oct.,	1890.	1889.	1888.	1890.	1889.
	bales	15,323	1,383	8,642	2,266	151

Messrs. Crocker's American Statistics, 1st Nov.		1890.	1889.	1888.
Imported into the United States from January 1st to date	Bales	186,542	188,844	168,190
Stock in Importers and Speculators hands in New York and Boston, Oct. 31	"	2,900	8,246	7,225

Exported to Europe and Canada from January 1st to date	Bales	16,730	3,826	9,682
Stock on hand, January 1st, Importers and Speculators	"	10,594	4,796	7,600
Deliveries since January 1st, New York and Boston ...	"	177,506	181,568	158,883
" past 30 days	"	23,190	17,607	21,584
Deliveries for Consumption for years ...	"	—	227,821	199,730
Prices current, Oct. 31	Per Pound	5½c. nom.	9⅛a9¼c.	8c.

Market very strong. Holders for both spot and shipment have been withdrawn from the market."—*(Ide & Christie's Circular.)*

AGAVE VIVIPARA, Linn.

Aloe Fibre (Bombay) No. 25.

Native of Central America.

An agave with a short stem, on which (in rich soil) viviparous buds are produced: the leaves are erect. It grows on dry stony soil.

It is doubtful what plant produces *Manila Aloe Fibre*, No. 18.

"*Aloe Fibre*.—Manila—All stocks cleared—16s. to 23s. Nothing offered distant. Bombay is enquired for, but holders having raised limits £3 to £4 per ton, no transactions have taken place.

Stock in Liverpool: Bombay, 1st Nov., 1890 6,910 bales."—*(Ide & Christie's Circular.)*

ALOE FIBRE. See *Agave vivipara*.

ATTALEA FUNIFERA, Mart.

Bahia Piassava Fibre, No. 8.

Native of Brazil.

The Piassava is a lofty palm, with large, pinnate leaves. The genus Attalea is distinguished by the nuts containing 3 cells with a seed in each. The "Coquilla Nuts" are very hard, and are turned for handles of umbrellas, &c.

The fibre is derived from the decay of the spathe which enclosed the young leaves. It is used for ropes, brooms, &c.

"Bahia *Piassava*.—We have received from Bahia, under date 9th October, the following:—Piassava.—Owing to high prices demanded by sellers and poor quality there has not been much doing, but barely good has fetched 5$250 to 4$400, and medium 4$500 per 15 kilos The sales are estimated at about 220 ton. Market very firm, and Stocks about 300 tons

Prime straight clean	50s. to 55s	Good fair	45s to 50s.
Ordinary	35s. to 38s.	Low to common	35s. to 38s"

(Ide and Christie's Circular).

BŒHMERIA NIVEA, Hook & Arn.

China grass. No. 30.

Rhea fibre ribbons from India. No. 31.

Prepared Rhea fibre (Indian prepared.) No. 32.

Prepared Ramie (Intermediate stage.) No 33.

Prepared Ramie (Final stage, 'Sliver'.) No. 34.

Native of Southern Asia.

The plant belongs to the nettle tribe (*Urticaceæ*,) and grows best in rich, fertile soil with plenty of water.

The fibre, obtained from the young shoots is one of the strongest and most beautiful. "It is glossy, tough and lasting, combining to some extent the appearance of silk with the strength of flax." (Mueller.) No machine or process has yet been devised by which the fibre may be extracted easily and cheaply. The fibre is contained in the bark which surround a hard woody core. It is easy enough to strip off the bark in "ribbons", but a resinous substance becomes hard, and complicates the process of extraction. "In 1871 a reward of £5,000 was offered by the Indian Government for a good extracting machine for this fibre; but although several competitors came forward, the prize was awarded to no one." (Watt.) There were trial competitions carried on at the Paris Exhibition, but with no satisfactory result.

"*China Grass*.—Spot values 31s. to 35s.; little available.

"*Rhea*.—Stocks exhausted." [In September: 17s. 6d. the quotation."]

(Ide and Christie's Circular.)

CANNABIS SATIVA, Linn.

Italian Hemp, No. 20.

Russian Hemp, No. 21.

Russian Hemp Yarn, No. 22.

Native of Asia.

The Hemp plant is an annual growing to a hight of 4 to 10 feet. It belongs to the Nettle family (*Urticaceæ*.)

It is possessed of narcotic properties, and in India the dried plant is smoked under the name of Gunjah, and pounded in water to make a drink under the name of Bhang.

A resin exudes from the plant, and is known as Churras. In small quantities it produces excitement, and in increasing and continued doses, delirium, catalepsy and insanity.

The fruit (commonly known as hemp-seed) contains a single oily seed, which yields on compression the well known hemp-oil.

The bark contains the fibre which makes the plant so valuable. Good well drained, dampish soil is required for its cultivation. Russia and Poland produce very large quantities, but the Italian is considered superior. To produce the best fibre the seed is sown close, which prevents branching.

" *Hemp Russian* very quiet; demand slack.

Values.—Petersburg, Clean	18s to 19s	Outshot	none	Half-clean	none
Riga, NFSPRH	29s " 30s	O	28s	P	27s
PRH	22s	RH	20s	Molotschanka	21s
Kongsberg, Clean	...	...	17s		
Outshot	none	Half clean	15s		

Stocks, 1st Nov., 1890	440 tons	Delivered, Jan.-Oct	1890.	1889.
" " 1889	500 "		2500	2600 tons.

Yarns much less doing, sellers firm.

1st Bolt Rope 36s 1st sort 22s 2nd 17s 3rd 11s to 13s

Italian.—A large business on the Continent, here small.

G, spot	33s	c. i. f. Liverpool	31s 0d
PC "	30s to 31s	" "	29s 0d
Dressed	40s " 52s	toppets	25s to 35s"

(*Ide and Christie's Circular.*)

CHAMÆROPS HUMILIS, Linn.

Green curled Fibre, No. 10.
Black curled Fibre, No. 11.
Native of South Europe, North Africa, and Southwest Asia.

The Dwarf Fan Palm is an ornamental plant. Its leaves are used for making hats, baskets, etc., and also for thatching.

A fibre somewhat resembling horsehair is made from the leaves.

"*Black Curled.*—Firm; Black 12s, Green 7s." (*Ide & Christie's Circular*).

CHINA GRASS.—See *Boehmeria nivea.*

COCOS NUCIFERA, Linn.

Cochin Coir, No. 35.
Ceylon Coir. No. 36.
Cochin Coir Yarn. No. 37.
Ceylon Coir Yarn. No. 38.
Cochin Coir Rope. No. 39.
Ceylon Bristle Fibre. No. 40.
Native of the Tropics.

The Coco-Nut Palm produces a large fruit, the outer husk of which yields the Coir fibre.

" *Coir Goods.*

Coir Yarn.—Auctions since our last have been held on 17th and 31st ulto. and 14th inst. the quantities exposed being 1,450 tons of Cochin and 300 tons of Ceylon imports. Although the attendance of buyers throughout the month has been but moderate, a steady demand has been maintained, the bulk changing hands, at prices showing no particular alteration from last quotations, the figures realized at the last series being the best. Good Cochin roping bales continue scarce, the few small parcels exposed finding ready buyers. Common to good medium Ceylon descriptions have found a ready sale; good qualities irregular.

Coir Fibre.—Cochin is unprecedently scarce, the very few lots now in second hands held for extreme prices. Ceylon continues in abundance, no change in value.

Coir Rope remains quiet, the high quotations from the other side stopping forward business.

Spot values are as follows:

Coir Yarn—	
Common to good Cochin Roping Dholls	£12 10s to £17 0s
Common to good " " Bales	£13 0s " £18 0s
Common to fair " Weaving "	£14 0s " £21 0s
Fair to good " " "	£21 0s " £26 0s
Good to extra " " "	£27 0s " £36 0s
Common to fair Ceylon Dholls and Ballots	£14 10s " £18 0s
Fair to good " Ballots and Bales	£18 0s " £22 0s
Good to extra " "	£25 0s " £36 0s

Coir Fibre—Cochin, common	£21 0s to £22 0s	nominal
fair	£23 0s " £24 0s	
good	£25 0s " £26 0s	
Ceylon, short	£6 0s " £7 0s	
clean fair	£8 0s " £10 0s	
Coir Rope—4 to 5¾ inch	£19 0s " £20 0s	
3 to 3½ inch	£16 0s " £17 0s	
1 to 2½ inch	£16 0s " £15 0s	

	For the Month of October. Landed. 1890	Delivered. 1890	Stock 31st October. 1890	1889	1888	Landed from the 1st Jan. to 31st Oct. 1890	1889	Delivered from the 1st Jan. to 31st Oct. 1890	1889
Yarn.......	1263 tons	968 tons	3683 tons	3533 tons	3939 tons	8786 tons	9006 tons	9393 tons	9219 tons
Fibre.......	48 "	96 "	361 "	279 "	429 "	989 "	699 "	1904 "	777 "
Rope.......	24 "	29 "	199 "	125 "	158 "	397 "	204 "	293 "	210 "

	4th Nov. 1890.		4th Nov. 1889.
Yarn floating to London @ Coconada..................tons	nil	...	nil
" " " Ceylon and Cochin............	118	...	401
" " " Bombay.........................	15	...	nil
" " Liverpool "	nil	...	123
Fibre " London and Liverpool	1	...	52
Rope " " "	nil	...	nil
Yarn " New York.....................................	84	...	327
Fibre " "	nil	...	50
Rope " "	nil	...	nil
Yarn " Continent..	nil	...	nil
Fibre " "	nil	...	nil
Rope " "	nil	..	nil
	218		953

(*Ide & Christie's Circular*).

Coir—See *Cocos nucifera*. Corchorus capsularis, Linn., and Corchorus olitorius, Linn.

Jute (good), No. 14.
Jute (native mark), No. 15.
Natives of Southern Asia.

This plant is an annual growing to a height of 10 or 12 feet. *(Tiliaceæ)* It requires good, loamy soil and a hot, damp climate. A crop is obtained in 4 or 5 months from time of sowing. In India, jute often alternates with rice and sugar cane. "Under favourable circumstances 2,000 to 7,000lbs. may be obtained from an acre, according to quality of soil. It is best grown on temporarily flooded ground, as otherwise it proves an exhaustive crop." *(Mueller.)* The fibre is extracted by steeping from 5 to 8 days.

"*Jute Indian* moving off rather better on spot but at low rates; arrival after free selling at 11s. for M double triangle is firmer, and a slight advance now demanded.

Spot values—

Prime	...	£16 10 0	to £18 0 0
Good	...	15 0 0	" 16 0 0
Medium	...	11 0 0	" 13 0 0
Common	...	8 0 0	" 11 0 0
Rejections	...	7 0 0	" 8 0 0
Cuttings	...	5 0 0	" 5 5 0

	Imported. London.	Delivered. London.	Stock 31st Oct., 1890. London."
Jan.–Oct., 1890 ... tons	101,200	99,500	14,000

(Ide and Christie's Circular).

Crotalaria juncea, Linn.

Sunn Hemp. No. 12.
Bombay Hemp. No. 13.
Native of India, Malay Is., and Australia.

An annual shrubby plant, belonging to the Pea Family, *(Leguminosæ,)* of erect habit, growing sometimes as high as 10 feet, with bright yellow flowers.

It is naturalised in Jamaica, but is not anything like as common as Crotalaria retusa, which is cultivated for fibre in Madras.

The soil must be rich and friable. To obtain stems without branches for fibre, the seed is sown close. The plant is sometimes grown for fodder, especially for milch cows, and then seed is sown at greater intervals. The plants are ready for harvesting in 4 or 5 months. If a soft fibre is wanted, the plants are pulled in flower; if a strong fibre is desired the plants are left until the seeds are almost ripe. Retting is necessary and takes 3 days. The stems are then bent so as break the wood, and they are beaten on the surface of the water, until the fibre comes away. It is hung up to dry, and finally combed out. The fibre is used for cordage, coarse cloth, and the waste fibre for paper.

"*East India*—Sunn steady; 5s. to 12s. ordinary, 10s. to 15s. 6d. good. Bombay unchanged—8s. to 17s.

London East India Hemp Statistics.

		1887.	1888.	1889.	1890.
On hand 31st Oct.	...	1076	2076	1743	1638 tons.
Delivered, January-Oct.	...	2717	3124	1736	1533
Imported do.	...	3210	4125	1910	1811."

(Ide & Christie's Circular.)

Curled Fibre. See *Chamærops humilis.*

Dictyosperma album, W. & D. (?).

Madagascar Piassava, No. 7.

There appears to be some doubts about the palm which yields this fibre. The one which is ascribed as the source of the fibre is cultivated in the Jamaica Botanic Gardens. It is a handsome palm with pinnate leaves.

There is no price given in Messrs. Idé & Christie's Circular.

Esparto. See *Stipa tenacissima.*

Flax. See *Linum usitatissimum.*

Flax, New Zealand. See *Phormium tenax.*

Furcræa gigantea, Vent.

Mauritius Hemp, No. 24.
Native of Central America.

This plant is very much like the one known in Jamaica as silk grass, but it is larger and has a distinct stem.

It probably yields some of the fibre exported from Yucatan as Sisal Hemp, but it is not the true plant, and the price of the fibre is not as high. It was introduced many years ago into Mauritius, where it rapidly spread. When a demand arose for fibre there was an immense quantity in Mauritius ready at hand; and there was no expense incurred in planting.

"*Mauritius Hemp* firm, but little prime quantity to be had. A large turn over has occurred in fair ordinary quantity.

Good White......28s. to 30s. Fair......27s. Common......23s. to 25s.
Stock 1st Nov., 1890............... 1205 tons."

(Ide and Christie's Circular.)

HEMP, BOMBAY. See *Crotalaria juncea.*
HEMP, ITALIAN. See *Cannabis sativa.*
HEMP, MANILA. See *Musa textilis.*
HEMP, MAURITIUS. See *Furcræa gigantea.*
HEMP, RUSSIAN. See *Cannabis sativa.*
HEMP, SISAL. See *Agave vigida.*
HEMP, SUNN. See *Crotalaria juucea.*
JUTE. See *Corchorus capsularis.*
JUTE, CHINA. See *Abutilon Avicennæ.*

LEOPOLDINIA PIASSABA, Wallace.

Para Piassava No. 9.

This palm forms large forests on the plains between the Rio Negro and Orinoco rivers. It grows to a height of 15 to 40 feet and has large pinnate leaves.

"The Indians collect the fruit in large quantities, and by burning and washing, extract a floury substance, which they use as a substitute for salt." (Wallace). It is singular that there is a palm in Madagascar *(Areca madagascariensis)*, the fruit of which is used for the same purpose.

The spathe of the young leaves decays, except the fibrous part which hangs down all round, and is locally known as the beard. It is a finer kind than that produced by *Attalea funifera,* and is used for brushes and brooms.

"*Para* Piassava.—Steady.

Prime dry	...	...	nominal 65s.
Damp ordinary	...	...	50s."

(Ide and Christie's Circular).

LINUM USITATISSIMUM, Linn.

English Flax. No. 26.
Russian Flax. No. 27.

Native of Europe, and as far east as India. An annual plant with blue flowers and narrow leaves.

The seed is known as Linseed, and is very valuable for the oil which it yields. The cake left after the expression of the oil is valued for feeding cattle.

Flax has been cultivated from time immemorial for its linen fibre. The cultivation is more suited to a temperate climate, than to the tropics.

Tow consists of the short fibres, separated by heckling.

"*Russian Flax* is much quieter.

Riga, K	...	21s.	St. Petersburg,	Pava 12 head	...	26s.
HD	...	21s.		Louga "	...	24s.
W	...	18s.		Saletsky "	...	22s.
D	...	15s.		Rjeff 3 Crown	...	27s. to 28s.
DW	...	13s.				

English.—Steady—50s. to 65s.
Italian Tow.—Slow.

1st sort	...	23s.	2nd sort	...	20s.	3rd sort ...	17s."

(*Ide and Christie's Circular.*)

MANILA ALOE. See *Agave vivipara.*
MANILA HEMP. See *Musa textilis.*
MAURITIUS HEMP. See *Furcræa gigantea,*
MEXICAN FIBRE. See *Agave heteracantha.*

MUSA TEXTILIS, Luis Nee.

Manila Hemp (fair current). No. 17.
Quilot Manila. No. 19.
Native of Philippine Islands.

This plant the Abaca of the Phillippines, is very much like the Banana and Plantain, but the fruit is not edible. It is in cultivation in Castleton Botanic Gardens.

"The Abaca is cut when about one year and a half old, just before its flowering or fructification is likely to appear, as afterwards the fibres are said to be weaker. If cut earlier, the fibres are said to be shorter and finer. It is cut near its roots, and the leaves cut off just below their expansion. It is then slit open longitudinally, and the central peduncle separated from the sheathing layers of fibres, which are in fact the petioles of the leaves. Of these layers the outer are harder and stronger, and form the kind of fibre called *bandala* which is employed in the fabrication of cordage. The inner layers consist of finer fibres and yield what is called *lupis* and used for weaving the *nipis* and other more delicate fibres; while the intermediate layers are converted into what is called *tupoz,* of which are made web-cloths and gauzes, four yards long, of different degrees of fineness. These are universally used as clothing; some being so fine that a garment may be enclosed in the hollow of the hand." (Royle).

"*Manila Hemp* is £8 per ton dearer, with a large buying for American account, but closes very quiet.

		1889.	1888.	1887.	1886.	1885.
Receipts, &c., in Manila	bales	566,000	658,000	535,000	396,000	423,000
Shipments to U. K. and Continent	"	322,000	348,000	227,000	164,000	191,000
" U. S.	"	200,000	246,000	246,000	166,000	196,000

Manila cables 10th inst., thus—

Receipts this year	418,000	bales, against	500,000	bales last year.
Shipment to U. K.	260,000	"	272,000	"
" U. S.	85,000	"	168,000	"
" other places	54,000	"	44,000	"
Loading to U. K.	11,000	"	14,000	"
" U. S.	nil	"	17,000	"

price £43 3s. f.o.b.

Spot, landed terms.

Prime roping ...	50s.
Fair current ...	46s.
Seconds ...	44s.
Good brown ...	42s.
Common " ...	41s.
Quilot ...	46s. to 60s.
Lupiz ...	80s. to 100s.

Futures c.i.f. terms. fair current basis.
Distant shipment, sellers 44s.
buyers 42s.

	Imports.			Deliveries.			Stock 1st Nov.		
	London.	Liverpool.	Total.	London.	Liverpool.	Total.	London.	Liver'l.	Total.
Jan.-Oct., 1890 bales	105,900	99,000	204,900	120,600	98,500	219,100	3,546	795	4,341

Messrs. Crocker's American Figures 1st Nov.

		1890.	1889.	1888.
Imported into the United States from January 1st to date (Manila)	Bales	94,946	252,677	202,601
(Europe)	"	60,120	91,525	81,367
On the way for the United States, by mail, to Sept. 22	"	11,200	30,348	42,672
" " " " by cable, to Nov. 3	"	15,000	16,000	59,000
Loading at Manila, by cable	"	15,000	17,000	42,000
Stock in Importers and Speculators hands in Boston, Oct. 31	"	4,707	none	none
" " " " in New York "	"	none	none	none
Supply	"	45,907	63,348	143,672
Exported to Europe and Canada from January 1st to date	"	4,250	2,501	10,530
Stock on hand January 1st, Importers and Speculators	"	3,450	500	6,500
Deliveries since January 1st, New York and Boston	"	149,559	342,201	279,938
" past 30 days ...	"	26,351	24,153	31,482
Deliveries for consumption for years ...	"	—	390,760	829,602
Prices current, Oct. 31 per pound	"	$9\frac{7}{8}a10$c. nom	$11\frac{1}{2}a11\frac{3}{4}$c.spot and to arrive	$10\frac{1}{4}$c.spot and to arrive

Considerable business both from England and Manila has been done at advancing prices. Market closes very strong."—(*Ide & Christie's Circular.*)

New Zealand Flax. See *Phormium tenax.*

Phormium tenax, Forst.

New Zealand Flax (good.) No. 28.
Do. (fair current.) No. 29.
Native of New Zealand, Norfork Is., Chatham Is., and Auckland Is.

The Flax Lily of New Zealand has long narrow leaves, 3 to 6 feet long. The branched flower-spike rises from 6 to 16 feet, and the flowers are of an orange colour, (*Liliaceæ.*)

It is under cultivation in the Hill Garden, Cinchona, where it flowered in 1889. Experiments are now being made as to its adaptability for the plains. It grows on inferior ground, but thrives best on rich soil.

" A strong decoction of the root and leaf-bases is used in surgery for dressing wounds with a view of producing ready and healthy granulation."—(F. A. Monkton.)

The leaves give a very large percentage of fibre, viz. 15.20 per cent., compared with the 3 to 5 per cent. in the Agaves. The gummy matter, however, requires that the fibre should be treated with some such substance as sulphite of soda in order to make it of superior quality. The fibre is naturally white, soft, and of a silky lustre. It is used for making ropes, and the refuse is an excellent paper material.

New Zealand Flax advanced £5 per ton at the close, but has been still higher, and a large trade has taken place.

	Jan.-Oct., 1890	1889	1888
Landed ... tons	11121	5559	1826
Delivered ... "	6270	4837	1500

	1890	1888	1889	1887
Stock 1st Nov., tons	5894	1026	365	23

Values, Hemp 21s. to 29s. Tow 6s. 6d. to 7s.

Direct floating to London 3,200 bales.
January-October arrivals—America 57,759 bales."

(*Ide and Christie's Circular.*)

Piassava, Bahia. See *Attalea funifera.*
Piassava, Para. See *Leopoldinia Piassaba.*
Quilot. See *Musa textilis.*
Raffia. See *Raphia Ruffia.*
Ramie. See *Bœhmeria nivea.*

RAPHIA RUFFIA, Mart.

Raffia. No. 6.

Native of Madagascar.

The Raphia palm grows in brackish swamps. The trunk is not large, but the pinnate leaves are often 50 feet in length.

There are young palms in the Castleton Botanic Gardens.

"*Rafia.*—Dearer; 22s. to 23s."—(*Ide and Christie's Circular.*)

RHEA. See *Boehmeria nivea.*

SISAL HEMP. See *Agave rigida.*

STIPA TENACISSIMA, Linn.

Oran Esparto. (Algerian). No. 1.

Spanish Esparto grass. No. 2.

Flax Esparto. No 3.

Tripoli Esparto. No. 4.

Native of the shores of the Mediterranean.

A rush-like grass, growing in sandy districts.

The plant has been used from remote times for making baskets, hats, ropes, &c., and of late years an immense trade has sprung up in consequence of its utilisation as paper stock.

"*Esparto.* During the last fortnight of October the arrival of fuller supplies at the ports had the effect of arresting, temporarily at least, the strong enquiry which had hitherto prevailed for spot and stored parcels. The total imports of the month, although still short of the average consumption of the trade, show a materially augmented quantity on those of August and September, and the relief to consumers has been proportionately great. It will be observed that out of the total of 14,633 tons, the Scotch ports have received 9,222, of which all but 943 tons consisted of Spanish and Algerian. Stocks at the various ports have generally suffered depletion during the month, and much that remains is the property of consumers and not on sale. Any recurrence of delay in shipments would therefore be again reflected in the enhanced value of spot lots, which are now so diminished as to require but little to wipe them out of existence altogether. For the present, however, the situation is easier and the market inclined to dulness for early delivery, but the visible supply on the water is small, and there is no pressure to sell. Rates of freight, influenced by the prospective closing of Black Sea navigation, are no longer a disturbing element in the value of Esparto, and fairly abundant steam tonnage is offering for winter employment. Distant delivery contracts have been few in number, and the enquiry for them is limited. Sellers quotations are too highly pitched for any extensive business to be entertained by buyers, but merchants are cons rained to "sit firm" in view of the prospects at the African centres of production.

Spanish has arrived in full quantity during October, and the total for the ten months is 55.126 tons, or 1,200 tons less than last year. During the past fortnight the imports have been small, and there is but little advised as afloat. Sellers have of late shewn increased firmness in their quotations for future shipments, but buyers are disinclined to concede any advance, and business therefore, is restricted. The tendency seems more the result of sympathy with African prospects than of adverse advices from Spain as to supply.

Algerian imports have made up partially for the deficiency of September, and the total stands just over 63,000 tons for the ten months, against 60,500 last year. All the chief ports shared in the October arrival and little was available for sale from ships' side, but such parcels as were free commanded full prices. Intelligence from various sources in Algeria is unanimous in testifying to the unsatisfactory prospects of supply. Stocks at the ports are much below the average quantity held at this season, while deficiency of labour in some districts impedes the transport of gathered grass to the baling centres. Rains have interrupted, and in some cases terminated, the season's gathering in the interior, and prices for all available grass are rising. With these news before them sellers in the home markets are firm at quotations for all winter and spring shipments.

Tunisian arrived in contract fulfilment at Cardiff and Leith in October, followed, this month, by a cargo to Wear. There has been a good enquiry, but sellers are compelled to refuse engagements save with the option of delivering Tripoli as a substitute. Receipts at the shipping ports continue merely nominal and stocks there are barely sufficient to cover contract raquirements on this side.

Tripoli has again been scarce and the arrival for October is the smallest of the year. Total imports 38,524 tons, a deficiency of 5,000 as compared with the corresponding period of 1889. During the current month two large cargoes have arrived (Thames and Wear) and further parcels are on the way and loading. There is only a very limited quantity for sale, and quotations are steadily maintained. Distant contracts are cautiously enquired for by consumers, but it is difficult to get sellers to make offers at a workable price. Raids in Tripoli have caused Esparto receipts at market to fall away, and drawn off labour to ploughing, sowing, and other agricultural occupations.

We append official returns of Stocks at Tyne and Cardiff (including Penarth) on 31st Oct.:—

TYNE DOCK.

Sfax Esparto	84 tons
Tripoli "	277 "
	361

CARDIFF.

Spanish Esparto	72 tons
Algerian "	157 "
Tripoli "	399 "
	628

The following is an official summary of Esparto arrivals at all U. K. ports during October—

From		Spain.	Algeria.	Tunis.	Tripoli.	France.	Belgium.	Italy.	Morocco.	W. Coast Africa.	Total.
London	tons	60	810	—	250	—	—	—	50	—	117 tons
Cardiff	"	—	622	583	380	—	—	—	—	—	1585 "
Liverpool	"	185	1172	—	—	200*	—	18	—	4	1579 "
Fleetwood	"	430	—	—	—	—	—	—	—	—	450 "
Glasgow	"	230	355	—	—	—	—	—	—	—	585 "
Aberdeen	"	585	812	—	—	—	—	—	—	—	1397 "
Dundee	"	671	—	—	—	—	—	—	—	—	671 "
Alloa	"	—	140	—	—	—	—	—	—	—	140 "
Grangemouth	"	270	609	—	—	—	—	—	—	—	879 "
Granton	"	2565	1437	—	—	—	—	—	—	—	4002 "
Leith	"	—	605	943	—	—	—	—	—	—	1548 "
Tyne	"	525	—	—	—	—	—	—	—	—	525 "
Hull	"	—	—	—	—	—	2	—	—	—	2 "
Harwich	"	—	—	—	100	—	—	—	—	—	100 "
Total	"	5541	6562	1526	730	200	2	18	50	4	14633 "

* From Algeria *via* Marseilles.

Total imports into the United Kingdom of Esparto and other vegetable fibre for making paper, viz:—

Month ended 31st October	17,377 tons	11,461 tons	14,683 tons
Ten months ended 31st October	213,647 "	182,213 "	177,724 "

AVERAGE CURRENT PRICES 15TH NOVEMBER, 1890.

	£ s. d.		£ s. d.	
Spanish, fair to good	5 17 0	to	5 10 6	per ton
fine to best	5 17 6	"	6 7 6	"
Oran, fair to good	3 17 6	"	4 10 0	"
first quality	4 10 0	"	5 0 0	"
Bona & Philippeville, gd. av.	4 5 0	"	4 15 0	"
first quality	4 10 0	"	5 0 0	"
Sfax and Gabes	4 7 6	to	4 15 0	per ton
Tripoli, fair average	4 5 0	"	4 10 0	"
hand-picked	4 7 6	"	4 15 0	"
Mogador (nominal)	3 10 0	"	4 5 0	"

(Ide & Christie's Circular.)

FERNS: SYNOPTICAL LIST: III.

Synoptical List, with description of the Ferns and Fern-Allies of Jamaica, by F. S. Jenman, Superintendent Botanical Gardens, Demerara (continued).

16. *T. crinitum*, Swartz.

Stalks tufted, very slender, ½–1¼ in. l, not or only slightly winged at the top, hairy, arising from an upright rootstock, which is clothed with brown pointed scales, and the bases of old stalks; fronds spreading or prostrate, 2–5 in. l., ½–1 in. w., slightly tapering from the base to the rounded apex, very thin, pale yellowish-green, surfaces and margins hairy; pinnately-parted, or the base fully pinnate; rachis with rusty shaggy hairs and narrow wings: segments crowded, overlapping, or the lower apart, deeply and bluntly toothed, or the lower pinnately-parted, ¼–½ in. l., 2–3 li. br. oblong; veins pinnate, 2–4 branches to a side, simple, or the inner forked;

sori 1, 2, or 3 at the end of each pinna;

involucres immersed to the expanded hairy mouth, receptacles long protruding, with club-shaped tops, forming a fringe along each side of the fronds.

Frequent at high elevations and descending as low as 2,500 ft. alt., growing in forests on decaying wood, generally under the shelter of rocks and old stumps. The fronds,, when pressed, have a crimped, double-edged aspect, where fertile. The long receptacles are a curious feature, the fringe being from ¼–¾ in. l. This is one of the loveliest species, the fronds presenting a beautiful golden-bronze hue under certain aspects of light.

17. *T. Kaulfussii*, Hook. and Grev.

Stalks close together, 2–4 in. l., broadly winged upwards, arising from a free-creeping root-stock which is densely coated with bright pointed scales; fronds ½–1 ft. l., 12–2 in. w. membranous, pellucid, with few hairs, rachis broadly winged and densely hairy, pinnately-parted; pinnæ close spreading, almost horizontal, blunt or rounded, 1–1¼ in. l., ¼ in. br., with rounded or long pointed teeth; veins pinnate, branches once or repeatedly forked;

sori 2 - several, around the outer part of the pinna;

involucres immersed, mouth rather dilated, the corners projecting, receptacles protruding or not.

Infrequent in forests and coffee fields, on decaying logs, above 3,000 feet alt. I have no Jamaica specimen of this, but it was gathered by Menzies, and a plant found at Murray's Flat, Mt. Moses, St. Andrew's by Mr. Syme, of which he sent me a pencil drawing, though only 3 in. high, undoubtedly, I think, belongs to it. It resembles *T. crispum*, next which the untoothed state would be placed in this arrangement, but is less deeply pinnately parted, and the stalk is winged.

18. *T. alatum*, Swartz.

Stalks tufted, several, slender, 1 - 2 in. l., usually hairy, free or slightly margined at the top, arising from a rootstock covered with rusty shaggy hairs; fronds oblong lance-shaped, thin, more or less hairy throughout, 2 - 5 in l. ¾ - 1½ in. w.; rachis slender, winged to the base, generally twice pinnately-parted; pinnæ close, spreading, ½ - 1 in. l., 2 - 4 li. w. the inner half lobed or pinnately-parted, the outer tapering or attenuated, toothed, final lobes toothed, 1 - 2 li. l., 1 li. w., veins branched in the lobes;

sori one to each lobe;

involucres fully immersed, the mouth widely dilated, deeply depressed transversly; receptacles more or less protruding.

Very common in forests above 4,000 ft. alt. on the trunks of trees. Variable in size and habit of growth, but not to be mistaken in any of its local forms. In the common Jamaica state the root-stock is short, upright with the fronds tufted at the end. I gathered however on the slopes of Catherine's Peak, where the species is particularly plentiful, a large variety of thicker texture and strong creeping root-stock, with wiry stalk scattered along it. In var. *T. ptilodes*, V. D. B., gathered in Jamaica by Wiles, the fronds are a foot long and 3 in br., stalks tufted, pinnæ pinnately divided, 2 in. l., $\frac{1}{2}$–$\frac{3}{4}$ in. br., lobes toothed, texture delicate, and rachis winged.

19. *T. Bancroftii*, Hook. and Grev.

Stalks several, tufted, erect, 1 - 2 in. l., broadly winged, arising from a short, erect, minutely scaly root-stocks; fronds erect oblong 1 - 3 in. l., $\frac{1}{2}$ - $\frac{3}{4}$ in. w., firm, dark green, mostly glabrous and rather glossy, base truncate, apex rounded, pinnately divided, the rachis broadly winged; pinnæ close, often overlapping, or the lower a little apart, spreading, oblong, $\frac{1}{3}$ in. l., 2 - 3 li. w. the ends rounded, and the sides with a few blunt teeth and wavy outline; veins pinnate;

sori 1 to 5 to a pinna, around the outer margin;

involucres immersed to the expanded rim, receptacles protruding.

Common in forests on decaying logs from 1,500 to 4,000 ft. alt. The fronds and stalks are nearly equal in length, and the margins particularly full and wavy. In places it forms considerable masses, but the individual plants grow in separate erect tufts. It varies in size, and from the higher altitudes, is often only an inch or so long, but fully fertile.

20. *T. pyxidiferum*, Linn.

Stalk slender, firm, $\frac{1}{2}$-2 in. l., slightly margined in the upper part, scattered on a slender, wiry, free-creeping, hairy root-stock; fronds variable in size and form, less than 1-4 in. l., $\frac{1}{2}$-2 in br. thin pellucid, without hairs and rather glossy, pale or dark green, apex pointed, rachis winged, pinnæ composed of few segments or very compound;

sori generally forming a single or partly double row on each side of the rachis in the upper part of the fronds;

involucres; tube cylindrical, free but narrowly margined, with a broad, expanded, sometimes free, rim to the mouth; receptacles often much protruding. *T. brasiliensis*, Desv.

General from 500 or 1,000 ft. alt. up to the slopes of the highest ridges, on the stems of trees.

21. *T. tenerum*, Spreng.

Stalks $\frac{1}{2}$-1 in. l. very slender, scattered on the thread-like, free-creeping root-stock, fronds pendent, 2-6 in. l., $\frac{1}{2}$-$1\frac{1}{2}$ in. br., without hairs, pale-green, delicate and flaccid, twice or thrice pinnate, variable and irregular in outline; rachis thread-like, margined only at the top; pinnæ lax, pendent.

sori sparse, usually confined to the outer inferior of the axillary pinnules;

involucres winged, rim expanded; receptacles long protruding. *T. angustatum*, Parm.

Rare in forests on the stems of tree-ferns at about 6,000 ft. alt., gathered on the slopes of John Crow Peak and above Morse's Gap. A much more delicate, pendent, and finely-cut species than the last from which it is easily known by these characters, and the hair-like rachis being devoid of membrane, except at the top. The colour is a bright straw-green.

22. *T. trichoideum*, Swartz.

Stalks very slender, channelled not margined, 1-$1\frac{1}{2}$ in. l., scattered on the thread-like, free-creeping rootstock; fronds feathery, dark-green, 3-5 in. l., $\frac{1}{2}$-$1\frac{3}{4}$ in. w., twice or thrice pinnate, all the parts hair-like;

sori on the inferior lobes;

involucres stalked, not margined, rim expanded; receptacles protruding. *T. capillaccum*, Sw.

Exceedingly abundant in forests, covering the trunks of trees and tree-ferns, above 5,000 ft. alt. The most finely cut species of all, the parts being as fine as hair, with no membrane at all except to the very slender ultimate divisions. On the higher slopes of the Blue Mountain range this species forms a most beautiful feature of the forest vegetation.

23. *T. scandens*, Linn.

Stalks 2-4 in. l. strong, at first with rusty scales becoming quite bare, scattered on the strong free-creeping densely reddish hairy, root-stock; fronds almost pendent, $\frac{1}{2}$-$1\frac{1}{4}$ ft. l. 3-8 in. w., ovate lance-shaped, pointed, membranous, bright silky-looking golden green, more or less covered with rusty hairs, three or four times pinnate; rachis free of membrane except at the top;

sori copious, often occupying nearly all the teeth, or at least the inferior ones;

involucres immersed and winged to the expanded rim; receptacles generally protruding.

Very abundant in the forests of the lower mountains, from 1,000–2,000 ft., and extending upwards, though much rarer, to 6,000 ft., alt, and distributed well through the island. In the eastern parishes at the lower elevations, it seems almost exclusively confined to trunks of *Cyathea elegans*. Among the larger species this is unrivalled for its gracefulness and beauty.

24. *T. radicans*, Sw.

Stalks strong, narrowly margined; fronds $\frac{1}{2}$–$1\frac{1}{4}$ ft. l., 2–5 in. w., oblong-lance-shaped, long pointed, membranous, glabrous, very dark green, three or four times pinnate, rachis and ribs margined, pinnæ numerous, spreading:

sori often copious, in the angles;

involucres cylindrical, free, the mouth slightly two-lipped; receptacles barely or much protruding. *T. speciosum*, Willd.

Common at all elevations from the valleys of the lower hills up to the slopes of the highest ridges and peaks, in forests, on wet surfaces quite through the country. There are 3 or 4 distinct forms, all of which are of a very dark dull colour and in pressing, to be preserved, dry black. The long stalked form, in which the fronds are $1\frac{1}{2}$ ft. l. is *T. Kunzeanum*, Hook., and the one in which the fronds are much shorter, and without stalks is *T. Luschnatianum*, Presl., but there are intermediate forms which connect these.

25. *T. rigidum*, Sw.

Stalks strong, wiry, 3–6 in. l., erect, tufted, arising from a short root-stock, somewhat erect; fronds erect, much divided, ovate, long-pointed, 4–8 in. l., 3–6 in. w., dark-green; rachis and ribs faintly margined; pinnæ spreading, approximate, about a dozen to each side;

sori more or less copious, in the angles of the final segments;

involucres stalked and free, or partly adherent, mouth rather dilated or even two-lipped; receptacles shortly protruding.

Very abundant in wet forests of the higher elevations, and descending as low as 1,500 ft., at which alt., it extends throughout the island. A terrestrial species, plentifully scattered over the forest floor in some situations, very wiry and stiff, with elastic membrane that shrivels in drying. It is much more abundant and larger at the higher elevations.

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No. 22. July, 1891.

BULLETIN

OF THE

BOTANICAL DEPARTMENT,

JAMAICA.

CONTENTS:

PRICE—Two-pence.

JAMAICA:
GOVERNMENT PRINTING ESTABLISHMENT, 79 DUKE STREET, KINGSTON.
1891.

REPORT ON FIBRE MACHINERY.

SIR, Botanical Department, Gordon Town P.O., 19th May, 1891.

I have the honour to submit the following Report, prepared at the request of H. E. the Governor on the Weicher Fibre Machine.

2. The Machine is worked by a portable steam engine of 15 h.p., which is capable of driving two machines, besides doing other work at the same time.

3. The fibre-cleaning part of the Machine is covered in by an iron casing. It is stated that the speed of the drum is 400 revolutions a minute, and that it is capable of 600 revolutions with certain fibres. The drum is 20 inches wide, and 26 inches in diameter.

4. The table of the feeding-apparatus may be compared to the feeder of a sugar-cane mill, which it resembles in the mode in which it revolves in a long ellipse. The bars of which the table is composed, are in sets of nine, eight of which are flat, and the ninth delta-shaped in section. Round the table revolves another set of bars,—the grip-bars,—in an ellipse about twice the length of the table. The orbits are close together except at the end remote from the fibre-cleaning apparatus. The grip-bars are reverse V shaped in section, and are at just such a distance apart as to fit down exactly on the deltoid bars of the table. The effect is that as the leaves are laid on the table, the ends are gripped between two bars; the leaves are fed into the cleaner, and as the table revolves, are pulled out again below the table, brought round to the workman, who easily reverses them, and the other end is fed in, and cleaned in the same way. As the fibre is brought back, it is handed to a woman to be washed, and hung up to dry. The speed of the table is stated to be 60 feet a minute. The workmen feed the machine, and one woman washes and hangs up the fibre.

5. Trials were made with the following plants:—Silk Grass (*Furcræa cubensis,*) Pinguin (*Bromelia Pinguin,*) African Bow String Hemp (*Sanseveria guineensis,*) Common Yucatan Sisal Hemp (*Agave rigida,* var *elongata,*) Pita Sisal Hemp (*Agave rigida,* var *Sisalana*).

6. The leaves were not all ripe, and as only a small quantity could be obtained, the percentages of fibre are not by any means exact, but the main point was to determine the speed of the machine in the average output of *wet* fibre.

7. In the weights of the wet fibre of Silk Grass, Nos. (2) and (3) and for the weights of all the dry fibre, I am indebted to the courtesy of Mr. J. Sharpe, Manager of the Jamaica Fruit Company.

8. The following Table gives the results of these trials, the last column being the most important. I have added results obtained by a Government Committee, appointed in December, 1883, to test the working of Kennedy's Machine, quoted in Mr. Morris' *Annual Report* for 1884, and also the average results obtained by the Mauritius Machine in cleaning Mauritius Hemp (Furcrœa gigantea) quoted in the *Kew Bulletin* for May, 1890:—

—	Number of Leaves.	Weight of Leaves.	Number of minutes at work.	Weight of wet Fibre.	Weight of dry Fibre.		Percentage of weight of dry Fibre to weight of Leaf.	Average of dry Fibre per hour.	Average of wet Fibre per hour.
WEICHER MACHINE.				Lbs.	Lbs.	oz.			
Silk Grass No. 1	238	600	33½	45	19¾	0	3.29	35.37	80.60
Ditto 2	55	150	8½	10	3	1	2.0	21.62	70 59
Ditto 3	25	90	4½	8	1	10	1.8	21.67	106.66
Bowstring Hemp	1,200	402	54	24	.		4.35	.	26.67
Penguin	363	77	23	2½	¾	0	1.0	1.96	6 52
Pita	30	46	3½	4½	1½	0	3.26	25 71	77.14
Yucatan Sisal	115	185	17	20¾	8¼	0	4.46	29.12	73.24
KENNEDY'S MACHINE.									
Silk Grass	.	366½	83	.	7½	0	20.5	5.42	20.24
Bowstring Hemp	.	1,185	1,000	.	29	10	2.49	1.65	3.82
Penguin	.	1,131	1,835	.	20¼	0	1.79	0.66	2.13
MAURITIUS MACHINE.									
Mauritius Hemp	.	.	.	.	.		.	.	.
(Furcrœa gigantea)	.	.	.	.	.		.	26.72	93.67

9. The cost of the Mauritius machine is 250 rupees in the Colony where alone it is manufactured. Information about this machine is to be found in "Kew Bulletin" for May, 1890. It is stated that the Weicher Machine is not for sale but a central factory will be established in any place where there is a sufficient quantity of fibre plants available and where terms can be arranged with planters for the purchase of the leaves.

10. Each Weicher Machine requires 2 feeders at 1s. 6d per day, 1 boy at 1s., 1 woman at 9d.—4s. 9d. Two Machines can be driven by one engine, for which an engineer at 2s. per day is necessary. Total for driving two Machines 11s. 6d. per day.

11. As stated in Bulletin No. 15, Death and Ellwood's Machine cleans 8,000 leaves per day, whereas Weicher's will not clean more than about 3,000

I have, &c.,

W. FAWCETT, Director of Public Gardens and Plantations.

To the Honble. the Colonial Secretary.

COFFEE LEAF DISEASE.

Every precaution is taken by the Government to keep out the Coffee Leaf Disease, the ruin of many a planter in various parts of the world. The Proclamation, inserted below, has been issued to prevent the spores (seeds) of the deadly fungus, *Hemeleia vastatrix*, being by any possibility introduced in the coverings of tea chests. But it would be well for Coffee Planters in Jamaica to acquaint themselves with the nature of the disease and suggested remedies, so that if by some misfortune the *Hemeleia* happened, in spite of every precaution, to be introduced, they might at once be in a position to battle with the foe. Dr. Burck's interesting article is reproduced from the "Bulletin" for last April, edited by Mr. H. N. Ridley, Director of Gardens and Forests, Straits Settlements.

(L.S.) Wilsone Black, Major-General.

By His Honour Major General Wilsone Black, Companion of the Most Honourable Order of the Bath, Administering the Government of the Island of Jamaica and its Dependencies.

A PROCLAMATION.

WHEREAS it is enacted by Section 1 of Law 25 of 1891, "A Law in aid of the Seeds and Plants "Importation Law, 1884," that is to say, in aid of Law 4 of 1884, that "it shall be lawful for "the Governor by Proclamation under the provisions of the said Law to prohibit the importation "from the Country named in such Proclamation of any particular goods, packages, coverings or other "articles or things to be named in such Proclamation which in his judgment are likely to be a "means of introducing diseases in plants from the Country to which such Proclamation applies:" And whereas it has been made to appear to me the Major-General Administering the Government of this Island and of its Dependencies for the time being, that chests or cases of Tea imported directly or indirectly into this Island from India or the Island of Ceylon are frequently enclosed in coverings of fibrous cloth or other fibrous material: And whereas in my judgment such coverings are likely to be a means of introducing diseases in plants from the said Countries:

Now I, the Major-General Administering the Government as aforesaid, do hereby prohibit from the date of this Proclamation the importation into this Island of all coverings or wrappers of fibrous cloth or other fibrous material as aforesaid in which chests or cases of Tea imported directly or indirectly from India or Ceylon may be enclosed, and I hereby direct that chests or cases of Tea coming directly or indirectly from either of the said Countries be allowed to be imported only on condition that any such covering as aforesaid be first stripped off and burnt by the Officers of Customs, and that no such coverings shall be permitted by the Customs Authorities of this Island to be landed in any part thereof.

Given under my Hand and Seal at King's House, this 24th day of June, in the 55th year of Her Majesty's Reign, Annoque Domini, 1891.

By Command,

J. Allwood, Acting Colonial Secretary.

DR. BURCK'S METHOD OF TREATMENT OF THE COFFEE-LEAF DISEASE IN JAVA.

Introduction.

Articles have been recently published in the *Javaasche Courant* under the title of "Over de Koffieblad ziekte" by Dr. Burck, the Assistant Director of the Botanical Gardens at Buitenzorg, which are the results of some years' observations and experiments. The methods employed by Dr. Burck have been so successful in Java that it seems well worth while to publish here a condensed translation, or rather abstract, of the original papers (which are published in Dutch) in the hope that some Malayan planters may try what the results of Dr Burck's plan may be here.

For the translation I am indebted to Mr. P. Nuy, late Secretary to the Government Savings Bank at Singapore.

The Disease.

It will be well to remind my readers of the nature of the disease and its life history which has been the subject of so much careful investigation by Professor Marshall Ward and others. The disease is well known to be due to a fungus termed *Hemileia vastatrix* which appears in the form of yellow or orange coloured spots on the upper side of the leaves, while on the under side they are covered with a fine orange powder. This powder consists of spores or seeds of the fungus, which are easily brushed off. If this is done, however, by the next day the spot is covered again with another layer of spores. This can be repeated for several days before the fungus is exhausted.

Professor Marshall Ward has estimated that each sick spot can produce 150,000 spores in a day, and can continue this production for from 7 to 11 weeks, and as there are often 60 or 70 spots upon one leaf, the number of spores produced in a coffee plantation at all affected by the disease is something enormous.

The spores are borne away by the winds and scattered far and wide. All those that fall upon a coffee leaf, and find there the requisite conditions of existence, will develop the disease in that leaf. If they fall upon the trunk of the tree, or upon the ground, or upon the leaves of other plants, or even upon the upper side of a coffee leaf they perish. When a spore falls in a drop of water on the under side of a leaf, it first increases in size by absorbing the water and after a couple of hours produces one or more tubes which enter the minute pores on the under side of the leaf known as stomata; then attacking the internal tissue of the leaf they destroy it, and the destruction of the dark green cells of the upper surface of the leaf produces the well-known yellow spot. This operation takes three or four weeks. The fungus then prepares to produce fresh spores. Some of the threads or tubes in the interior of the leaf forming bundles project through the above-mentioned pores upon the under side of the leaf and each produces on its end a small globular body, which develops into a spore, behind this is produced another and another, till they hang down in chains, and this is continued till the fungus is exhausted.

Sometimes the spores instead of being drifted away by the wind to other leaves, fall upon the same leaf, and attack it again; this produces the secondary spots, but, as a rule, the leaf is exhausted by the time that the spores are produced, and after turing brown drops off.

As long as there are but few spots on the leaf, and the attack is but slight, little harm is done. It is not only the destruction of so much leaf tissue by the fungus which injures the plant, but it appears probable also that the tubes of the fungus suck out the nourishment from the leaf, and as soon as the leaf has no longer a sufficient supply for itself, it perishes.

Conditions for the germinating of the Spores.

Dr. Burck in his examination of the germination of the spores, noticed that spores taken from the same sick spot and deposited in a drop of water, at different periods of the day, did not always germinate. By following up this clue he found that, besides air and water, darkness also was a requisite of successful germination. If spores are put in a drop of oxygenated water and exposed to light they do not germinate. Pure sunlight is not essential to prevent their growth. The diffused light of the laboratory at some distance from the window prevented any development. If, however, the spores are taken into the dark, in 2 hours or 2½ hours they germinate and emit the tube. Total darkness, however, is not necessary for this. Further investigation showed that the light absolutely killed the spores, after a short exposure to it, even if removed into the dark, they no longer are able to produce the tube. Of spores placed at a distance of six or seven feet from the window for 1¼ hours most were dead, and after an exposure of an hour and three-quarters all were dead. This, however, it must be remarked, applies to spores in water only. If kept quite dry they will withstand the sunlight for a long time Coffee leaves with the spores still suspended from the sick spots may be exposed to the influence of sunlight till they are quite dried up without losing life. It is, therefore, the spore swelling with the water which it has absorbed that is killed by the light. Further, it was noticed that the blue rays of the spectrum were the fatal ones. In the red rays the spores grew as rapidly as in complete darkness. Even the strongest petroleum light had no effect upon the spore, the actinic rays being too weak to kill it.

The requisites for germination are thus, water, air and more or less complete darkness. For the further stages it is requisite that it fall upon the under side of a coffee leaf, for on the upper side are none of the stomata by which alone it can penetrate to the inner tissue of the leaf. These observations are not without practical interest, for the injurious effect of sunlight upon the spores explains to us the fact well known to planters that the leaves of the upper branches of untopped trees are seldom attacked so badly as to affect the ripening of the fruit. Repeatedly, Dr. Burck affirms, he learnt from the planters in Java that generally it was the crop of the upper branches that was obtained and that of the lower branches and middle ones that there was reason to fear for.

Everyone who has seen a plantation in an advanced state of destruction will remember the bare trunk and dead side branches crowned at the top with a few tufts of leaves which have escaped the general destruction.

It is, therefore, better on the whole not to top the trees, and in the plantations where the trees have already been topped for some years, it is better to let them shoot up again. The lower sides of the upper leaves receive light of higher intensity than the middle and lower branches, and this increase of light is sufficient to kill the spores if damp. Of course, even those leaves of which the under side is fully exposed to sunlight are not free from the possibility of infection by night, but by this exposure their chances of infection are much lessened.

It might be imagined from this that the destruction of the shade trees would be desirable, but this would not avail much against the disease, as it is on the under side of the leaf that the spore can make its attack and that is shaded by the leaf itself and by the other leaves on the bush.

Fallen Leaves.

Most of those who have written about the disease have cautioned planters against allowing the fallen leaves to remain on the ground, fearing that they may affect the healthy leaves. Dr. Burck found, however, that spores taken from fallen leaves did not germinate, the reason being that they were killed by exposure to light as soon as they were wetted by rain or dew. It is indeed quite safe to leave the dead leaves upon the ground whether the upper or lower side be exposed to light. For if a leaf lies upon its upper surface the spores are killed by exposure to light; if on the lower surface they begin to grow and are then killed by the excessive wet of the rain on the ground. Should the weather be very hot and dry it will be advisable to destroy the leaves. The disease, however, rarely occurs during the dry season. Dr. Burck has, he states, only seen such a case three times and then in a plantation of one or two years' growth.

Infection of the Leaves.

The spores will not germinate in air however damp it be. They require fluid water; so that the leaf can only be affected when it is covered with drops of dew or rain.

Professor Marshall Ward thought that fresh spores put into a drop of water only began to germinate after from 12 to 24 hours, and did not enter the leaf for 48 hours after they were put into the water. If this were so, the disease could hardly exist, for where are the trees that are covered with drops of water for forty-eight hours? Besides, it must be remembered, that during heavy rains no tubes can be formed by the spores, as they would be washed off by the constantly falling drops. The period required, is, however, very much shorter. In a number of trials, the spores germinated after 2 hours and 20 minutes, and a few hours afterwards there were tubes long enough to enter the stomata. Sometimes the operation took a longer time, but whenever the spores were alive the tube was in full growth after five or six hours.

On examining a coffee bush in the morning after a rainy night, it will be seen that the old leaves are nearly all quite dry, but the freshly unfolded leaves, soft and pale green, still retain on both sides some drops. This is due to their possessing still some of the sticky bud resin which has prevented the fall of the drops.

From this it appears that the young leaves alone can be attacked by the disease, and this is absolutely correct. On each branch the yellow spots first appear on the third pair of leaves, counting the bud as the first pair, for the second pair though probably affected does not show the spot for a month, by which time the next pair of leaves has been unfolded and a new bud is formed. This then is the appearance of a branch. The bud is not affected, the next pair is affected but not visibly, the third pair shows yellow spots, the fourth and lower pairs are more affected not only by the primary but also by the secondary spots.

Much importance attaches to this observation, for it reduces the treatment of the whole plant for the disease to the treatment of a single pair of leaves upon each branch. If the primitive spots are destroyed on the third pair of leaves, the leaf is safe from further infection. The danger from secondary attacks, the real cause of the fall of the leaf, is thereby removed, and the chance of a renewed attack on the treated leaf is but small as the leaves soon pass out of the stage in which, owing to the persistence of the bud resin, the rain drops do not run off.

The rainy months of 1887 and 1888 confirmed this; the appearance was as described above with but few exceptions, but in 1889, these exceptions had become the rule. The attack was remarkably heavy, more so than any one in Buitenzorg had ever known before. As a rule, not more than three or four spots occur upon the third pair of leaves, and very often only one or two, for rain drops only remain upon these leaves irregularly and do not cover them. But now nearly all the leaves were covered with sick spots. The opening of the leaf buds which may happen in the West monsoon in Java in twenty-seven days only commenced after long intervals and consequently the latest opened pair on each branch and even the bud leaves shewed the well-known signs. What was the cause of this exceptional attack? No one in Buitenzorg remembered a West monsoon with so little rain, or with such heavy dews, and the attack is closely connected with the latter. When the dew falls upon a coffee leaf, it does not, like rain, collect in large drops and then fall off, it is deposited in drops so fine that they do not run together. In the morning after a clear night in the rainy season, it is not rare to find a coffee bush covered with dew. If there are spores on the lower side of the leaf either before or during the fall of the dew it is possible for the leaves to be very extensively and completely infected.

Many planters cannot get rid of the idea that the disease can do no harm on virgin soil or on ground that has been well worked and manured. This is, however, quite erroneous. A badly nourished plant possesses, it is true, little power of resistance when attacked, but the hypothesis that a well nourished individual under favourable conditions is less or not at all liable to attack is certainly untenable. Experiment has shown that predisposition to disease or incapacity for receiving it alike do not exist. Liability to sickness is quite independent of the soil, altitude or condition of life of the plant. Dr. Burck found the disease at 5,000 feet elevation on the Tengger and other mountains as on the sea coast near Poeyer and at all intermediate levels. It was as destructive in the well manured and carefully cultivated gardens of private planters, as in the abandoned plantations of the poorer cultivators, in virgin soil and in ground long under cultivation. All sorts and varieties cultivated in the East Indies, or introduced from Brazil, and all the species in cultivation, Coffea arabica, liberica, benghalensis and Maragogipe Coffee, are equally liable to the attacks, nor has a single plant been found that absolutely resists disease. Bushes which planters have affirmed to be disease proof have always taken the disease when inoculated and become sick in the usual period.

Some planters imagine that the coffee plant may, during lapse of time, have become liable to the attacks from cultivation, and various are the causes to which this is ascribed. Some attribute it to the continuance of long and enforced cultivation; others to the exhaustion of the surface soil, or to the dampness of the climate. It is quite possible that long cultivation may have had some injurious effect upon the plant. But little attention has been paid to the selection of seed, methods of planting, &c., but whether and in what way these have affected the plant it is difficult to decide. Correct descriptions of the Arabian coffee plant of two centuries ago we do not possess, and cannot compare it with that of the present day so as to know whether it then produced more fruit than now. However, if the soil be suitable and the plants properly and carefully cultivated, we have no need to complain of the results. Dr. Peilen tells us that the Arabian coffee in its native home, in Galla country in Abyssinia and at Kaffa, can produce 20 to 25 pounds in its second year. This is indeed hardly credible; but it is easily conceived that the originally introduced plants might have produced a very much larger crop than most of the trees do now. That the soil in Java has deteriorated through coffee cultivation is true, but that this predisposes the trees to the disease is negatived by the fact that the disease appears as acutely in plants grown in virgin forest ground, well cared for plantations and in pots with carefully prepared soil, as in old ground.

The suggestion of Dr. Peilen that the relative dampness of the climate has made the plant more subject to hemileia is also highly improbable, because it leads to the belief that the coffee during two centuries of cultivation has only just begun to feel the effects of the dampness of the climate. The disease was first noticed in Java about 1876. Can the climate have become damper during that and the following years? There is no record of meteorological observation in Java till 1879, so that the rainfall of the years preceding the appearance of the disease cannot be determined, but, if anything, it should be greater then than now because of the recent great destruction of forests to make way for cultivations. Here is a table of coffee production in three districts which have recently suffered heavily from the disease, arranged in periods of five years:—

Average yearly production.		*Samarang.*	*Cheribon.*	*Madiren.*
In 1864-1868	...	52,700 pikuls	24,900 pikuls	60,300 pikuls
„ 1869-1873	...	51,550 „	22,500 „	61,700 „
„ 1874-1878	...	49,200 „	22,700 „	58,600 „
„ 1879-1883	...	50,500 „	24,600 „	66,400 „
„ 1884-1888	...	27,300 „	11,760 „	33,275 „

The fall in the last five years can hardly be attributed to a sudden alteration in the climate. Again, if as Dr. Peilen thinks excess of damp is the cause, mountainous districts and those parts of Java where the rainfall is heaviest, such as Buitenzorg, the disease ought to be worst. This is not the case. The theory of the same writer that the growth of the mycelium of the hemileia is dependent on the degree of concentration of the cellular fluid in the leaf from which the fungus draws its nourishment and that only when the concentration is small can the fungus grow, is not yet proved by experiment.

Eradication of the Disease.

Two plans have been invented by Dr. Burck, both of which have been attended with highly satisfactory results; one of these is a repressive, the other the preventive method of dealing with the disease.

The first of these consists of the destruction of the sick spot in the leaf. There are two forms of apparatus in use. One of these consists of a small bottle of concentrated sulphuric acid through the cork of which a glass tube passes. The coolie is supplied also with a fine needle of bamboo. The tube passes about half way down the bottle, which is filled for ¼ or ⅓ its length with sulphuric acid; by this arrangement there is no fear of the sulphuric acid escaping if the bottle is upset. The operator dips the needle into the acid through the glass tube and then punctures the spot with it, a very small quantity is sufficient to destroy the fungus, and the sick spot drops out of the leaf leaving a hole where the mycelium has been at work. This little instrument has proved most successful, but it has the disadvantage that the quantity of acid cannot be regulated and it is also liable to get upon and burn the hands of the operator. The instrument-maker, Heckkking, at Sourabaya, invented a pair of scissors for cutting out the spots, which is now used in many plantations in preference to the acid bottle. The coolies apparently work faster with the scissors and more easily. A little tube on the scissors receives the cut-out bits and when filled these can be thrown into water or otherwise destroyed in order to prevent infection spreading, but in wet weather it does no harm to throw them down merely upon the ground.

As explained above, it is the third pair of leaves which shews the attack first: the fourth, fifth and earlier pairs are already so badly attacked, that they are not worth attempting to save. The operator then cuts out or burns with the acid the spots on the third pair on each branch. It is very rarely attacked a second time as it very soon passes out of the stage in which it is most liable to attack. In a month the third pair has become the fourth, and the pair above is the third; this pair is then treated in the same manner, and so on. Thus, two leaves on each branch, once a month, is all that is required to be treated. Leaves thus treated instead of falling in eight weeks after infection remain healthy and of a good colour for months, and the operation is so simple that it can be performed by children at a very low rate of pay.

The cultivators, viz., Mr. F. W. Morren, President of the Blithan Company of Coffee Planters and Manager of the Estate Bantarum near Mingi, and Mr. J. A. A. Taunay, Aministrator of Kawi-Sari near the same spot, have tried the plan on a very extensive scale, *i.e.*, of 220,000 and 170,000 trees raspectively, and were very satisfied with the result, and other reports were equally favourable. Mr. Morren, in answer to a circular sent round for information, said that "It is my decided conviction that "not only with me but on every private plantation the method can be applied even when the disease becomes more severe," and Mr. Taunay supported the same opinion. Several other gardens gave good reports, but in Paseroean and Bantam the reports of the treatment were unfavourable, that is to say, it seemed to have no effect on the crops. However, it must be admitted that in some cases the disease may become so bad that this treatment is useless.

The Preventive Method.

This will indisputably become the most general. It depends upon the treatment of the laves with a chemical re-agent which acts fatally upon the fungus, but does not hurt the leaf. The spores of hemileia are very sensitive to many kinds of re-agents, organic and inorganic, and experiments were made with chloride of iron, sulphate of copper, nicotine, boric acid, sulphate of quinine, extract of cinchona bark, cupric hydroxide, mixture of lime and sulphur, cupric sulpho-steutite.

The last mentioned gave no satisfactory result, it soon washed off the leaves. Iron chloride gave good results at first, but the application on a large scale was found to be unsatisfactory on account of its hygroscopiety, which prevents an accurate proportion being taken, and its liability to decomposition, by which it soon loses its effect and is likely to injure the leaves. It is fatal to the fungus in doses of 1 part in 7,000 parts of water. Copper sulphate is more successful. It does not decompose; it is very cheap and easily obtained. It can be obtained in the form of powder, and dissolved easily in water. One part per thousand of water was used with favourable results, but it will still kill the disease when one part is mixed with 150,000 parts of water, so that the stronger solution dose would be quite strong enough even if diluted by rain or dew to a large extent.

Sulphate of quinine is fatal at a strength of one in 2,000, and borax and boric acid at the same dilution.

One objection to copper sulphate is that the solution becomes condensed by evaporation and crystals deposited on the leaf, which burn it and make it look unsightly, especially when used for a long time consecutively. This, however, may be obviated by the addition of a little sugar which prevents crystallization, at least to a large extent.

Tobacco water, however, does not damage the leaves at all. It is more expensive than copper sulphate, but, of course, refuse tobacco can be used for the purpose and is cheap enough in Java. The liquid is applied by a spray diffuser to the under surface of the leaves, any fungus already there is, of course, killed at once and as the liquid becomes condensed by evaporation a thin layer of tobacco extract is left on the leaf. The next rain or dew re-dissolves the extract and this prevents the spores which fall upon the leaf from germinating; gradually, of course, the rain washes away part of the tobacco and it is, therefore, necessary to treat the plant again. Tobacco water does not remain as long on the leaf as copper sulphate or iron chloride.

Treatment of young Plants.

Young plants as is well known are very liable to disease, and they often let fall a great part of their leaves before they have been transplanted to the open ground from the nursery.

This is partly due to the crowding of the little plants together and also to the necessity of sprinkling them with water during the dry season, and the slow evaporation of the water from the plants under cover. The sprinkling should be done twice a week. Plants treated like this were found to be free from disease, except where by some accident the tobacco water did not touch the leaf, although they might be surrounded by untreated plants which were extensively affected. Indeed the chance of infection then is so great that a leaf only partially wetted was sure to get ill.

It cannot be too much urged to commence sprinkling before the disease appears. If you wait till the yellow spots appear you lose many leaves without necessity. It must be remembered that when the disease is once visible on the lower leaves it is certain that one or two pairs of higher leaves are attacked and will shew the spots in a few days. You cannot save these leaves, you can only prevent the disease going further. It is thus possible to plant out all the young shrubs into the plantation free of disease and without the loss of a single leaf. After the plants are removed to the plantation, they must still be protected by means of the scissors or sulphuric acid bottle, and also the tobacco water. A cooly is instructed to examine each plant twice a month and to destroy with acid or scissors each sick spot, and, of course, one man can look after a very large number of plants, especially if the work is commenced immediately the plants leave the nursery. Usually the disease commences on each plant sporadically, gradually spreading afterwards, so that if each primitive spot is at once removed, not only do you prevent any secondary attack, but also keep the disease sporadic and prevent a strong attack. The cost of sprinkling each plant with tobacco water twice a week was at Buitenzorg $\frac{1}{5}$ cent (guilder) per year for labour and about $\frac{1}{10}$ cent for refuse tobacco. Dr. Burck used one "lempeng" of tobacco in a kerosine tin of 18 litres. The tobacco was put in the evening before use in warm water. Two kerosine tins were enough for 1,000 plants. As the plants get older, of course, the expenses are greater but the cost of treatment of a plant from the time of sowing in the nursery till it begins to fruit will rarely be more than $1\frac{1}{2}$ guilder cents.

The Use of Hedges against the Disease.

An examination of a thirteen-year old coffee garden at Buitenzorg shewed that the North-west side was badly attacked by disease, but it decreased on the North-east, East and South sides of the plantation in proportion to the distance from the North-west side, and again the bushes in the interior of the plantation were less badly attacked than those of the outside. Now the prevailing wind here is from the North-west, and it seems evident from this that the more a plantation is exposed to the prevailing wind the more it is liable to be affected. Further examinations shewed that the interior of the plantation is less attacked than the exterior. From this it is clear that the planting of a close hedge of coffee trees which by means of tobacco water is protected against disease and loss of leaves, is of the greatest importance in protecting the plants enclosed by the hedge from disease or at least will keep it in a sporadic state; of course more than one hedge will have to be planted where the ground is broken. The number and position of the hedges will depend on the circumstances of each plantation, and each Manager will have to judge of this for himself, remembering that the great object is to prevent one patch or plantation being affected by wind dispersal of spores from another. The hedges should be as close and thick as possible, but even if not quite close the disease in the rows of trees enclosed will not even be so bad as not to be easily preventable by the repressive method if necessary. By this means should the hedges be as successful as there is every reason to believe they will prove to be the much dreaded disease may be simply and inexpensively combated.

Spray Diffusers.

Two of these have been invented in Java for throwing the tobacco water or copper sulphate over the plants in the form of a fine spray. Of these, one made by the French firm Broquet for the mildew disease of the vines in France was found to work very well except for the great quantity used on ea tree, *i.e.*, 1 litre The chief objection to this was that it entailed the carrying about of such large quantities of the liquid and this was very cumbersome. For small patches and in cases where it is only requisite to sprinkle the dividing hedges, this instrument does very well. The Chief Engineer of the Public Works Department, T. Van Schaik, and H G. Derx, Chief Inspector of Railways, invented a machine which was superior in possessing a stronger pump and using less liquid; with this instrument a coolie could work for the whole day with two petroleum tins of liquid, about 36 litres.

In place of the hedge of coffee bushes constantly sprinkled with tobacco water, fences of other bushes may be used and of these none are more suitable than Annatto (*Bixa Orellana*), a plant which grows very rapidly and has the advantage also of being a valuable dye producer, the demand for which in the European market is increasing, or a fence may be made of pepper-vines cultivated upon Kapok trees (*Eriodendron anfractuosum*) these if planted close together forming a very impenetrable hedge.* In using these hedges it is to be remembered that the spores which are carried by the wind upon the leaves are not necessarily destroyed as in the previous case, but the chances of life are against them, as the spores are likely to be washed down by the rain or killed by the light, before they have drifted off again upon the coffee leaves.

It seems remarkable that the danger from allowing the plants to be so distant that the wind can freely penetrate the plantation and bring with it the spores has been so long overlooked. It was observed that the edges of plantations were more severely attacked than the interior but this was attributed to insufficient shading. Professor Marshall Ward, however, knew well the influence of the wind on the disease and mentions plantations free of disease on account of their being protected by strips of forest land, and recommends the separations of plantations by the culture of other plants or of forest ground.

Duration of Protection of Leaves by Tobacco-water.

This depends much on two factors (1st) the frequency of rains, and (2nd) the chance of infection. The latter depends very much upon the distance from diseased plants and on the direction of winds.

That the danger of infection diminishes with the increase of distance from a diseased garden is obvious, but the spores are so very light that the wind can carry them to enormous distances. Thus the hemileia which appeared in Ceylon in 1869 was blown over to Sumatra where it first appeared in the Padang uplands. Thence it was carried to Java where it appeared in 1876 in the Botanic Garden at Buitenzorg. After which it spread over the whole of West, Middle and East Java.

In order to find exact data for the effective duration of the tobacco water, plants in pots were placed among some very badly diseased ones in the nursery grounds and were allowed to remain there from March 16th to April 16th in the time of heavy daily rain, and every two days were sprinkled with tobacco water, and in spite of the air being saturated with disease, they were unharmed. A similar batch similarly placed were then treated twice a week only with tobacco water, *i.e.*, every three and four days alternately. These became attacked but not so badly as a similar lot which were not treated at all.

The tobacco water must, in any case, give protection for forty-eight hours. For, suppose the leaves are sprinkled in the morning, during the day while the sun is out the liquid is protecting the leaf and has already killed all the seeds which fell on it before. The rain of the afternoon or evening will wash off the tobacco, so that next day they are quite unprotected again. Directly after the rain falls there is again the chance of infection, principally in the early morning hours, when the young leaves are still wet with rain and dew-drops. The fungus can then begin to germinate, and a few hours after will begin to enter the pore. It can go on growing till the morning of the next day when it is again sprinkled. By this time though the tube has entered a short way into the stoma of the leaf, it is not yet free of the seed, but is still drawing nourishment from it, and it is only when this food is done that it is independent of the seed, and before this, it is again sprinkled and the seed killed. Thus absolute security can only be obtained by treatment every two days. Some nursery plants standing a few yards away from badly diseased plants were treated during the first months of the rainy monsoon, viz., November to February, only once a week, and notwithstanding remained free of disease, but perhaps that was because there were fewer wet days than usual then. Later the remedy was applied twice a week, but whether it is necessary to do it quite as often as this, is still doubtful. The planter is, however, recommended not to be too sparing where the disease is rampant and increasing every year. This abundant treatment is more adapted for nurseries and young plantations and for protection hedges.

Summary.

Any planter can keep his nurseries free of disease at a little expense by sprinkling them with tobacco water and so start the plants in life in a healthy state. Young plantations can be similarly treated and any spots arising from insufficient wetting of the leaf can be cut out with the scissors or burnt out with sulphuric acid as described above. In fruiting plantations heavy attacks can be prevented by enclosing the gardens by hedges which can be composed either of coffee trees kept free of disease by tobacco water, or of annatto or some such shrub, Teosinte grass or of trellises with creepers. If these attempts to arrest and prevent the disease are carried out by all cultivators, it is by no means improbable that the disease will be so reduced that it can never form any obstacle to culture and loss from it will always be a negligible quantity.

Dr. Burck has here shewn that it is by no means impossible to cope with the disease as was stated no great time ago, and that it is a mere question of beginning the struggle early enough. Further experiments may simplify the methods of contending with the disease, but at present this plan is comparatively inexpensive and has proved decidedly successful.

Notes on the Foregoing.

The abstract of Dr. Burck's works I have made is very much condensed from the original. The substance has, however, been reproduced, but I have omitted portions which have no bearing upon cultivation in the Straits Settlements. The whole system of cultivation differs considerably in the two

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* Another plan is to make hedges or fences of sticks covered with creepers such as *Antigonon leptopus*, *Ipomeas*, or *Thunbergias*, or again, Teosinte grass (*Eucholena luxurians*), or maize may be planted in rows, or raised banks.

countries. In the first place the seasons are entirely different, here are no distinctly wet or dry seasons but on the whole the seasons are uniform. Again, Liberian coffee has alone proved successful here and the damage wrought by the disease is much less with this species than with Arabian coffee. From latest advices, however, we gather that the Arabian coffee in Java seems to be dying down, and slowly but steadily succumbing to the disease. If so, it is much to be feared that Arabian coffee will ere long be absent from our markets, as Java produces the largest quantity next to Brazil, and the unsettled condition of the latter country will probably, for the next few years, produce a distinct falling off in the supply.

Another distinction is in the soil upon which the coffee here has to be grown. Java is a volcanic region and volcanic soil is far more suitable for cultivation of coffee, as well as for several other cultures, than the so-called laterite of which the greater part of the Peninsula consists.

At the same time any light thrown upon the habits and requirements of the fungus is of great value, and Dr. Burck's suggestions and observations seem to me to possess, even for the cultivation of Liberian coffee here, a great deal of value and importance. All who have seen a view of the coffee fields in Ceylon, must have noticed the entire absence of any hedges or jungle breaking up the enormous tracts of coffee cultivation. The ground is, it is true, very undulating and hilly, but there is no attempt made to separate the fields at all by hedges. The whole country is open to the sweep of the prevailing wind to carry the fungus spores from end to end of the island, and, indeed, the undulating nature of the ground is in favour of the spread of the disease. Professor Marshall Ward, when he was investigating the disease in Ceylon, pointed out this very thing, and urged the formation of hedges. It is not probable that this simple method would have so far arrested the disease as to save the now ruined cultivation in Ceylon, but it would, doubtless, have lessened the violence and rapidity of the attack, and given some chance of combating the disease, by breaking up the whole into more manageable plots. It must be remembered that it is very rare to find any one species of plant growing in masses together unmixed with any other in a natural state. The effect is somewhat like that of herding many animals of one kind together in the same space. However, for crops such as coffee it is essential to do this. They require to be grown under unnatural conditions but as this is unavoidable, it is still possible to break up the plantation at least to a small extent by having belts of jungle, here and there, running through the plantations. The quantity of coffee lost by not putting these belts under cultivation is trifling compared with the advantage to be derived from them. These belts will arrest the spread of fungus spores, and blight. They will also be of signal use in attracting the insectivorous birds which will aid to keep down the insects which injure the coffee, and they will also be useful as supplies of sticks, poles, &c. required from time to time in the plantations. It is of course possible that monkeys and musangs will resort to these jungle patches, and sally forth at night to devour the coffee, but they are tolerably easily kept down in small woods and it is usually when there is extensive forest near the plantation that they are so injurious. Where the jungle has been destroyed, and where there are no bushes to make screens, I would suggest the planting of such trees as, *Adenanthera pavonina, Saman, Tembusu Erythrinas*, Jacktrees, etc., in thick rows, so as to break up the plantations. Nor would I restrict the use of jungle belts to the cultivation of coffee only. With all crops cultivated on a large scale here, I think it would be advisable to break up the plantations, if possible. It may be that with some cultivation no enemy worth considering is yet known, but no plant is entirely free from enemies either fungal or insectal, and although it may seem strange to say that a small jungle belt can and will act as a defence against strong winged insects, yet such is the case, for the insects when they rise in the air high enough to clear the jungle, are very liable to be borne far away over the plantation, and if even they do invade the plantation they come but a few at a time and can be easily dealt with. The peculiarities of insect attacks on crops here must, however, be treated of at some future time.

But with respect to Dr. Burck's treatment with the sulphuric acid and scissors, and also the tobacco water treatment. At present the disease in the Straits does not seem to be sufficiently destructive to require such elaborate attacks upon it. For although it is very difficult to find a tree entirely free from attack, yet the Liberian coffee, unless a weak plant, seems capable of resisting any ordinary outbreak. Nevertheless, we may expect, should the cultivation of coffee ever become very extensive, to find, as years go on, the disease becoming in time virulent, and this is the more likely as the soil in which we have to cultivate coffee is immensely poorer than that of Java.

Dr Burck, it appears, does not attribute much of the virulence of the disease to poverty of soil, yet I have doubts as to whether this may not have played a great part in the ruinous catastrophe of Ceylon. For a long period the same land had been under coffee. There was no rotation of crops, which indeed is impracticable for the most part with any crops except those of annuals or biennials. This constant growth of the same species of plant on the same soil, cannot but remove a large portion of the most valuable salts, and the plants must get gradually weaker, nor does there seem to be any reason to doubt but that weakly plants are more liable to succumb to disease, whether animal or vegetable, than healthy ones. There is abundant evidence of this throughout both the animal and vegetable kingdoms. Of course thoroughly healthy plants may also be attacked, but they have a much better chance to throw off the disease.

I do not think Arabian coffee can ever be successfully cultivated in the Straits Settlements It seems here to be very liable to produce "brush," that is to say, abnormal flowers, with minute, green, irregular sepals and petals, no stamens, and the pistal very small and apparently effete. I imagine this is due to the permanent dampness of the climate, and absence of any period of rest from growth. It appears to be a preliminary stage of what is known as phyllody of the flowers, *i. e.*, conversion of the part of the flower into leaves, instead of reproductive organs. This is common here also in certain orchids as *Phalænopsis Schilleriana*, which produces bulbs and leaves on the flower spike instead of flowers

On some Enemies to the Coffee in the Straits Settlements.

Besides the fungus, hemileia, the coffee suffers to a smaller extent from several destructive animals' among which are monkeys, musangs, a species of locust, the caterpillar of the bee-hawk-moth and a scale insect.

Of the monkeys the most destructive are the golden monkey (*Macacus sinicus*) and the black monkey (*Semnopithecus sp.*). The latter does not occur in Singapore but is common in Johor. These monkeys eat the fruit whole, passing the seeds uninjured, and the seeds passed by them are stated to be the best for cultivation. If this is correct it is perhaps due partly to the animals selecting the best fruit, but it is possible also that the seeds are absolutely improved by passing through the animal's body and so being manured, as has been shown to be the case with seeds of hawthorn trees swallowed by turkeys.

The musangs (*Viverra malaccensis*) are even more destructive than monkeys, and a good deal harder to destroy, as they are strictly nocturnal and very skilful at avoiding traps. They may, however, be caught in traps bated with pieces of bananas. On one estate, I am informed, that these animals eat a pikul of coffee per diem.

The locust is a large species of grasshopper not yet identified. It is about 3 inches long, yellowish green spotted with black. The hind wings are pink and very conspicuous when it flies, which it does very briskly. It does not eat the coffee leaves, but injures the bushes by laying its eggs in the shoots. This it does by making a series of slits in the bark of the shoots spirally, in each of which cuts it deposits a long narrow white egg. The larvæ do not appear to injure the shoot at all, and probably leave the plant as soon as hatched. The shoots, however, soon wither and turn black and finally fall off, and this is certain evidence of the presence of the locust. As a rule it does not do much harm, but under certain circumstances it may become exceedingly abundant and injurious. It is quite a common insect here, but I have seen it most abundant in Johor. It must be caught in butterfly nets, and destroyed.

The bee-hawk-moth (*Cephonodes hylas*).—The caterpillar of this insect is very destructive to the coffee by devouring the leaves, and clearing bushes with astonishing rapidity. The moth lays its eggs upon the leaves of the trees, and the caterpillars quickly emerge and commence the work of destruction, usually attacking weakly plants. When full grown the larvæ is about three inches in length and of a bright green colour. The head is small and dull green, the next segment is ornamented with a number of raised yellow dots, the rest of the body is smooth bright green, bluish above, along each side is a raised pink line and down the middle of the back runs a double white line from the head to the tail meeting behind the horn which, like most of the hawk-moth caterpillars, this animal has upon its tail. This horn is curved and sharp, yellow with raised black dots. The last segment and hindmost feet are ornamented with raised yellow dots. The feet are furnishe with tufts of hair, but otherwise the caterpillar is quite smooth. When full grown the caterpillar spins a web between the leaves and becomes a chrysalis. It remains in this state for about a fortnight and then emerges as the moth. The perfect insect is very beautiful, it is about $1\frac{1}{2}$ inches long, the body dark reen, the tail fan-shaped black and yellow. The wings are perfectly transparent except along the edges, which are of a dull dark red. It is very active and not very easy to catch, flying briskly abot in the evening shortly before sundown, and may be seen sucking the honey from the coee flowers, which it probably fertilizes, but as there are many other harmless insects which do this equally well it may be destroyed whenever met with without detriment to the fertilization of the coffee. It is most easily destroyed in the caterpillar state. The larvæ should be picked off by hand and destroyed. They are most abundant in January, but I have taken it full grown in December, and seen the perfect insect at several different periods of the year.

The scale insect commonly called black blight *(Lecanium coffeæ)* is also very injurious at times especially to weak plants. It may be destroyed by the application of phenyl, diluted with water till it is of the consistence of milk or by shaking powdered lime over the leaves with a flower dredger. Phenyl water can be applied with aid of a squirt of bamboo, or an ordinary syringe. Many of the scale-insects are protected from most liquids suitable for killing them without injury to the plants, by the waxy secretion with which they are covered, which prevents the liquid actually touching the insect's body, but phenyl will penetrate the wax and attack the animal. The phenyl should be poured into the water and stirred up till it assumes the appearance of good white milk. A kerosine emulsion is recommended by the Editor of "Notes on Indian Insect Pests," vol. i. p. 7. An emulsion resembling butter can be produced in a few minutes by churning with a force pump two parts of kerosine with one part of sour milk or soap solution in a pail, emulsions made with soap solutions being generally found to be more effective. The liquids should be at about blood heat. This emulsion may be diluted with from nine to fifty parts of water which should be thoroughly mixed with one part of the emulsion. The strength of the dilution must vary according to the nature of the insect to be dealt with as well as the nature of the plant, but finely sprayed in twelve parts of the water to one of the emulsion it will kill most insects without injury to the plants. It should be applied through a spray nozzle.

The white or mealy bug *(Pseudococcus adonidum)* is not as common here, but is also injurious. It should be treated in the same way.

I have received some specimens of coffee branches attacked by a fungus from Johor. This is quite a different kind to the hemileia. It seems to invade the bark of the branches filling them with a white mycelium and eventually forming a flesh-coloured crust on the outside of the twigs, which are then become black and rotten. It appears to be rather consequent on the death of the twigs from some other cause, and though it might perhaps spread a little to heatlhy parts is not much to be feared. It generally appears where the bushes are very crowded, and where the branches overlap, or where the locality is very damp. The dying and infected branches should be cut off and burned.

FERNS: SYNOPTICAL LIST: IV.

Synoptical List, with description of the Ferns and Fern-allies of Jamaica by G. S. Jenman, Superintendent Botanical Gardens, Demerara, (continued).

TRIBE II. *Davallieæ.*

Sori marginal; sub-marginal or medial; punctiform or transversely oblong; involucres attached interiorly, the margin of the frond often forming an exterior valve.

3. *Dicksonia.*—Sori terminal on the veins; involucres cup-shaped or bilabiate.
4. *Davallia.*—Sori terminal on the veins; involucres scale-like or pocket-shaped.
5. *Cystopteris.*—Sori on the back of the veins; involucres scale-like or hood-shaped.

GENUS III. DICKSONIA, L'HERIT.*

Sori marginal, globose or nearly so, on the summits of the veins; involucres interior, cup-shaped or bilabiate, the inner value special, the outer formed of modified crenules of the margin, opening exteriorly, the lips closed or overlapping at first; veins free, forked; fronds decompound.

Where this and the next genus meet the line of distinction is not very clear, the border plants fitting as appropriately into one genus as the other. All the local species have decompound, and, as a rule, large fronds.

a. Sori small, in axillary crenules of the final lobes; involucres cup-shaped, or sub-bilabiate, reflexed.

1 D. cicutaria, Swartz.
2 D. dissecta, Swartz.
3 D. rubiginosa, Kaulf.

aa. Sori small, terminal, or in axillary crenules of the final lobes; involucres flat, as wide or wider than the leaf-segment.

4. D. anthriscifolia, Kaulf.
5. D. antillense, Jenm.

aaa. Sori large, terminal on the final lobes; involucres bivalved, the outer hooded and overlapping the inner.

6. D. coniifolia, Hook.

aaaa. Sori serial around the margins; valves of the involucres closed at first; many or all of the veinlets fertile.

7. *D. Plumieri, Hook.*
8. *D. adiantoides, H.B.K.*

1. *D. cicutaria*, Swartz.

Rootstock free-creeping, rusty ciliate; stipites 3-4 ft. l. channeled, dark-brown, glossy; fronds quadri-pinnate and again pinnatifid, 3½—5 ft. l. nearly as w. at the base, chartaceous, glossy dark green, glabrous or beneath very slightly ciliate; pinnæ alternate, 1½—2½ ft. l. 10—15 in. w., petiolate, the basal ones generally the largest; pinnulæ alternate, serrate and finely acuminate at the point, stipitate, 4—7 in. l. 1—2 in. w. tertiary segments ½—1¼ in. l. ¼—½ in. w. rounded and toothed at the apex, within this deeply cut into 4—6 lobes to a side, the larger of which are again toothed, the largest of all being on the superior base and 1—3 li. l. by 1—2 li. br.; veins forked; sori on a crenature in the sinuses of the lobes, one to each, or two or more to the largest basal lobe; involucres deep, cup-shaped, ¼—½ li. w. sharply reflexed. Plum. Fil. t. 31.

Var. *D. apiifolia*, Hooker—surfaces more naked and brighter; teeth of the margins deeper and sharper; involucres deeper and smaller. Hook., Sp. Fil. vol. 1. t. 26, C. *D. incisa*, Fee, Fil.Ant. t. 25, fig. 1.

Common in open and lightly shaded places from 2,000 - 5,000 ft alt., easily recognised from the rest by its bright colour. There are three or four local forms, which differ most in the size and cutting of the segments and size of the involucres, the var. *apiifolia* is about the minimum dimensions given above and is easily recognised by its naked very glossy surfaces, and deep, sharp, marginal teeth. The form with largest, and bluntly lobed segments occurs at the higher elevations.

2. *D. dissecta*, Swartz.

Rootstock free-creeping, dull, puberulous; stipites 1½—3 or 4 ft. l. channeled down the face and laterally, dirty dark coloured; fronds 3½—5 ft. l, 3—4 ft. w., naked dull cloudy green, thin but firm, quadri-pinnate and again pinnatifid; pinnæ nearly or quite opposite, 1½—2½ ft. l., ½—1 ft. w. sessile: pinnulæ numerous, 4—8 in. l, 1—2 in. w. sessile, the point acuminate and serrate; tertiary segments, approximate. ½—1¼ in. l, 2—5 li. br,, rounded or blunted at the obtusely, rarely acutely, dentate, open, deeply pinnatifid, the lobes oblong and 3—7 to a side, the lowest on the superior side largest and 1½—3 li. l., by 1—1½ li. w., those above half the size, even-margined or their outer part faintly dentate: veins forked; sori one to each lobe in a crenature near the base, the larger basal lobe having two or more; involucres shallow, cup-shaped, or at first two-lipped, the inner valve being at length concealed under the expanded rotund sorus. Plum, Fil. t 30. *D. adiantoides*, w, *D. cicutarioides*, Fee. Fil Ant. t. 2., fig. 2.

Common in forests from 2,000 to over 6,000 ft. alt. always in damp dripping situations. Mature plants, especially at the higher elevations, bear bulbils in the axils of pinnæ. Near the preceding, and presenting as many forms, but distinguisbed by the sessile pinnæ, dull cloudy colour, as a rule blunter segments, and more shallow involucres. One of the forms from the higher elevations has minute sori, and is as finely cut as the var. *apiifolia*, of the preceding species, the pinnæ of which look like lace-work when mounted on paper.

3. *D. rubiginosa*, Kaulf.

Rootstock wide-creeping; stipites scattered, 2 - 3 or more ft. l. slightly asperous faintly channeled, glabrescent; fronds 3—4 ft. l. 2½—3 ft. w. quadripinnate and again pinnatifid, light green, chartaceous, more or less ciliate; pinnæ 1¼—1¾ ft. l. 6—10 in. w. alternate, nearly sessile; pinnulæ numerous, approximate or close, nearly sessile, serrate-acuminate, 3—5 in. l. ¾—1¼ in. w.—tertiary segments close, blunt or rounded and toothed at the end, 4—8 li. l. 2—4 li. w. deeply cut into blunt crenate-dentate lobes which are 1—$2\frac{1}{2}$ li. l. $\frac{1}{2}$—$1\frac{1}{2}$ li. br. the lowest on the superior side largest; veins forked; sori copious, minute, borne chiefly on the lowest crenature on the outerside of the final lobes, or on both sides of the larger inferior ones; involucres cup-shaped or sub-bilabiate.—Hook. Sp. Fil. Vol. 1. t. 27. A.

Common on open banks and waysides, and under light shade, from the lowlands up to 4,000 or 5,000 ft. alt., extending all through the country. The vestiture is chiefly confined to the vascular parts. The texture though thin is firm, and feels harsh to the hand. In shade it reaches 10—12 feet high.

4. *D. anthriscifolia*, Kaulf.

Rootstock, strong, creeping; stipites scattered, $1\frac{1}{2}$— $2\frac{1}{2}$ ft. l. channelled, wood—or straw-coloured, naked, fronds 2—3 ft. l. $1\frac{1}{2}$—2 ft. w. thin, dull green, naked, except the ribs which are slightly ciliate, quadripinnatifid; pinnæ nearly opposite, or quite so above, 1—$1\frac{1}{2}$ ft. l. 4—6 in. w. nearly sessile, the lower pairs apart; pinnulæ approximate, sessile, acuminate 2—$3\frac{1}{2}$ in. l. $\frac{3}{4}$ in. w., tertiary segments $\frac{1}{3}$—$\frac{1}{2}$ in. l 2—3 li. w., the rounded apex toothed, below this cut on both sides into 3—5 short dentate oblong lobes which are 1—3 li. l. $\frac{1}{2}$—$1\frac{1}{2}$ li. w., veins forked; sori small, in the crenatures, or terminal on the final lobes; involucres bilabiate, at length cystiform. Hook. Sp. Fil. vol. I. t. 27 B.

Common in open places on the banks of streams, near the Government Cinchona Plantations, at 5,000 ft. alt. In general aspect near the last species, but less robust, with terminal sori, transversely flat, compressed, involucres prior to their opening out, and flattened (appearing as if margined) costules.

5. *D. antillense*, Jenm.

Rootstock creeping: stipites 2—$2\frac{1}{2}$ ft l. bright brown, naked, channeled; fronds 3—$4\frac{1}{2}$ ft. l. naked, thin, pellucid, bright glossy dark green, quadripinnate and again pinnatifid; pinnæ opposite or nearly so, sessile, 1—$1\frac{1}{2}$ ft. l. 6—8 in. w., pinnulæ sessile, $1\frac{1}{2}$—$3\frac{1}{2}$ in. l. $\frac{3}{4}$—$1\frac{1}{2}$ in. w. lobed to the acuminate point; tertiary divisions the same shape but proportionately reduced, fully pinnate; quaternary cut into lobes $\frac{1}{4}$—$\frac{1}{3}$ li. w. which when barren are sharply pointed, and the larger emarginate; veins simple in the final lobes; sori terminal on most or all lobes; involucres bivalved, compressed, wider than the lobe.

Slopes of Blue Mountain Peak 7,000 ft. alt. discovered a few years ago by Mr. Morris, and gathered a year later by Mr. Sherring. It has the general outline and colour of *cicutaria*, but is much more finely cut than any form of that, and differs entirely by the terminal sori, and compressed involucres which are wider than the lobes. The cutting is as fine as in *Davallia fumarioides* and *Gymnogramme schizophylla*. In the character of the involucres, this and anthriscifolia do not differ from some conditions of *Davallia*, and might as appropriately be placed in that genus.

6. *D. coniifolia*, Hook.

Rootstock stout, a few in. l. oblique, densely clothed with ferruginous wool-like scales; stipites tufted, 1—$1\frac{1}{2}$ ft. l. laxly spinescent in parallel rows down the sides, as is also the rachis, castaneous, the base clothed like the rootstock; fronds subcoriaceous, light clear green, naked except on the rachis, &c., deltoid or ovate-deltoid, 1—2 ft. l. $\frac{3}{4}$—$1\frac{1}{2}$ ft. w. quadripinnate, the several divisions proportionately reduced but much the same shape as the frond; lowest pair of pinnæ, pinnulæ, &c. the largest, final segments ovate, 2—6 li. l. $1\frac{1}{2}$—4 li. w. lobed or pinnatifid at the base, above this dentate, the teeth acute and about $\frac{1}{2}$ li. w.; veins forked; sori large, on one or both sides of the final lobes; involucres coriaceous, the outer valve hooded over the inner, 1 li. w. $\frac{1}{2}$ li. d.—Hook. Sp. Fil. vol. 1, t. 24 A.

Very common, often forming large patches, in places in forests of the higher slopes and peaks between 6,000—7,000 ft. alt. An interesting and beautiful plant, very near *D. Culcita*, L'Herit. of Madeira and Azores. The stipites are permanently adherent to the rootstock, and hence the dead fronds remain attached till, in the course of time, they decay away. The lowest pair of pinnæ are barren.

7. *D. Plumieri*, Hook.

Rootstock stout, oblique; stipites tufted, strong, channeled, dark brown, 2—4 ft. l. the base slightly scaly; fronds $2\frac{1}{2}$—4 ft. l. nearly as wide, light green, paler beneath, sub-coriaceous, naked, tripinnate; pinnæ alternate, sub-distant, 1—2 ft. l. $\frac{1}{2}$—$1\frac{1}{4}$ ft. w. serrate-acuminate, petioled, lowest pair largest; pinnulæ sub-distant, alternate, the upper ones adherent and decurrent, the lower petiolate serrate-acuminate, deeply pinnatifid or fully pinnate at the base, 4—8 in. l. 1—3 in. w.; tertiary segments variable, some rounded, others acute or acuminate, the larger 1—2 in. l. $\frac{1}{4}$—$\frac{1}{2}$ in. w. serrulate or lobate-serrulate; veins simple or forked; sori copious around the margins, close; involucral valves sub-equal, the lips shallow. Plum. Fil. t. 7. *Davallia adiantoides*, Swartz.

Common in moist forests from 2,000—4,000 ft. alt. A very robust plant, marked by the stout suberect rootstock, frequently a foot long and several inches thick, and the unequal final segments, some of which are rounded and others longer and pointed on the same pinnules. When open the involucres are pocket-shaped It has an equal claim to be placed in *Davallia*, in which case Swartz's name should be used.

8. *D. adiantoides*, H. B K.

Rootstock stout, $1\frac{1}{2}$—2 ft. l. naked; stipites naked or slightly ciliate, channeled, $1\frac{1}{2}$—3 ft. l.; fronds 3—4 ft. l. nearly as w, tripinnatifid, bright green, paler beneath, chartaceous, naked; pinnæ opposite or nearly so. $\frac{3}{4}$—$1\frac{1}{2}$ ft. l. 5—9 in. w. the lower ones shortly petiolate; pinnulæ spreading, apart, sessile or the lower shortly stipitate, upper ones adnate decurrent, basal pair greatly reduced, serrulate—acuminate at the apex 4—6 in l. 1—2 in. w. cut more or less deeply into close, crenate, broadly rounded lobes which are 3—4 li. w. and less or more deep; veins simple or forked; sori contiguous, serial around the lobes; involucres wider than deep, at first two-lipped, finally open and more or less cup-shaped.—Hk. Sp. Fil. Vol., I. tab. 26. fig. B. and *D. Paroni*, Hook, fig. A. *D. obtusifolia*, Willd. *Davallia arborescens*, Willd. Plum. Fil. tab. 6.

Infrequent in gullies near the highest peaks at 7,000 ft. alt., gathered near Blue Mountain peak, distinguished from the last by the pinnæ and pinnulæ being parallel sided, the dwarfing of the lowest pair of the latter, and the final lobes being equal and uniform. The largest states are tri-pinnate. Plumier's figure I think undoubtedly represents this species, but it does not show the pair of dwarfed pinnules at the base of the pinnæ. Willdenow's names quoted above are the oldest. It is a discovery of recent years (1885-86) in Jamaica.

No. 23. SEPTEMBER 1891.

BULLETIN

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BOTANICAL DEPARTMENT,

JAMAICA.

CONTENTS:

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JAMAICA:
GOVERNMENT PRINTING ESTABLISHMENT, 79 DUKE STREET, KINGSTON.
1891.

REPORT ON THE COCO-NUT DISEASE AT MONTEGO BAY.

Botanical Department, Gordon Town P. O.
24th July, 1891.

Sir,

I have the honour to report that I have visited Montego Bay to examine into the death on a large scale of Coco-nut Palms in that neighbourhood.

The first intimation I received on the subject was an extract from the Report of Mr. J. W. Gruber, Collector of Taxes, forwarded to me by you. At a later date the Doctors McCatty favoured me with some observations that they had made.

I passed through the extensive plantation of Mr. Levy on the east of Montego Bay, and had the opportunity of hearing his remarks on the commencement and progress of the disease.

The Rev F. H. Sharpe, Rector of Montego Bay, showed me the devastation that had taken place among the Coco-nut Palms in the church-yard in the town.

I discussed the subject with the Doctors McCatty, Messrs. Gruber, Geo. Robertson, Rerrie, Facey and others.

Mr. Doul, the Manager of Catherine Hall Estate on the west of the town, afforded me every assistance at the Coco-nut plantation on the Estate. Dr. Sinclair was also most kind and helpful.

Several trees were cut down and the roots, stem, leaves, and cabbage examined. There was no evidence whatever of attacks by a beetle, there were some small larvæ, some wood lice, earwigs, ants of several species and other insects on the affected parts, but they were evidently only preying on the diseased juices, and were not the cause of the disease.

The roots were quite sound and the stem appeared to be unaffected. Both stem and leaves were of normal size, and there was no indication of a gradual dwindling of vitality due to lack of proper nourishment extending over a long period. The disease, whatever it might be, seemed to be quick in destruction.

The youngest parts were those affected. The leaves and flowers in the bud were sometimes able, though affected, to withstand the disease so far as to open out, and some leaves and nuts attained almost their full development before the tree succumbed. In the case of tall trees, the first indication of the disease was the dropping of the young fruit. It was stated that the disease in this condition had been checked by setting fire to the fibrous material at the base of the leaves, which process burnt all the leaves; new fronds, however, developed, and the tree was at any rate for the time saved. The application of salt to the cabbage had also, it was alleged, been successful.

If the terminal bud in the cabbage is affected, the tree is doomed.

In almost all the trees examined, the sour smell of a putrefactive fermentation was very noticeable, and I am of the opinion that the disease is due to an organised ferment which is able to attack the very tender tissues of the youngest parts, even outside the terminal bud. If this ferment can be destroyed by fire or other means before it reaches the terminal bud in the heart of the cabbage the tree may be saved.

Any remedy should therefore be applied on the very first signs of disease. If delayed too long until the terminal bud is diseased, the tree cannot be saved.

Although to fire the fibre at the base of the leaves is easy of application, it is not safe near buildings, and by the destruction of the leaves, the production of fruit is for a long time retarded with consequent loss.

I would recommend that those who do not care to apply fire should drench the cabbage with a solution of sulphate of iron in water in the proportion of two pounds of sulphate to one gallon of water. A solution of sulphate of copper might also be tried in the proportion of 5 parts to 100 of water, and a solution of boracic acid in the proportion of 4 parts to 100 of water.

All diseased trees which cannot be saved, should be cut down and burnt, to prevent infection.

In order to give the tree every chance of recovery the soil might be scraped away from the roots and the ashes of the burnt trees applied together with some manure.

It may be said that these remedial experiments are costly, but on the other hand the annual value of each tree is stated to be at least four shillings.

I have, &c.,

(Signed) W. Fawcett,
Director of Public Gardens and Plantations.

The Honble. the Colonial Secretary.

COCOA: SAMPLES FROM LONDON MARKET.

The following correspondence transmitted by the Secretary of State for the Colonies to the Jamaica Government on the subject of Cocoa has reference to samples received from Messrs. Wilson, Smithell & Co., through the kind offices of Kew. The samples have been placed in the Museum of the Jamaica Institute for ready inspection by those interested.

Royal Gardens, Kew, to Colonial Office.

Sir, Royal Gardens, Kew, 1st July, 1891.

I am desired by Mr. Thiselton Dyer to inform you that he has received from Mr. W. Fawcett, Director of the Botanical Department, Jamaica, an application for samples of commercial Cacao as it is usually received in the London market, for the purpose of bringing before planters in Jamaica the appearance and quality of Cacao which receives the highest prices.

2. In furtherance of Mr. Fawcett's wishes application was made by this Establishment to a firm of brokers in the City and the enclosed report, with a set of samples, has been received from Messrs Wilson, Smithell & Co. The samples are being forwarded direct to the address of the Director of the Botanical Department, Jamaica, by the outgoing mail.

3. The Cacao industry in Jamaica has steadily extended of late years. The quantity of Cacao exported has increased fourfold, but the value per cwt. has been almost stationary. In fact it has become a matter for serious consideration to the Government of Jamaica how it may be possible to rescue an otherwise promising industry from being crippled by the carelessneas of the small proprietors, (who at present grow the bulk of Jamaica Cacao) in exporting an inferior article.

4. In an address given at the request of Sir Henry Blake at the late Jamaica Exhibition on February 9, I drew particular attention to this subject and pointed out that owing to bad curing Jamaica Cacao was at the bottom of the list of Cacao in the London market and the Island lost yearly on this account about £20,000 to £30,000. Acting on my suggestion then given, the Government has lately taken steps to send intelligent instructors round the Cacao growing Districts to explain carefully to the settlers the way the Cacao should be cured and the Legislative Council has voted a sum of £600 for this purpose. The result of this experiment will be watched with some interest.

5. As confirming the information placed before the Government of Jamaica it will be noticed that Messrs. Wilson, Smithell & Co., report that the bulk of Jamaica Cacao "is of very ordinary quality"; the only West Indian Cacao taking rank below it being St. Domingo from Jeremie, "whilst that from Samana in the same Island is superior to Jamaica."

6. Owing to the facility with which Cacao can be grown under the shade of bananas the extension of Cacao planting in Jamaica should proceed *pari passu* with that of fruit culture. The little attention, however, so far devoted to properly curing the produce is a matter of grave concern to those interested in the Island and it is to be hoped that the measures now in course of being taken to remedy the defect will produce results of a more hopeful character.

I have, &c.,

Edw. Wingfield, Esq., C.B., (Sgd.) D. Morris.
Colonial Office, Downing St.

Messrs. Wilson, Smithell & Co., to Royal Gardens, Kew.

41 Mincing Lane, London, E.C., 25th June, 1891.

Sir,

We duly received your letter of 11th instant requesting us to supply for the Government of Jamaica, commercial samples of the various sorts of cured Cacao which come into the London market, and we have much pleasure to advise you that we have despatched four samples the best of the respective kinds to your address, viz:

No. 1. Fine Ceylon, value 154/ per cwt., from Aloowihare Estate.
No. 2. Fine Trinidad, value 98/ per cwt., from Locounseo Estate.
No. 3. Fine Grenada, value 65/ per cwt., from Tufton Hall Estate.
No. 4. Fine Guayaquil, value 90/ per cwt., from Arrila Prima Estate.

We have not included a sample of Caracas as that growth is generally cured in the earth of the country and attempts made in various places to prepare Cacao in that manner have almost invariably ended in a disappointment. A small proportion of Jamaica Cacao imported here has undergone fermentation to a greater or less degree, but the bulk is of very ordinary quality, the only West Indian Cacao 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 Cacao—although wanting in size, and if properly harvested, fermented or sweated, and then dried in the sun until the bean becomes crisp to the feel, so that the shell is fairly loose, and the interior dry and of an even chocolate brown, not violet colour 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 can not 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.

We are, &c.,

D. Morris, Esq. (Sgd.) Wilson, Smithell & Co.

REPORT ON POTATOES FROM CANADA GROWN AT CINCHONA.

The Hon. Adam Brown, Honorary Commissioner for Canada at the Jamaica Exhibition, presented the Department with several varieties of potatoes These potatoes were sown at the Hill Gardens, Cinchona, elevation 4,900 feet, and the following tables, giving the results, have been prepared by the Superintendent, Mr. Cradwick.

It will be noticed that the tops first appeared above ground from 12 to 17 days from planting, and that the potatoes were ready for digging in from 68 to 73 days from sowing. The mean temperature during the period was about 62.5° F.; the total rain was about 8¾ inches which fell on about 20 days.

I believe that very much better results would be obtained if potatoes were sown in October, or November, during the rainy season; and larger prices would be received in the markets of Canada and New York in January and February than in May. This experiment cannot be looked upon as doing much more than indicating which varieties are likely to suit a dry season in Jamaica.

Of the list of varieties given in Mr. Brown's Official Report, the following do not appear to have been sent: Imperator, Vanguard, Thorburn's Paragon, Early Onion. Carter's Surprise, Sugar, First Crop Ash Leaf. The following names occur in our list, not mentioned in Mr Brown's: Eye Carpenter, St. Patrick, Prime Minister; and there are four unnamed varieties.

The colums which are important in coming to a conclusion are (a) weight of saleable potatoes per hill, (b) number of saleable potatoes per hill, and (c) the gross weight per hill. The column (c) is important as in wetter weather the greater portion of the small potatoes would have been saleable; (b) compared with (a) will give the average size of the potatoes.

The best varieties seem to be Crown Jewel, International Seed Company's, Prime Minister, and King of the Earlies. Of these, the International gives the largest yield in weight, gross, and of saleable potatoes; though the Crown Jewel potato is larger and would no doubt obtain a better price per lb.

W.F.

POTATOES. Names of Varieties.	Date of Planting in February or March.	First Appearance of Haulm or Tops.	Days from planting.	Date when Tops were dead, potatoes ready to dig.	Days from Planting.	No. of sets planted.	No. of sets lifted.	No. of saleable Potatoes per hill.	Total number of Potatoes per hill.	Weight of saleable Potatoes per hill in ozs.	Gross weight of Potatoes per hill in ounces.	Total weight of Potatoes lifted lb. ozs.	Mean Avg. Temp. for time during which Potatoes were in ground.	Rainfall.	No. of Days on which rain fell.	Percentage of diseased Tubers.
Ruper Eating Crane	23.2	13.3	17	6.5	73	12	12	1 40	4.00	4 0	7.0	5.4	62.3	8.98	22	16
King of the Earlies	23.2	12.3	17	6.5	73	11	10	3	6.00	12.80	19.	2.(	62.3	8.98	22	0
Magnum Bonum	27.2	14.3	15	6.5	69	12	12	1 00	6.00	4.00	13.	0.0	62.	8.55	18	7
Bliss's Triumph	25.2	17.3	20	6.5	70	14	12	3.00	5 00	8.00	10	8.0	62.2	8.65	20	0
Rose's New Giant	26.2	17.3	19	5.5	68	17	16	0.00	2 00	0 00	2.	2.0	62.9	8.63	19	0
Eye Carpenter	24.2	12.3	16	5.5	71	12	12	3.00	6.00	8.00	9	7.(	62 4	8 83	21	0
New Badger State	25.2	16.3	19	5.5	69	24	20	0.00	3 0	0 00	2.8	3.8	62 9	8.65	20	0
Great Eastern	25.2	14.3	17	6.5	70	10	0	3.00	6 50	6 00	8.(	5 (	62 2	8.65	20	30
Early Albino	26.2	13 3	15	5.5	68	19	19	2.06	10 50	6 05	12.(	5.(	62 9	8.63	19	2
Rural Blush (Rennie)	25.5	13.3	16	6.5	70	13	12	2.00	4.00	5.00	8.	6.(	62.2	8.65	20	4
Ohio Gunner	25.2	13 3	16	6.5	70	17	14	4.00	6.00	1 60	12.	1.0	62 2	8.65	20	10
Halton Seedling	26.2	13.3	16	5.5	68	16	16	1.20	0 08	3.00	12 (	12.(	62.9	8.63	19	4
King of the Russets	25.2	13.3	16	6.5	70	11	11	3.00	7.00	8 80	11.	8 (	62.2	8.65	20	0
Early Maine	25.2	13.3	16	5.5	69	16	16	1.05	7 06	2.50	8 (	8.6	62.9	8.65	20	17
Early May Queen	26.2	14.3	16	5.5	68	16	16	1.00	10.00	3 00	1.(	11.0	62.9	8.63	19	6
Ruby	26.2	17.3	19	6.5	69	21	21	0.50	3.50	1.50	3.8	5 0	62 5	8.63	19	20
Lee's Favourite	25.2	15.3	18	5.5	69	2	22	1.08	7.90	3.90	6.	9.8	62 9	8.65	20	2½
Rose's Beauty of Beauties	26.2	14.3	16	6.5	69	15	15	1.00	4 20	3.20	6.4	6.0	62 2	8.63	19	22
Member of Parliament	25 2	16.3	19	6.5	70	16	16	0.50	6.00	3.00	8.(	3 0	62.2	8.65	20	10
Holborn Abundance	25.2	15.3	18	6.5	70	22	20	3.00	5.00	6.80	8 (	10.0	62.2	8.65	20	0
Adirondack	26.2	17.3	19	5.5	68	13	11	0 00	4.00	0.00	2.	2 0	62.9	8.63	19	0
White Star (W. Dewar)	24.2	13.3	19	6.5	71	4	13	1.00	4.40	2.00	4	4 (	61.4	8.83	21	50
Burpee's Superior	25.2	12.3	15	6.5	70	14	14	3.00	10.80	5.70	12.	11.(	62.2	8.65	20	3½
St. Patrick	25.2	16.3	19	5.5	69	11	11	.70	10.80	4.40	12.4	8.8	62.9	8.65	20	6
Brownell's Best	24.2	12.3	18	6.5	71	18	11	3.00	7.0	9.00	11.6	8.(	62 4	8.83	21	13
Dumfrie's Early White	25.2	14.3	19	6.5	70	12	11	2.00	5.00	6.00	7.	5.0	62 2	8 65	20	4
Empire State	25.2	14.3	17	6.5	70	21	21	2 00	6. 0	5.30	10.7	4.0	62.2	8.65	20	0
Burpee's Seedling	26 2	13.3	15	5.5	68	12	2	2.00	9.90	5.0	13.	0 (	62.9	8.63	19	5
Alexander Prolific	26.2	16.3	18	5.5	68	12	12	1.50	5.00	4.00	8.6	6.(	62.9	8.63	19	2
Dakota Red	24.2	11 3	15	6.	71	20	20	4 00	11.20	4.0	17.(	2.0	62.4	8.83	21	0
Telephone	24.2	13.3	17	6.5	71	12	12	2.0	6.00	7.00	2.0	9.(	62.4	8.83	21	4
Vermont	25 2	14.3	17	6.5	70	17	4	4 00	5.00	5.0	6.9	6.(	62 2	8.65	20	2½
Prime Minister	24.2	13.3	17	6.5	71	20	17	4.30	5.60	13.10	15.(	16.(	62.4	8.83	21	28
Crown Jewel (Rennies)	24.2	13.3	17	6.5	71	6	6	4 00	6.00	16 00	24.0	9 0	62.4	8.83	21	6
Richter's Improved	25.2	14 3	17	6.5	70	21	4	4 00	6.00	8.00	9 1	8.0	62.2	8.65	20	2¼
Sharpe's Seedling	26.2	15.3	17	5.5	68	11	11	05	1.05	7.07	14.0	10 0	62.9	8.65	20	.1
Early Ohio	24 2	11.3	15	6.5	71	16	16	2.00	9.0	6 0	16.0	16.0	62.4	8 83	21	4
Compton's Surprise	26.2	15.3	17	6.5	69	17	13	1.70	4.00	2 60	4.3	3.8	62.5	8.65	19	4
Early Rose	27.2	15.3	16	6.5	68	12	12	2.00	7.00	4 00	13.3	10.0	62.2	8.55	19	6
White Star	24.2	13.3	17	6.5	71	24	20	4.00	10.00	10 04	16 0	20	62.4	8 83	21	16
Snowflake	24.2	13.3	17	6 5	71	10	10	.50	5 00	3.00	8 0	5 0	62 4	8 83	21	8
Clark's No, 1	24.2	13 3	17	6.5	71	24	20	4.00	6.70	11 20	13 6	17.(	62.4	8 83	21	11
White Sprout	24.2	11 3	15	6 5	71	16	16	4.00	6.00	10 0	13.0	3 0	62 4	8.85	21	40
Manhattan	24.2	14.3	18	6 5	71	16	16	1.00	4 00	2 0	4 0	4	62.4	8.83	21	[illegible]
Blue Bell	26 2	14 3	16	5 5	68	12	11	.00	7 00	0 00	6.6	4 8	62 9	8.65	19	0
Sample from International Seed Company—	23.2	11 3	16	6 5	72	10	10	7 00	12.70	29.40	28.8	18.0	62.3	8 98	22	6
Packets Unnamed 1	27.2	15.3	16	5 5	67	15	13	1.70	4 00	2 60	4.0	3 4	63 9	8 55	19	0
" 2	27 2	14.3	15	6 5	68	11	11	20	7 00	2 00	9 0	6.3	62.2	8 55	19	5
" 3	5 3	27 3	22	9.6	95	3	11	0	1 0	0	1 0	0 11	61 7	18.51	32	0
" 4	5.3	27 3	22	9 6	95	12	11	0	6 0	0	3.0	2 1	61 7	18.51	32	0
Early Sunrise	26.2	13 3	14	5 5	68	16	16	00	10.00	2.50	11.0	11 0	62.9	8 65	19	0

COLA NUT OR BISSY.

Cola Nuts or Bissy are the seeds of a tree (*Cola acuminata*, R. Br.), 20 to 40 feet high, a native of western tropical Africa. Each fertile flower produces 5 pods, and, as the pods contain each from 5 to 12 seeds, a single flower may yield 54 seeds, measuring a quart, and weighing $1\frac{1}{4}$lbs.

Situation.—Wherever bananas, nutmegs, or cocoa grow, cola will flourish. Hot, damp situations, where the annual rain falls is not less than 80 inches, suit it best. The tree grows in Jamaica in suitable situations at elevations varying from sea-level up to 3,000 feet, but probably it succeeds best, below 1,000 feet.

Soil. A deep, rich, somewhat clayey soil, will doubtless be most favorable for production, but the cola tree is hardy, and will endure variations in soil as it does in climate.

Planting.—Young plants are obtained by sowing the seeds, which may be done either in the positions of the trees to be permanent, or in nurseries to be transplanted. The latter is the better plan. The soil of the nursery beds should be a mixture of loam with peat or decayed leaf mould. The seeds may be sown at distances of 9 to 12 inches apart, and should be shaded.

The seedlings may be transplanted, when they are from 2 to 3 feet high. The permanent situation should not be less than 25 feet apart. If the soil is not very deep and rich, holes should be dug 3 feet every way sometime before planting, and only surface soil filled in. Shade for the plants is necessary, and this is best obtained by growing bananas alternately with the cola.

Yield.—The tree will begin to bear after 5 or 6 years, and will be in full bearing at 10 years. It should yield then about 120lbs. weight of nuts. An acre would yield from 7,000 to 8,000lbs. The "Chemist and Druggist," dated 15th August, 1891, gives the following quotation in its Trade Reports: "On Wednesday 1s. per lb. was paid for a box of well dried West Indian (Grenada) colas." Mr. G. A. Stevens, British Consul in Bahia, in a communication to the Marquis of Salisbury dated September, 1890, states that nuts arrive in that port from Lagos, and "each bean is sold here from 2d. to 3d., according to freshness."

Curing.—The seeds should be thoroughly dried, in the shade, if possible; but if there is dampness in the air, the drying must be done in the sun. Unless the seeds are dried perfectly, they will decay when exported. All inferior, or worm-eaten seeds should be picked out to form a second quality.

Dietetic Value.—The *Kew Bulletin* for November, 1890, and a lecture on "Kola Nut" by Dr. Neish, published by the Institute of Jamaica, enter fully into the question of its dietetic value. Dr. Neish says that the nuts furnish "a nutrient and stimulant beverage. Rich in the active principle of coffee, containing also a large proportion of theobromine, the active principle of cacao, these nuts, in addition, contain three times the percentage of starch contained in chocolate; and, moreover, they also contain less fat, so that, in addition to stimulant and nutritive properties, there is the probability that a chocolate prepared from them will more readily agree with delicate stomachs . . . What enhances the value of cola-nuts is the fact that citrate of caffaine,—a medicine now much employed for the relief of sea-sickness, megrim, and other nervous complaints—can be readily obtained from these nuts, for the reason that the nuts contain more caffeine than coffee berries; and in the cola-nut the caffeine is in the free or uncombined state." Mr. Prudencio Bravo, of Kingston, has kindly made experiments for the Director of Public Gardens in the manufacture of a cola-chocolate, and has produced an excellent article. Kola has been recommended by medical men in nervous complaints, and has been used with success as a remedy for sea-sickness.

FERNS: SYNOPTICAL LIST, V.

Synoptical List, with description, of the Ferns and Fern-Allies of Jamaica, by G. S. Jenman, Superintendent Botanical Gardens, Demerara, (continued).

GENUS IV. DAVALLIA, Smith.

Sori small, subglobose, oval or punctiform terminal on the veins, marginal or intramarginal; involucres sepal or pocket-like, attached only by the base or more often also by the sides, free and opening exteriorly; veins simple or forked; fronds variable in size and cutting.

As in the last genus, when the sori are marginal the edge of the frond forms an outer valve to the involucres. The vertical range is from the lowest to the highest elevations.

a. Fronds pinnate or bipinnate.
 b. Fronds pinnate.
  1. D. Saccoloma, Spreng.
 bb. Fronds bipinnate.
  2 D. Sloanei, Jenm.
aa. Fronds decompound, not climbing nor prickly. Sori intramarginal.
 b. Involucres sepal-like, attached by the base only.
  3. D. Speluncæ, Baker.
 bb. Involucres pocket-shaped, attached by the sides.
  4. D. inæqualis, Kze.
aaa. Fronds decompound, scandent, prickly; sori terminal on the segments.
  5. D. aculeata, Swartz.
  6. D. fumarioides, Swartz.
aaaa. Fronds multifid, divisions linear; sori terminal on the segments.
  7. D. clavata, Swartz.

1. *D. Saccoloma*, Spreng.—Rootstock short, erect or decumbent, very stout; stipites tufted, erect, 2-3 ft. l. dark brown, glossy, channelled, fibrillose and asperous at the base; fronds 2-4 ft. l. 1-1½ ft. w. chartaceous, glossy bright green, naked, simply pinnate, with a terminal pinna and numerous similar spreading lateral pinnæ, ½-1 ft. l. 1-1½ in. w. the base obliquely rounded or subcuneate, the lower ones stipitate; veins close, simple or forked, prominent beneath; sori one to each vein, forming a continuous series along the margins, falling short only of the finely serrated acuminate point: involucres shallow, broader than deep, the crenulate margin of the pinnæ forming an uninterrupted outer valve.—*Saccoloma elegans*, Klf.

Common in forests and on well-shaded banks of the eastern parishes up to 1000 or 1500 ft. alt. Through the veins being close, and each one fertile, the sori form an almost continuous line. From a mistaken or transposed note of Purdie's, which represents the rootstock as creeping 20 ft. high, the habit has hitherto been misunderstood. The rootstock is in fact 4-6 in. thick, reaching not more than 1 ft. high.

2. *D. Sloanei*, *Jenm.*—Stipites strong, dark-brown, channelled; fronds 3ft. or more l nearly as w. bipinnatifid or fully bipinnate, chartaceous, pellucid, light glossy green, naked; pinnæ alternate, apart, the upper ones narrow subentire, sessile; the lower 10-15in. l. 3-6in. w., petiolate, pinnate at the base, above this deeply pinnatifid, suddenly reduced in the outer third to a one-inch w. ligulate portion which is broadly and roundly lobed, the lobes fading outwards through mere sinuations into the serrulate acuminate point; pinnulæ alternate, 3-4in. l. ⅓-½in. w. oblique and except the lower one or two fully adnate and connected, with a broad cuneately notched sinus ¼-½in. w. between; veins once forked; sori terminal on the veins, forming an uninterrupted marginal line; involucres transversely attached, pocket-like, the crenatures of the thin membranous margin forming an outer reflexed valve.—Sloane Cat. p. 19; Hist. p. 89. tab. 47; plts. p. 102. *Pteris. Radd.*

Gathered by Sloane in 1688 about Mt. Diabolo, where he says it grew at the time in several places. No other collector has found it. Sloane's specimen, cited above, is an entire fertile frond. A good search of Mt. Diabolo for its rediscovery would be well worth the while of any collector.

3. *D. Speluncæ*, Baker.—Rootstock branched, short-creeping; stipites close, erect, 2-3ft. l. lightly channelled; fronds 4-5ft. l. 2½-4ft. w. tri-quadripinnate, rather soft, greyish green, both sides lightly pubescent; pinnæ apart, alternate, 1¼-2ft. l. 5-10in. w. acuminate, nearly sessile; pinnulæ numerous, 2¼-6in. l. ¾-1½in. w. sessile or nearly so, lobed to the acuminate point; tertiary segments approximate, broader on the outer side, ⅓-½in. l. 2½-5 li. br. blunt, dentate, deeply pinnatifid or fully pinnate, the lowest on the inferior side largest; final lobes 3-7 to a side, 1½-3 li. l. ½-1½ li. w. blunt, the larger dentate; veins forked, not reaching the margin; sori sub-marginal, terminal on the lowest veinlet in the crenatures at the base of the lobes, one to each except the large basal lobe which has 2-4; involucres wider than deep, attached by the base, ciliate or not.—*D. Jamaicensis* Hook. *D. polypodioides*, Eat. *Polypodium Speluncæ*, Linn.

Frequent in open and bushy places among the lower hills, and extending upwards to 2,000 or 3,000 ft. alt. It varies a good deal in size, shape of pinnœ and pinnulæ, and in pubescence. The texture is uniformly soft.

4. D. *inæqualis*, Kunze—Rootstock very stout, erect; stipites tufted, 3-4 ft. l. channelled, scaly at the base; fronds nearly deltoid, 3-4½ ft. l. 2½-4 ft. w. firm, naked, glossy pale green, quadripinnate; pinnæ alternate, similar in shape to the frond 1½-2 ft. l. ¾-1¼ ft. w. lax, petiolate, serrate, acuminate, the larger deeper on the lower side; pinnulæ proportionately reduced; tertiary segments similarly shaped, ¾-2 in. l. ⅓-¾ in. w. hardly sessile, the apex serrate or dentate, below this fully pinnate, the outer side the deeper; final segments ovate-oblong, dentate, or at the base lobate, 3-5 li. l. 1-2 li. br.; veins simple or forked, not reaching the margin; sori 2-6 to each of the final segments, placed against the shallow teeth, sub-marginal; involucres deeper than broad, quite enclosing the sori, pocket-shaped, opening only at the top.—Hook. Sp. fil. vol. i. t, 57. B.; Sloane's t. 57.

Frequent in mountain forests from 2000–4000 ft. alt. A large multifidly cut species, of pale or straw green colour, with glossy naked surfaces, and lax habit. The lower pinnæ are deeper on the inferior side, but this character is gradually reversed in those above.

5. *D. aculeata*, Swartz.—Rootstock prostrate, short-creeping, densely fibrillose; stipites close, variable in length, castaneous, glabrous; fronds ascending few to many ft. scandent, dark green, naked, chartaceous, quadripinnate; pinnæ opposite, horizontal, nearly sessile, 1½-3ft. l. ¾-1½ft. w.; pinnulæ alternate, ½-1 ft. l. 2-5 in. w. the basal pair conspicuously reduced; tertiary divisions 1-4 in. l. ½in. w. the several lower ones usually much the largest; quadriary segments cuneate-flabellate, pinnate or pinnatified, 2-3 li. w. and d. forming 1-3 emarginate or bifid wedge-shaped blunt lobes, which are ½-⅓ li. w. and into which usually a single veinlet runs; rachis and other ribs more or less castaneous, flat or channelled down the face, prickly beneath, costæ and costulæ flexuose or zig-zag; sori at the ends of the final lobes, one to each; involucres cuneate, rather deeper than w. opening at the top.—Hook Sp. Fil. vol., 1, t. 54 B. Plum. Fil. t. 94, (greatly exaggerated).

Abundant in forests and in their skirts, forming dense and impenetrable thickets from 2500 ft. alt. up to the highest ridges and peaks. The fronds reach 15 or 20 ft. high, supported by each other or the surrounding bushes or trees, the lower pinnæ dying and decaying away as the top of the frond extends. Cutting through a ticket, it emits a very offensive smell, the juice produces a yellowish stain or dye.

6. *D. fumarioides*, Swartz.—Rootstock prostrate, short-creeping; stipites close, a foot or more l. sparsely prickly; fronds ascending few or several ft. high, 3–5 ft. w. quadripinnate, naked, light green: rachis angular, and with the flexuose or zigzag costæ armed with recurved prickles, channelled, straw or chestnut coloured; pinnæ opposite, nearly sessile, 1½–3ft. l. ¾–1ft. w; pinnulæ usually alternate, 4–8 in. l. 2–3 in. w., lowest piece reduced and unequal; tertiary divisions the same shape, nearly sessile, 1–2in. l. ½–¾in. w.: quadriary segments flabellate, deeply pinnatifid or fully pinnate, 2–3 li. w. and

d. or deeper, the divisions cuneate, and cut into final linear lobes $\frac{1}{3}$ li. w. a single vein running into each; sori terminal; involucres scarcely cuneate, open at the top.—Sloane t. 61.

Abundant among the lower hills on the skirts of woodland, among bushes, in hillside pastures, and by open pathways, but not forming such dense thickets as the preceding, of which it is the lowland analogue, ascending only to about 2,500ft. alt. where that first appears. The two species hardly touch in their range. This is of thinner texture, pale colour, more prickly, the final lobes narrower more numerous, deeper cut, and rather smaller sori and involucres. The deeply incised segments distinguish it at a glance.

7. *D. clavata*, Swartz.—Rootstock creeping, thick as cord, densely fibrillose, interlacing; stipites slender, naked except the base, 3-8in. l. channelled, straw green. fronds tri-quadripinnate, firm naked, light-green, 4-10in. l. 2-4in. w.; pinnæ low, alternate, petiolate; other divisions proportionately reduced, but similar; final segments flat, linear, broadest at the truncate apex, $\frac{1}{2}$-$\frac{3}{4}$ li. w., one or two veins to each; sori terminal; involucres broadly attached by the base, as wide generally as the leaf-segment, the receptacles formed by the thickened apex of a single vein or by the transvere union of two.—Plum. Fil. tab. 101. B.

Frequent, on wet rocks, by the banks of streams and rivers, in shaded or open situations from sea-level up to 3,000ft. alt. in the eastern parishes. In the West Indian flora this is an exceptional species, closely connected with some of the Asiatic and Australian species of *Lindsayæ*; the fronds consist of the vascular framework and narrow wedge-shaped final segments.

Genus V., *Cystopteris*, Bernh.

Sori punctiform, medial on the back of the veins: involucres attached by the base, hood-like, covering the sori at first; fronds small, multifid, herbaceous; veins free, branched.

This genus differs from the two preceding by having the sori midway on the veins instead of near to or at their summits and in the form of involucre.

1. *C. fragilis*, Bernh.—Rootstock branched, shortly repent, clothed with small dark scales; stipites tufted, 1—4 in. l. slender, channelled, slightly filrillose at the base; fronds lanceolate, 5—10 in. l. 1$\frac{1}{2}$—4 in. w. bi-tri-pinnate, herbaceous, naked, light or dark-green; rachis slender, channelled, glabrous; pinnæ numerous, near or apart, nearly sessile, $\frac{3}{4}$—2 in. l. $\frac{1}{3}$—1 in w. acute or accuminate at the serrate point; pinnulæ 2—7 li. l. 1—3 li. w. rather lax, dentate or pinnatifid, acute, usually broadest at the base; teeth sharp; veins pinnate or forked in the lobes; sori medial, copious, several to the larger more entire lobes; involucres broadly attached around the base of the sori thence arising hood-like, terminating in a point.—*C. jamaicensis*, Desr.

Infrequent, but plentiful where present, on wet rocks in the beds of streams from 4,000—5,000 ft alt. gathered at Old England plantation, and a few hundred feet higher in streams of the Government Cinchona Plantation. It varies in aspect and in size and cutting, the fronds varying from 6 in. to a foot high. The involucres shrivel at length, leaving the sori naked. In heavy weather the fronds are washed away, but the rootstocks, which cling tightly to the rocks, spring again when the stream subsides. Found also in Britain and in all the principal countries of the world.

Tribe III. *Lindsayeæ*.

Sori marginal or submarginal linear or oblong; involucres the same shape, interiorly attached, usually narrower than the thin leaf-margin which forms an outer false valve; leaflets dimidiate in all the Jamaica species.

In habit the local members of this tribe resembles a large portion of the rest, especially in the form of the leaflets, which are as it were half cut away.

Genus VI. *Lindsaya*, Dryand.

Characters as given above for the tribe.

a. Segments usually over $\frac{1}{2}$in. l.

1. *L. falcata*, Dry. Willd.
2. *L. trapeziformis*, Dry.

aa. Segments usually under $\frac{1}{2}$in. l.

3. *L. guianensis*, Dry.
4. *L. stricta*, Dry.

1. *L. falcata* Dry. Willd —Rootstock repent, thick as cord, densely coated with minute scales; stipitis near, erect, $\frac{1}{2}$-1ft. l. chesnut or straw coloured, angular with sharp pale scariose edges; fronds erect, simply pinnate, or the base occasionally bipinnate, $\frac{1}{2}$-1$\frac{1}{4}$ft. l. 1$\frac{1}{2}$-3in, w., chartaceous dark or pale green, naked; segments numerous, horizontal, close, dimidiate, 1-1$\frac{1}{2}$in. l. $\frac{1}{3}$-$\frac{2}{3}$in. w., the base terminate and parallel with the angular sharp scariose edged rachis, the lower edge straight or decurved, the upper and outer rounded or sublunate, terminal segment enlarged, deltoid, not dimidiate; veins close, forked, subflabellate, combined near the margin by the linear unintermittent receptacle; sori continuous along, but a little within, the upper and outer margin; involucre narrow, continuous, not reaching to the membranous edge.

Port Royal Mountains, 4,000ft. alt. growing on the ground and decayed logs and trunks of trees; gathered by Mr. Sherring in 1886–7. The fronds are usually lanciform, and simply pinnate, but occasionally one is shortly branched on one or both sides at the base. The Jamaica specimens are smaller, darker, thinner with more decidedly intra-marginal sori than the continental.

2. *L. trapeziformis*, Dry.—Rootstock repent, fasciculate, clothed with minute sharp scales; stipites erect, quadrate, with sharp edges, channelled; fronds light green, bipinnate, with a terminal pinna

and from one to several pairs of similar, spreading, lateral ones, which are 4-8 in. l. and 1-2 in. w.; segments very numerous, close, $\frac{1}{2}$-1 in. l. $\frac{1}{4}$-$\frac{1}{2}$ in. w. dimidiate, entire, superior edge curved or sublunate, under straight or decurved, inner truncate and parallel with the angular sharp edged rachises, the terminal one large deltoid-acuminate; veins forked, flabellate, not reaching the edge; sori continuous along the upper and outer margin, involucre narrow, much exceeded by the indusæform margin.

Infrequent, gathered by Lambert, Wilson, March and Miss Taylor, by the last in Portland. A highly variable species, the smaller states being distinguished only from *guianensis* by the sharp angled square stipes and rachises. The Jamaica specimens I have seen all belong to the variety *L. horizontalis*, Hook, and have few pinnæ about 1 in. w.

2. *L. guianensis*, Dry.—Rootstock repent, fasciculate, finely scaly; stipites erect, from a few inches to $1\frac{1}{2}$ ft. l. straw or brown coloured, the face channelled, and back rounded; fronds (pinnate or) bipinnate, light or dark green, rachises like the stipites; lateral pinnæ few or several much shorter or as long as the terminal one which is $\frac{1}{2}$-1 ft. l. and about 1 inch w.; segments close, very numerous, $\frac{1}{2}$ in. l. $\frac{1}{4}$ in. br. dimidiate, the upper margin much curved, the under less so or nearly straight, the inner truncate; veins close, forked, flabellate; sori submarginal, continuous along the upper and outer edge; the narrow involucre exceeded by the indusæform margin.

Infrequent, apparently confined to the western parishes at 2,000—3,000 ft. alt. where it has been gathered by Purdie, Orth and Sherring—by the last at Bull Head. Equally as variable as *trapeziformis* when the continental states are included. Jamaica specimens are usually either simple in the blade, or with firm short branches at the base.

4. *L. stricta*, Dry.—Rootstock shortly repent and finely scaly; stipites slender, erect, very short or several or many in. l. glossy chestnut brown; fronds erect, very stiff and coriaceous, $\frac{1}{2}$-$1\frac{1}{4}$ ft. l. $\frac{1}{4}$-$\frac{3}{4}$ in. w. simply pinnate, or bipinnate by the presence of 1-3 pair of lateral branches at the base which grow erect in a line with the much longer central one; rachis castaneous, rounded on the back, face flat; segments very numerous, close or imbricated, forming a quarter of a circle in shape, 2-3 li. w. each way; the upper ones gradually reduced till they become minute; veins forked, flabellate; sori marginal, continuous; involucre almost as wide as the reflexed indusæform margin.

Western parishes with the same altitudinal range as *guianensis*, from which it is distinguished by the much stiffer narrower blades, and smaller often convex segments.

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BULLETIN

OF THE

BOTANICAL DEPARTMENT,

JAMAICA.

CONTENTS:

PRICE—Two-pence.

JAMAICA:
GOVERNMENT PRINTING ESTABLISHMENT, 79 DUKE STREET, KINGSTON.
1891.

NUTMEGS.

A large stock of the very finest nutmegs for seed has been imported from Grenada from the estate of the Honble. H. R. Pipon Schooles, Attorney General.

The germination of the seed in large quantities, and the care of the young seedlings, require the strictest attention to prevent extensive loss. From the seed-beds the seedlings are transferred to bamboo pots, and when they have quite recovered from the effects of transplanting, and have formed good roots, they are ready for the nutmeg plantation. The planters must now exercise strict supervision over the labourers, to see that the bamboo pot is carefully slit down on one side, and the plant, with the earth *undisturbed* round the root, gently placed in the hole prepared for its reception. If this operation is done too hastily or clumsily, the tip of the tap-root is broken, and the plant soon dies.

Nutmeg trees require a deep, rich, loamy soil, moist but not swampy, with a humid atmosphere. They thrive best in shady river valleys from sea-level up to 300 or 400 feet, but they will grow in favourable situations up to an elevation of 2,000 feet.

The trees should be placed at distances of 25 or 30 feet apart, and if the situation is not naturally shady and sheltered, trees should be planted as wind-breaks and for the purpose of shade.

The trees are a long time coming to maturity not producing a crop, as a rule, till they are 9 years old ; and only when they first flower, at 6 or 7 years of age, is it possible to determine whether they are male or female. A very small proportion of male trees is left for fertilisation by insects ; the rest are cut down and fresh plants are substituted. The fertile trees continue to produce fruit for 70 or 80 years. On an average each tree will yield 10 pounds of nutmegs, and about one pound of mace every year ; and when highly manured it is said that they will produce 10 times that amount.

A quotation for mace and nutmegs is the following from the *Planters Gazette* of 5th August :—

" Nutmegs.—Larger supplies sold at dearer rates ; of 44 cases Penang 40 cases sold, 65's at 3s 0½d, 76's at 2s 9d, 79's at 2s 8½d, 160's to 148's partly shrivelled 1s 9d, 160's shrivelled 1s 3d, 65's slightly mouldy at 2s 10d, and 80's at 2s 7½d to 2s 8d ; 14 cases Bombay wormy broken sold at 8½d to 8¾d ; 13 cases rough Singapore 78's sold at 2s 7½d to 2s 8d ; 2 cases defective Wild Bombay sold at 6½d ; 40 cases and boxes 14 barrels West India all sold, mixed long and partly dark to fair shape and colour, 74's at 2s 8d, inferior 2s 7d, 76's at 2s 7d, 83's and 84's at 2s 6d, 88's at 2s 5d, 86's to 82's mixed 2s 4½d to 2s 5d, 89's at 2s 4d, 98's at 2s 3d, 115's to 100's at 2s 1d, 118's to 109's at 2s, 86's to 73's in shell 1s 4d to 1s 5d per lb.

Mace is unchanged ; of 35 cases Penang only 8 cases sold, fine heavy bold bright 3s 1d, good bright red 2s 9d, low broken pickings 1s 11d to 2s ; 7 cases ordinary small red Singapore bought in at 2s 4d ; of 70 cases Wild Bombay 25 cases sold, good red 11½ to 1s 1d, middling 10d ; 10 packages West India sold at 2s. to 2s 6d per lb."

The imported seed has been sown in the Hope Gardens, and when ready for distribution, the plants will be sold at the very low rate of 1½d. each in large or small quantities.

It is hoped that these arrangements will tend to develop the planting of nutmegs on a large scale in suitable districts in Jamaica. There is already one order filed for 10,000 plants, and another for 5,000. Orders for plants should be sent in at once, so that, if necessary a further supply of seeds may be secured.

Mr. J. R. Reece, Resident Magistrate of St. Ann, writes as follows :—" I can not tell you how very glad I am to know that you are endeavouring to get people here to go in for nutmegs. Ever since I came to this Colony. I have been trying to impress on those with whom I have come in contact, and who possessed lands adapted for the growth of that valuable article, the great fortunes to be made thereby. I know Grenada well having been there on several occasions. There are lands here as suitable in every respect for the cultivation of cocoa and nutmegs as there are in that Island. As regards the value of nutmeg trees, I know an old man living about five miles out of St. George, who, when I was there last (1884) told me that, from two trees in the preceding year, he had got £30."

W. F.

EXPERIMENTS IN THE CULTIVATION OF VEGETABLES.—II.

Peas.

Some results were published in Bulletin No. 20, on the growth of Vegetables.

It is asserted, and apparently with foundation in fact, that seeds can only be sown with advantage in certain seasons. To ascertain how far this is the case with peas, and also to discover what varieties are best suited to our climate, I applied to Messrs. Carter, Seedsmen, 237 High Holborn, London, for a constant supply of seeds every month. This firm has very generously sent us a supply of over 40 varieties every month free of charge; and the following tables are the first results obtained. The tables and notes are by Mr. Cradwick.

W. F.

Names of Peas grown at Cinchona.	Date of Planting in March.	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 Seeds ripe.	Days from Planting.	Last Seeds 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.	Average Minimum.	Rainfall.	Number of Days on which Rain fell.	Height in feet.	Time of Cooking in Minutes.	Quality.
Blue Peter ...	6th	15th	9	14.4	39	11.5	66	19	28.5	83	1.6	87	2.0	2.0	63.5	52.2	72.9	68.6	58.5	17.1	28	½	12	3
American Wonder or Emerald ...	6th	15th	9	14.4	39	11.5	66	13	24.5	79	1.6	87	2.0	2.0	63.5	52.2	72.9	68.6	58.5	17.1	28	1	15	3
Abundance ...	6th	15th	9	27.4	52	28.5	83	15	12.6	98	29.6	115	12.0	4.0	64.2	52.2	73.9	69.4	59.1	28.4	43	2	20	1
Carter's Little Wonder ...	6th	15th	9	27.4	52	28.5	83	10	No Seeds ripened, Dead, 16.6.91						64.1	52.2	73.9	69.4	59.6	28.4	43	2	20	4
Bishop's Long Pod ...	6th	15th	9	28.4	53	2.6	88	14	No Seeds ripened, Dead, 30.6.91						64.2	52.2	73.9	69.4	59.1	28.4	43	2	23	5
William the First ...	6th	15th	9	15.4	40	19.5	74	16	28.5	83	15.6	101	9.0	4.0	64.1	52.2	73.9	69.1	59.1	28.4	43	5	8	2
Carter's Blue Express ...	6th	15th	9	14.4	39	11.5	66	20	28.5	83	15.6	101	4.50	3.0	64.1	52.2	73.9	69.1	59.1	28.4	43	3	8	1
Carter's First Crop or Ringleader...	6th	15th	9	15.4	40	8.5	63	20	22.5	77	12.6	98	6.0	4.75	64.0	52.2	73.9	68.9	59.2	24.24	41	3	15	1
Laxton's Alpha ...	6th	15th	9	14.4	39	8.5	63	18	25.5	80	18.6	104	15.0	3.75	64.1	52.2	73.9	69.0	59.2	28.4	43	4	9	3
McLean's Little Gem ...	6th	16th	10	15.4	40	11.5	66	17	28.5	83	15.6	101	5.0	2.0	64.1	52.2	73.9	69.1	59.1	28.4	43	2	9	2
Carter's Pride of the Market ...	6th	16th	10	14.4	40	28.5	83	Dead,	1.6.91	...	...	...	...	...	63.5	52.2	72.9	68.6	58.5	17.1	28	2	12	2
Early Sunrise ...	6th	16th	10	14.4	40	19.5	76	30	3.6	88	18.6	104	7.0	4.0	64.1	52.2	73.9	69.0	59.2	28.4	43	3	23	3
Princess Royal ...	6th	16th	10	27.4	52	25.5	82	21	5.6	91	29.6	116	16.0	4.0	64.2	52.2	73.9	69.4	59.1	28.4	43	6	20	2
Balmoral Castle ...	7th	16th	9	29.4	53	28.5	82	20	1.7	117	1.7	117	7.0	5.0	64.5	52.2	73.9	69.5	59.1	28.68	47	4	15	3
Laxton's Fillbasket ...	7th	16th	9	28.4	52	3.6	88	7	10.6	94	13.7	1[illegible]9	3.0	3.0	64.9	52.2	73.9	70.3	59.6	29.1	48	4	20	2
Carter's Anticipation ...	6th	17th	11	29.4	54	23.5	83	10	29.6	114	[illegible]9.6	116	2.0	5.0	64.2	52.2	73.9	69.4	59.1	28.4	43	3	15	3
Advancer ...	7th	17th	10	23.4	47	14.5	70	22	3.6	87	16.6	102	6.25	4.0	64.1	52.2	73.9	69.5	59.5	28.4	43	3	18	2
Carter's Wonder of the World ...	7th	17th	10	29.4	53	3.6	88	20	17.6	101	3.7	119	2.0	3.0	64.9	52.2	73.9	70.3	59.6	29.1	48	3	20	2
Sharpe's Invincible .	7th	18th	11	29.4	53	3.6	88	No Seeds ripened, Dead, 1.7.91					...	..	64.5	52.2	73.9	69.5	59.1	28.68	47	4	15	3
Sturdy ...	7th	18th	11	10.5	64	3.6	88	No Seeds ripened, Dead, 1.7.91					...	...	64.5	52.2	73.9	69.5	59.1	28.68	47	3	20	3
Carter's Stratagem	7th	18th	11	28.4	52	28.5	82	14	1.6	87	19.6	104	4.0	2.50	65.2	52.2	73.9	69.9	60.2	28.4	43	3	18	1
Omega ...	7th	18th	11	5.5	59	6.6	91	No Seeds ripened, Dead, 1.7.91					...		64.5	52.2	73.9	69.5	59.1	28.68	47	3	20	2
Carter's Elephant ...	17th	28th	11	3.5	47	6.6	81	24	5.7	110	24.8	160	5.0	3.67	65.1	53.2	76.9	70.6	59.6	34.62	58	8	20	3
Tall Sugar ...	17th	28th	11	10.5	54	6.6	81	30	15.7	120	11.8	147	5.50	3.40	65.1	53.2	76.9	70.7	59.6	34.62	58	8	20	3
Emperor of the Marrows ...	17th	28th	11	25.5	69	6.6	81	34	28.7	133	11.8	147	6.0	2.0	65.1	53.2	76.9	70.7	59.6	34.62	58	8	20	2
Kentish Invicta ...	6th	15th	9	14.4	39	11.5	66	14	3.6	89	16.6	102	10.0	4.25	64.1	52.2	73.9	69.4	59.6	28.4	43	5	8	2
Dickson's Favourite ...	17th	27.3	10	10.5	54	3.6	78	16	26.6	101	1.7	106	5.50	4.50	65.2	53.2	76.9	70.9	59.5	27.86	41	5	15	3
Carter's G. F. Wilson ..	17th	28.3	11	29.4	43	3.6	78	14	1[illegible].6	85	1[illegible].6	91	5.0	5.0	64.3	53.2	76.9	69.3	59.3	27.22	37	5½	17	3
Hundredfold or Cook's Favourite...	17th	28.3	11	5.5	49	3.6	78	23	20.6	95	6.7	111	5.0	3.30	65.7	53.2	76.9	71.6	59.9	28.21	42	5	20	4
James Prolific ...	17th	28.3	11	5.5	49	3.6	78	20	17.6	92	1.7	106	7.0	3.0	65.2	53.2	76.9	70.9	59.5	27.86	41	5	20	3
Sugar Dwarf ...	...	Was	not	Sugar	Dwa	rf at all	but	a tall	Pea 7	feet	high,	W. C.	...	..	...	...	...	...	...	...	...	...	...	...
Carter's Telephone ...	17th	28.3	11	3.5	47	3.6	78	20	10.7	85	1.7	106	7.0	5.50	65.2	53.2	76.9	70.9	59.5	27.86	41	6	10	2
Champion of England ...	17th	28.3	11	10.5	54	3.6	78	17	16.6	91	1.7	106	7.0	4.0	65.2	53.2	76.9	70.9	59.5	27.86	41	6	20	1
Marvel ..	17th	27.3	10	23.4	37	3.6	78	17	17.6	92	9.7	115	4.0	2.50	66.6	53.2	76.9	73.1	60.1	28.21	42	4	15	1
Telegraph (Carter's) ...	17th	28.3	11	23.4	37	3.6	78	20	20.6	95	1.7	106	7.0	5.0	65.2	53.2	76.9	70.9	59.5	27.86	41	7	15	1
Duke of Albany ...	17th	28.3	11	29.4	43	3.6	78	17	1.7	106	6.7	111	7.0	8.0	65.7	53.2	76.9	71.6	59.9	28.21	42	6	14	1
Ne Plus Ultra ...	17th	28.3	11	20.5	64	3.7	108	16	5.7	110	24.8	160	7.0	2.0	65.1	53.2	67.9	70.6	59.6	34.62	58	8	20	3
British Queen ...	17th	28.3	11	19.5	63	3.7	108	20	16.6	91	11.8	147	7.50	3.0	65.1	53.2	76.9	70.7	59.6	34.62	58	8	20	1
Carter's Progress ...	17th	25.3	8	22.5	66	3.7	108	22	18.7	123	15.8	151	4.80	2.0	65.3	53.2	76.9	71.6	59.6	33.16	55	6	20	1
Carter's Dignity ...	17th	26.3	9	5.5	49	13.6	88	10	30.6	105	6.7	111	7.0	5.0	65.7	53.2	76.9	71.6	59.9	28.21	42	6	10	1
Laxton's Supreme ...	17th	25.3	8	5.5	49	3.6	78	20	26.6	101	6.7	111	6.0	4.0	65.7	53.2	76.9	71.6	59.9	22.21	42	5	12	1
Carter's Empress ...	17th	28.3	11	5.5	49	3.6	78	20	5.7	110	24.8	160	3.0	2.0	65.1	53.2	76.9	70.6	59.6	34.62	58	6	20	1

Peas Sown at Hope.

Names of Peas.	Date of Sowing March.	Pods of edible size.	Number of Pods per 100 Plants.	Number of Peas in 100 average Pods.	Names of Peas.	Date of Sowing March.	Pods of edible size.	Number of Pods per 100 Plants.	Number of Peas in 100 average Pods.
Duke of Albany ...	March 20th, 1891.	1st 5th	23	115	McLean's Blue Peter ...	March 20th, 1891.	20.5	...	...
Laxton's Alpha ...		8.5	72	230	Hundredfold or Cook's Favourite ...		8.5	88	440
Bishop's Long Pod'd ...		20.5	81	324	Sugar Dwarf ...		8.5	61	427
Carter's G. F. Wilson ...		20.5	45	180	Laxton's Supreme ...		6.5	55	275
Early Sunrise ...		14 5	150	450	Laxton's Fillbasket ...		8 5	74	296
McLean's Little Gem ...		8.5	80	160	Advancer ...		6.5	57	228
Sturdy ...		14 5	20	120	James's Prolific ...		8.5	42	168
Carter's Stratagem ...		8 5	65	26[illegible]	Carter's Balmoral Castle ...		20.5	56	224
Omega ...		14.5	38	190	Sharpe's Invincible ...		20.5	43	215
Carter's Pride of the Market		14 5	133	665	First Crop or Ringleader ...		1.5	121	258
Kentish Invicta ...		6.5	85	340	Carter's Empress ...		20.5	11	44
Ne Plus Ultra ...		...	...	...	Little Wonder (Carter's) ...		...	...	...
Carter's Telegraph ...		8.5	30	150	Champion of England		20.5	35	140
Dickson's Favourite ...		20.5	41	164	Carter's Progress ...		20.5	...	...
American Wonder or Emerald ...		...	...		Carter's Dignity ...		14.5	34	170
Carter's Wonder of the World ...		...	...	...	Abundance ...		14.5	174	696
Princess Royal ...		14.5	62	310	Emperor of the Marrows ...		...	...	...
Laxton's Wm. First ...		6.5	200	800	British Queen ...		...	...	...
Carter's Blue Express ...		1.5	127	259	Marvel ...		6.5	150	450
Carter's Anticipation —		...	...	...	Carter's Telegraph ...		6.5	71	355
Tall Sugar ...		14.5	45	225	Carter's Elephant ...		...	...	...

Note.—The only peas, judging by the above results, which show any signs of thriving at Hope are :

1. Early Sunrise ; which shows an average of 150 pods per 100 plants, and 450 peas in 100 pods.
2. Carter's Pride of the Market ; averaging 133 do. do. 665 do. do.
3. Laxton's Wm. the First ; averaging 200 do. do. 800 do. do.
4. Carter's Blue Express ; averaging 127 do. do. 259 do. do.
5. Carter's First Crop ; averaging 121 do. do. 258 do. do.
6. Abundance ; averaging 174 do. do. 696 do. do.
7. Marvel ; averaging 150 do. do. 450 do. do.

The Cinchona averages for the same peas were, 700 pods 400 peas in No. 1 ; a complete failure No. 2 ; 900 pods 400 peas in No. 3 : 600 pods 475 peas in No. 4 ; 600 pods 475 peas in No. 5 ; 1,200 pods 400 peas in No. 6 ; 400 pods 250 peas in No. 7.

Notes on above Tables.

Pea Abundance :

This I consider the very best for general purposes, although not producing such fine pods, or such large peas as the taller growing varieties, it is far more profitable growing. As it grows only 2 feet high, it is not liable to be damaged by heavy winds, and is not apparently liable to attacks of mildew, as no trace of mildew appears on them at any time. The average production of 4 peas per pod was in some cases almost doubled as I picked 12 pods with 7 peas in ; the number of peas in a pod was however more uniform in this variety than in any.

The flavour was only surpassed by one variety, viz.: Carter's Dignity.

The taller peas Telephone, &c., require to be grown 6 to 8 feet apart between the rows. Abundance has ample room at a yard.

Pea, Princess Royal :

This pea ranks next for general purposes to Abundance, but is 4 feet higher, and the flavour is not so good.

Pea, Kentish Invicta :

It is also a good average pea.

Pea, Carter's Telephone,
" Telegraph,
Duke of Albany,
Ne Plus Ultra :

These four peas produced some grand pods as good as could be seen in any country, and the averages would have been much better but for a storm of wind and fine rain which lasted from the 12th to the 17th of June, three or four days after which all the tall peas were showing signs of mildew.

The average of 8 peas in a pod in the Duke of Albany it will be noticed is the highest, and must be considered extremely good.

Pea, Carter's Dignity :

This pea was the very best flavoured of any, the height 6 feet is not prohibitory, if anyone wished for a luxury in the way of peas.

W. C.

ONIONS.

In Bulletin No. 18, attention was called to the subject of the cultivation of onions in Jamaica.

The results on the whole have been fairly satisfactory, and they show that when care is taken, and where there is a fair amount of rain, the onion succeeds.

On application to Messrs. Hamilton, Teneriffe, for more seed, they stated that it had all been disposed of before May. For the information of those who wish to have the same seed this year, it is well to state that it can be obtained from Messrs. Peter Henderson, 35 Cortlandt St., New York, at the following prices :—

Pale Red. 10 cts. pkt. ; 25 cts. oz. ; 75 cts. ¼lb. : $2 50 lb.

White. 10 cts pkt. ; 20 cts. oz. ; 60 cts. ¼lb. ; $2.00 lb.

During the next season, it is intended to experiment with different varieties to see whether any other is likely to succeed better than the Bermuda onion.

At Hope Gardens half an acre was sown, and produced 201lbs. weight of onions. At Castleton a square chain yielded 20lbs. At Cinchona, the seedlings were almost completely destroyed by grubs, which came up out of the ground at night, and ate the young shoots. A correspondent has kindly sent the following recipe for killing grubs, which will be tried, and may also be useful to others :—"For destroying grubs or cabbage worms ;—1lb. Alum dissolved in 3 gallons of water. Dissolve in boiling, and fill up with cold. Water the ground with this every 2 or 3 days."

Mr. C. L. Walker writes : "The Bermuda Onion Seeds that you kindly let me have turned out well and gave an enormous return. . . . They were manured with old stable manure, and thinned out about 8 inches apart. I did not weigh all the onions, but many weighed from 8 to 10ozs. They were grown at Ballards Valley. Annual rainfall 75 inches. We had very dry weather in St. Mary's at the fall of the year. Elevation about 340 feet. Soil, heavy black."

Mr. Arthur Douet of St. Ann's states that he sowed about 100 seeds, and got 4lbs. weight of onions. The seedlings were transplanted. Soil, red earth. Elevation 1,500 feet. Annual rainfall 75 inches, of which 10 inches fell during the months the onions were growing. Some of the seeds were given to neighbours, but none grew.

Mr. A W. Watson Taylor, of Haughton Grove, Hanover, writes, "A few rows gave a satisfactory return of onions for our own use, but I seemed to notice that during the height of the dry weather, watering did not seem to keep up the growth."

The late Mr. Augustus Thorp, Mahogany Vale, wrote as follows : "The Onion Seed planted in January was 6ozs., covering 1½ chains of land in 9 inch apart drills. The yield upon digging in middle of May was 36½lbs. Owing to the continued dry weather with the exception of one or two light showers, the onions did not obtain their full growth. The flavour was good and pungent. Had weather been favourable the result would have been most satisfactory. The elevation here is 1,700 feet above sea-level, average temperature 75°."

W. F.

SOILS.

The following is an interesting and useful paper on Soils by Mr. P. McMahon, Curator of the Botanic Gardens, Queensland :—

"There is no subject of more vital interest to the tiller of the ground than the character of the soil which he is called upon to cultivate. In the presence of the audience of practical cultivators of the soil who this evening favour me with their attention, I have thought it better to eschew, as far as possible, the many interesting problems and circumstances connected with this subject, when viewed from a scientific standpoint, and to confine myself to a consideration of those questions with which the practical farmer finds himself daily confronted, in the hope that in the discussion which will follow some gentlemen present may be induced to give us the results of their long and varied experience, and hence observation of soils in general, and of the soils of Queensland in particular. For although I should probably be the last person in the world to underrate the value and advantages of theoretical science, I hold, and shall always hold, that agriculture is a science of practice, experience and observation, rather than of chemical formulæ and physiological research ; a science of the country rather than of the college ; of the field and farm-yard rather than of the lecture-room and laboratory. You will, no doubt, divine from this expression of a conviction based on some practical research, that the gist of my advice this evening will not be to select a certain six-inch cake of the soil from your field, send it to an analyst, and ask his opinion as to the kind of plants you should grow upon your farms. To attempt to gauge the capabilities of a farm by this method is just as reasonable as to take one soldier out of an army, and to have an opinion of that army's efficiency or otherwise upon the manner in which he would perform his drill. A curious instance of the fallacy of attempting to guide the practical operations of farm from the laboratory came under my notice some time ago. The superintendent of a very large estate in India, devoted to the cultivation of tea and other economic products, was requested by his London Board of Directors to send home for analysis samples of tea soils from various parts of the estate. On every Indian estate there are rings of earth known as callé maté (black earth), which are believed to be the sites of ancient village earthenware factories, and upon which no amount of cultivation or manuring will induce a single plant to grow. The superintendent sent home, without comment, a sample of this soil, carefully labelled with name and number, and judge of his surprise when a letter arrived from London, requesting that he would exert himself to the utmost to extend the cultivation of the tea plant in the earth marked "Callé maté, No. 17," as an elaborate analysis and careful comparison of its chemical constituents with those of the tea plant had proved it to be admirably suited to the growth thereof. The superintendent smiled a grim smile, but, being wise as the serpent, he thanked the Board for the analysis, and had the honour to inform them that the proportion of callé maté upon the estate was too limited for extensive cultivation. I must not be understood as altogether denying the value of chemical analysis as a means of assisting in the determination of the capabilities of soils; but I insist that its conclusions, when applied to a larger area than that of the sample actually analysed, are partial in conclusion and likely to be modified, and indeed often entirely changed, by surrounding circumstances, such as drainage, position, permeability, porosity, power of capillary attraction, evaporation of water, absorption of water, absorption of heat, and other physical conditions—a practical knowledge of which should constitute part of the stock-in-trade of every man having anything to do with the soil, whether he be farmer, gardener, or pastoralist. And here let me pause to observe that a small text-book on this subject, written in a clear practical style in plain Anglo-Saxon, and without any puzzling tables or chemical formulæ, placed in the hands of every State school child in Queensland by the Government, would do more to ensure an intelligent system of farming in the next twenty years than any number of agricultural conferences. The Government of Jamaica have recently offered a prize for such a handbook suitable for their schools. We all know that we often experience much difficulty in forgetting, as we grow to maturer years, the useless things we learnt at school, in order to make room for that which will serve us in the struggle for existence. Every farmer and other persons engaged in the cultivation of the soil should be able to refer any particular soil to its class, and to approximately determine its component *parts* and its physical character, and from these its relative fertility, and thus by some settled means the "rule of thumb" method which so many cultivators employ. I had occasion once to make enquiry of a large number of cultivators as to the character of the soil in their respective districts, and the answers I received very forcibly impressed upon me the necessity of having some standard of comparison to which soils could be referred

Soils have been divided in various ways according to their texture, and to the variety and quantity of the substances of which they are composed. The following is perhaps one of the best of these classifications:—

1. Argillaceous soils, having over 50 % of clay, and little or no calcareous matter.
2. Loamy soils, having from 20 % to 50 % of clay, with some lime.
3. Sandy soils, having not more than 10 % of clay.
4. Marly soils, having from 5 % to 20 % of calcareous matter.
5. Calcareous soils, having more than 20 % of carbonate of lime.
6. Humus soils, containing a large proportion of vegetable mould.

The selector or farmer can, by the exercise of a little ingenuity and the aid of the most simple apparatus, decide for himself the class to which his soil belongs. One of the most successful valuers of agricultural land I ever knew used no other apparatus than a glass tube graduated to inches and tenths by means of a paper scale pasted on its outside, and a small flask of muriatic acid. He placed in this tube a quantity of the soil to be examined, mixed it with water, then violently shook the whole up, and allowed it to settle. In a minute or two the coarse sand settles to the bottom, then the finer sand, then the coarser particles of clay, then the lighter and more impalpable particles, and finally the lighter humus or vegetable mould. Distinct rings of these various substances are formed, and their relative proportions can be measured by means of the graduated scale pasted on to the tube. I need scarcely remark that a long, wide mouthed bottle will serve the purpose equally well. A small quantity of diluted muriatic acid poured on a small quantity of the soil serves to show if calcareous matter be present, and the amount of effervescence set up serves to indicate in what quantity it is contained in the soil.

In examining a soil with a view to determining its permanent value for agricultural purposes, certain physical facts in relation to it should first be ascertained. The first of these is Drainage. To the Queensland farmer the natural drainage of the land which he may select is an important matter, and likely to become more so in the future. The signs of the times point to the adoption of irrigation on a fairly large scale at no very distant date. The tendency of irrigation on lands not drained by nature or by art is to raise the level of the subsoil water, and so bring it more within the range of the influence of the sun. In countries where the latter is powerful, a rapid evaporation is set up, which produces two effects. In the first place, the evaporation considerably reduces the earth temperature over the area where it takes place; and in the second place, increasing quantities of saline matters are brought to the surface and deposited there in the same way that salt is obtained in "evaporating pans," only of course in a less degree. This is the cause of what is known in India as "Reh," the name given to a white efflorescence which has appeared on the surface of immense areas of canal irrigated country, rendering it as sterile as the surface of the Sahara.

The Subsoil next requires to be examined; indeed, upon the character of this depends to a great extent the completeness of the drainage. It should be neither so sandy as to part too readily with its moisture, nor yet so retentive as to interfere with free drainage. The requirements of a subsoil in this respect varies greatly with the rainfall of the district in which the farm is situate, and this is one circumstance which the intelligent cultivator will not fail to take into account. Coming to the surface there is no variety of soil more suited to the requirements of the general agriculturist than that known as loam. When the gardener desires a soil in which his plants will thrive, he directs his efforts to the production of a loam which he often produces by mixing together other soils and substances in the required proportions, just as Dame Nature, with the forces at her command, first wore down the rocks into the more or less comminuted substances of which all soils are composed, and then by means of torrent, stream, river, and sea blended them together into what we know as soils. The gardener, too, only takes a lesson from the great book of nature in placing at the hollow of his receptacle for the soil which he has thus prepared coarser substances to serve as a free conduit for the water which, if retained around his plant, would mar all his efforts.

Loam is composed generally and chiefly of siliceous sand, clay, and carbonate of lime. Other substances, too, are present in smaller quantities, such as iron, in the form of peroxide magnesia, and various other substances; seldom, however, in such proportions as to affect its nature in any material degree. Decayed vegetable matter, too, is present in most loams, and although no less a person than the great chemist, Baron von Liebig, has declared that humus exercises a comparatively small influence upon the life and growth of plants, every cultivator knows perfectly well how materially its presence enhances the fertility of his soil. A great advantage of the presence of humus in soils, independently of its directly fertilising qualities, arises from the fact that in the chemical changes which it continually undergoes gases are being evolved which act mechanically in loosening the soil and bringing it under the influence of the air and sun. Of course there are various varieties of loams, varying from a hungry loam, largely composed of sand and deficient in organic matter through all degrees of fertility, to a stiff clay loam containing a proportionally small quantity of sand, most difficult to work, and requiring expensive cultivation and often drainage. For purposes of irrigation, a light loam, containing a fair proportion of organic matter and resting on a gravel subsoil, cannot be surpassed. It is on this variety of land that I have seen the very best results achieved from irrigation in India. The native of that country—those, at least, of them who are engaged in tillage—have learned from centuries of experience that in a warm climate the soil must retain its porosity to produce good results, and they will not apply water to the surface of a variety of soil which will solidify after the water has drained off, or if they do, it will be only over such an area as can be quickly gone over with the hoe after the water has been drawn off. Where unsuitable soils have been irrigated in India with disastrous results, the fault lies not with the cultivators so much as with those who thought that the art of irrigation consisted in the erection of engineering works for the distribution of water, without any reflection as to the nature of the soil to which the water was to be applied. The proportion in which the different earths are present in loams varies considerably, often without any corresponding variation in their fertility. A good loam, and one which we may take as a standard, consists of three parts clay, two parts sand, and one part chalk. A mixture of humus will add to its fertility, or this can be supplied by manure. Such a soil, given a good sand subsoil, can be freely cultivated at all seasons; the constituent of which it is deprived by plants can be restored by the aid of manures, natural and artificial. It will have its fertility increased by irrigation, always bearing in mind that irrigation, thorough cultivation, and systematic manuring must go hand in hand, or the results will be deterioration and ultimate sterility. The aim of the cultivator who would seek to improve the character of his soil should be to bring it as nearly as possible to the condition of loam, by adding to it those substances which it lacks. Thus, if it is a stiff clay, caking on the surface after rain and retaining moisture, the natural remedy is the admixture of a sufficient quantity of sand and chalk to get it as nearly as possible to the condition above described. Soil in this condition may be improved to a very great extent by burning a portion of the clay. This process of calcining destroys the affinity for water, and it becomes converted into a substance like burnt brick, which acts mechanically the part of sand, if mixed with the remaining soil, in keeping it porous, and in fact in forming it into a loam. Any admixture of a gravel containing quantities of calcareous or living matter is more useful in this respect, since it has not only the mechanical effect here referred to, but has also a chemical action upon the organic matter in the soil, reducing it to soluble forms, readily assimilable by the delicate rootlets of plants. Should the soil be good, containing too great a proportion of sand, allowing the water to run through too rapidly, then the remedy is to endeavour to bring it to a state of loam by the addition of marl. This is a word used in a general sense to indicate a very valuable factor in the improvement of certain varieties of soils. I have met in several parts of the world very different substances locally called by this generic title. Marl was formed by the collection together of vast quantities of shells, either in fresh water lakes or in torrents, and these were mixed with quantities of clay or sand. As either of these substances predominate, it is called clay marl, sand marl or shell marl, and when it has been subjected to such pressure as to solidify it, it is known as slate marl—in which form it must be burned to be of use to the agriculturalist. In many parts of England, clay marl is largely used on light soils with the most beneficial results, while shell marl, and very frequently chalk, is largely applied to heavy soils for the double purpose of rendering them mechanically lighter, and for the more speedy solution of the organic matter contained in them. Besides the chief constituents to which I have here referred, it will be at once seen that since all soils were formed in the first instance by the erosion of rocks under atmospheric and aqueous influences, they must contain certain proportions of the minerals which originally formed part of those rocks, and it only needs a moment's reflection to assure us that in the chemical changes which are constantly taking place in the soil those same minerals are being converted into soluble substances, which plants, by that process of endosmosis with which you are no doubt all familiar, can take up, and by means of those wonderful natural laboratories, the leaves, convert into a part of its own substance. Of these mineral substances I will speak presently. Let us take a case of two soils called A and B. A may be rich in all the chemical constituents required for the growth of, say, the orange plant, and found in the ash of that plant, whilst B may show some deficiency in some of those particular constituents, and yet an orange grove on A might be a most lamentable failure, whilst B might produce a tolerably fair crop. The physical condition of the soil A may be such that the process of solution cannot take place, as is often the case with humus imprisoned in a stiff clay. Plants cannot live on the crude material. Their food must be, so to speak, cooked for them, and this is what is at the head of the system of rotation of cropping, and the practice of allowing land to lie fallow. The expression "giving the soil a rest," applied to the latter system, is a misnomer. What is really done is to give the soil time to work, time to resolve under the influence of sun and air the crude substances contained in it, into soluble and, so to speak, properly cooked plant food. It will be seen from this that the similarity between the chemical constituents of a soil and the ashes of a green plant cannot be accepted as a criterion of its suitability for the growth of that plant, and that tables professing to guide the farmer by means of such comparisons are misleading. Again, some plants are surface feeders, and others draw their supplies from far beneath the surface. Others have their roots formed to penetrate the interstices of stony ground, and others to push their rootlets through stiff soil; and no temptation in the shape of chemical constituents approximating to their ashes will induce them to alter their predilections in these respects. The theory so brilliantly expounded by the great agricultural chemist, Baron von Liebig, that the adaptability of a soil for a given plant depended on the similarity between the often minute mineral constituents of one and the ash constituents of the other, is now thoroughly exploded in Europe under the crucial test of extended practical experiment; and I was not a little surprised to find that a large measure of credence is still extended to it in these colonies. Consequent upon the proportions which the clay, sand, chalk, and humus occupy in the soil, it possesses—

1. Permeability to water, &c.; power of absorbing and retaining moisture.
2. Power of absorbing and retaining plant foods in gaseous and liquid forms.
3. Colour.

The permeability of soils to water is of great importance, and many soils apparently similar will be found to differ largely in this respect. Fill a number of tubes of one inch in diameter, having the lower end closed by muslin, with soils of different samples; stand the tubes upright; and gently pour on water, filling the tube to a certain distance above the soil. It will be found that in some soils the surface will always be dry long before others. That soil which has its surface so mest dry, while holding relatively by weight the greatest quantity of water in its pores, is, all things being equal, the most fertile soil. Thus the surface of poor sand will soon be dry, but the water will all have run through, and little relative increase in weight will be recorded, while with an equally unproductive clay the surface will not be dry for a long time, though the weight will be increased considerably. The following table of the comparative absorptive powers of soils is taken from Schubler, and will be useful in this connection :—

——	Water absorbed by 100 parts. Per cent.	Of 100 parts of water absorbed, there evaporate in four hours, at 66° F.
Sand	25	88.4
Light clay	40	52.0
Stiff clay	50	45.7
Heavy clay	61	34.9
Pure clay	70	31.3
Humus	190	20.5
Rich garden soil ...	96	24.5

From these figures it will be seen that the richer a soil is in decaying vegetable matter the more rapidly and extensively it will absorb water, while the more slowly it will part with it. This is not only true as regards the water which falls upon a soil in the shape of rain, but also of the moisture deposited in the shape of dew and absorbed by the soil from contact with damp air. The power of absorbing and retaining plant food in gaseous and liquid form is another peculiar property which they possess. This property was well illustrated at Merthyr Tydvil when the sewage of that town was poured on to an area of sandy loam, with the result that the water came through quite clear and entirely deprived of the matters—chiefly plant foods in soluble form—which it had held in solution on suspension. This important property is much more active in soils possessing a fair degree of humus in its composition, and it is also markedly more active in soils which are porous, and soils which are well worked will absorb from the water which passes through them far more plant food in a fit condition for the immediate needs of the plant than those which are allowed to remain untilled, and this is one great reason why the surface of soils should be continually stirred and exposed to the air, from which it absorbs no small part of its supply of plant food. I have divided the plants in a large conservatory into two equal classes, of equal numbers, and in about equal states of health. I had the surface of the earth in the pots of one class continually stirred, and the surface in the other pots left untouched for four months during the growing season. The result was a most marked increase in growth and improvement in health on the part of those plants which had the surface of the soil around them constantly stirred.

The colour and texture of soil have a great effect upon their fertility by the absorption of heat. Black humus soils absorb heat far more readily than those of a lighter colour, and the heat penetrates to a greater depth. Anyone can try this for themselves by sowing two boxes of seed, one in light-coloured and the other in dark-coloured soil. He will find that the latter will germinate a comparatively long time before the former.

Plants derive from the soil the mineral constituents which compose their ash, and it is in the determination of the presence, or otherwise, of the mineral constituent that the chemist can aid the farmer after the latter had either chosen his soil with a due regard to its physical qualities, or, by means of judicious admixture with other soils, has brought it to a state of loam and has so improved the subsoil as to secure the essential free drainage. The following methods, which I have used in India for the rough determination of the character of soils, may prove useful :—

1. Weigh an imperial half-pint of the soil in its natural condition. The result multiplied by 150 will be the weight of a cubic foot of that soil within a fraction.
2. Dry the soil in the sun. The loss is the water with which it will part under atmospheric conditions.
3. Expose the soil to 300° F. until it ceases to lose weight. The loss on its original weight indicates the total amount of water it contains under ordinary conditions.
4. Burn whatever remains. The loss is mostly organic matter.
5. Add to some of the soil strong hydrochloric acid. The presence of lime is indicated by an effervescence. If peroxide of iron (that is, iron in its beneficial form) is present, the acid will quickly become brown; and if black oxide of manganese is present, chlorine will be evolved, and its peculiar smell readily recognized.
6. Wash your sample of soil under a very gentle tap in a shallow dish or in a running stream, so as to get all the clay out of it. This requires some time, care and patience. What is left is insoluble siliceous sand.
7. Dissolve common soda in a small enamelled saucepan of water. Powder some of your soil; put into the water and well boil. Pour the solution into a tumbler and allow to settle, then pour off into another glass without sediment. It will be of a clear brown colour Add vinegar or dilute hydrochloric acid, and if humic acid be present in the earth brown flakes will fall in the solution. Poor soils possess little or no humic acid, rich soils contain much.
8. To test presence of phosphates of lime, weigh 200 grains of soil into a glass, pour half-an-ounce of dilute hydrochloric acid over it. Stir with a glass rod. Let stand for thirty hours, then add half-an-ounce of distilled water. Stir again and filter through a filter paper. To the clear solution add a little liquid ammonia, and if phosphate of lime be present an amber liquid will rise to the top and float on the water.
9. Saltpetre may be determined by boiling 500 grains of powdered soil in two ounces of distilled water. Cool and filter. Evaporate the solution to a teaspoonful, and then dip in it a bit of the margin of a newspaper or other unglazed paper, and sun-dry it. When dry, if nitre is present in the soil the piece of paper will burn like touch paper."

THE MANGOSTEEN.

There are two trees of the celebrated Mangosteen in Castleton Garden, but they have only occasionally produced one or two fruits, and these were very inferior to the description given by those who have eaten the fruit in the Malay Islands. This year however one tree has borne several fruits and of a better quality.

Firminger states that "the cultivation of the Mangosteen in the open air, at least as high north as any part of Bengal, seems now pretty well decided to be impracticable. Plants have been repeatedly introduced into the gardens about Calcutta, but have never been known to yield fruit." I think, however, from this year's experience that although it has not been successfully grown outside its native country, except perhaps, in a few spots in southern India, we need not despair of its cultivation in Jamaica.

The tree grows to a height of 20 to 30 feet, with simple elliptical, pointed leaves, and dull red flowers, about the size of a wild rose.

Dr. Abel, writing of the fruit of Batavia, says: "First in beauty and flavour was the celebrated Mangosteen. This, so often eulogised by travellers, certainly, deserves much of the praise bestowed upon it. It is of a spherical form, of the size of a small orange, when ripe, reddish brown, and when old of a chestnut brown colour. Its succulent rind is nearly the fourth of an inch in thickness. It contains a very powerful astringent juice, and in wet weather exudes a yellow gum which is a variety of gambogе. On removing the rind, its esculent substance appears in the form of a juicy pulp, having the whiteness and solubility of snow, and of a refreshing, delicate, delicious flavour.

We were all anxious to carry away with us some precise expression of its qualities; but after satisfying ourselves that it partook of the compound taste of the pine-apple and peach, we were obliged to confess it had many other equally good but utterly inexpressible qualities."

It is said that to taste the fruit in perfection it must be eaten as it is gathered from the tree.

W. F.

THE JAMAICA FORGET-ME-NOT.

The following note from the "Gardeners Chronicle" will interest those who are familiar with the pretty blue Jamaica Forget-me-not *(Browallia demissa.)*

"The great botanist, Linnæus, had among his numerous acquaintances a certain friend named John Browall, who was very humble in his relations with Linnæus, and, having adopted his new sexual system of botany, wrote an article against Seigesbeck defending that system. Linnæus, in acknowledgment of his friend's services, dedicated to him a genus of a single species, naming it *Browallia demissa.* Shortly afterwards Browall, having been made Bishop of Abo, assumed the pomp and dignity of a great magnate, and Linnæus having discovered a second species of this genus named it *Browallia exaltata.*

This excited the wrath of Browall, and he proceeded to write pamphlets against Linnæus, denouncing him in the most severe language. Later on, Linnæus discovered a third species differing slightly from the original outline of the genus, which he named, *Browallia alienata.* The two men were never afterwards reconciled to each other, and thus we have, preserved in the nomenclature of this genus, a historical incident to which future generations of botanists will look back with considerable interest."

SISAL HEMP IN THE BAHAMAS AND FLORIDA.

Enquiries have been made from time to time, as to the progress of this fibre industry in the Bahamas, and the methods of cultivation, &c.

On application to the Government of the Bahamas, I was favoured with pamphlet-reports on the subject by Messrs. James M. Rae and George Preston.

Mr. Rae's Report is dated 26th January, 1891, and gives details to that date as follows :—

"There are now planted in the Bahamas, as near as can be ascertained, 4,199 acres of land with 2,633,000 Sisal plants. In addition to this number there are in nurseries 1,342 500 plants. The latter may, I venture to think, fairly be regarded as growing plants, in considering the extent of the cultivation of Sisal. The number of pole plants estimated to be procured during the ensuing six months from trees that are now in pole is 937,500 and the number of suckers or root plants, for the same period from plants now growing is 960,500. . . . . .

The enterprising little settlement of Harbour Island, always foremost in developing some new industry, has not been unmindful of its tradition; and was one of the first to engage in the planting of Sisal. No large capitalists have located themselves here, but the people generally have planted with an energy worthy of emulation. Cultivations varying in size from one to three or four acres are to be met with plentifully, while there are some of much larger extent. Many persons find it a lucrative business to grow the plant in nurseries for sale, and many thousands of young plants have thus been distributed among other Islands of the Colony. I was in a field of some six or seven acres containing about seven thousand plants from eighteen months to three years old, belonging to a gentleman who informed me that he had already been reimbursed the cost of planting it, and was then realizing $20.00 per month from the sale of suckers.

This field is situated in an abandoned "provision" field, near the sea shore. The soil is red earth contained in holes and crevices in the rock, and in deposits of a few inches depth in certain spots over the rock. The plants were as healthy and vigorous in appearance as I have seen anywhere. The above result regarding the quantity of suckers which had already been sold from them, speaks for itself of their power of reproduction. . . . . .

The people of Abaco, Harbour Island, Long Island, Rum Cay, Exuma and Grand Bahama, where the largest number of Sisal plants are met with, have for many years past, been in the habit of making a small quantity of rope for home use, from the fibre they extracted from the leaf of the Sisal by the primitive method of bruising and maceration; and for this purpose they kept a few plants growing about their yards; consequently when the production of the fibre as an article of merchandize became an acknowledged resource, the above named islands had a comparatively good supply of old trees, from the poles of which large numbers of seedlings were readily procured, and the people found profitable employment in planting nurseries to meet the great demand for young plants. These in turn on being planted in the field, very soon began to produce "suckers," *ad libitum,* hence the rapid progress which has marked the establishment among us of the new industry. . . . . .

In Abaco we have the "head quarters" of the Sisal industry, for it is on this island and some of its adjacent cays that the largest cultivations in the Colony exist. Beginning at Hole-in-the-Wall, Mr. J. S. Johnson, of Preserved Pine-apple celebrity, has 200 acres planted with 130,000 plants, some of which planted two years ago have leaves over three feet long. Mr. Johnson has also two other cultivations on Abaco, namely, one at East Creek, Little Harbour, of 25 acres with 21,000 plants, and another at Witch Point of 60 acres with 31,200 plants. Cotton is being planted between the rows of Sisal.

The "Bahama Fibre Co., Limited," of which Mr. Abbott is the manager, has a field of 150 acres at Broad Creek with 73,000 plants, and another field of 108 acres at Joe Creek with 62,000 plants. These two fields also contain 264,000 nursery plants. In addition to these the Company has purchased a cultivation at Sweeting's Village, and another at Great Guano Cay, both of which were planted some years ago, and are yielding thousands of pole plants as well as a large number of suckers.

Cherokee Sound has confined itself mostly to nursery planting, and I saw several thousands of such plants growing about this settlement.

The Munro Fibre Company, managed by Mr. T. Trumble, commenced planting in August, 1889, and now have 1,100 acres planted at Cocoa Plum Creek with 654,000 plants, and 10 acres at Black Sound with 7,000 plants. In addition to the field plants, there are also about 300,000 plants in nurseries. For the time that has necessarily been occupied in preparing and planting so extensive a cultivation, the plants look strong and healthy.

The Company intend to plant their fields with cotton between the Sisal, and I understood Mr. Trumble to say that seed for this purpose had already been received from one of the Southern States of America. The Company has also a factory at Black Sound in which there are five of Death & Ellwood's machines worked by a 15 horse power Steam Engine. These have been employed in cleaning Sisal leaves purchased from persons who have full grown trees. The yield of cleaned fibre was ascertained to be about 4 p. c., but I could not help being struck with the large proportion of fibre that was wasted in the process. There can be no doubt that with the improved machinery which the demand must necessarily cause to be produced, the percentage of cleaned fibre will be largely augmented.

A portion of the above factory contains the necessary plant for the preserving and canning of pine-apples. This part of the establishment I had the privilege of visiting in July last when in full operation, and I was very much pleased with the order and cleanliness that obtained.

At Marsh Harbour, I think I can, with all sincerity, say that I visited the handsomest Sisal field I have seen. This was planted by Mr. Benjamin E. Roberts two years ago, and contains 140 acres with 107,000 plants. The land is undulating, and the soil is black and abundant. The plants looked as vigorous as possible, and were most prolific with regard to suckers of which there were at least 25,000 then in the field, and Mr. Roberts assured me that he had already removed 47,000. This field was being planted with dwarf cotton between the Sisal.

At Hope Town, Mr. Thomas Russell, whom I have elsewhere referred to, has about 20,000 plants, some of which have been growing half a dozen years, and from these he expects to gather 100,000 pole plants this year, in addition to a large number of suckers.

Another gentleman of the same name, now residing in Nassau, has a very fine nursery at Black Sound containing many thousands of young plants. , . . .

Propagation.—The plant is propagated in two ways, namely, from the young plants furnished by the pole, and the suckers which are thrown out from the roots. On the plant reaching maturity, a pole 15 to 20 feet in height grows out from its centre, on which a number of blossoms appear borne on arms which extend laterally from the upper part of the pole. In about six months after the appearance of the pole, so far as I can learn, these blossoms develop into young plants varying in length from 2 to 4 inches, and in number from 1,000 to 2,500 and occasionally more. They are then gathered and set out 8 or 9 inches apart each way in nursery beds. In 6 months they will attain a growth of 8 to 12 inches, and they may then be transferred to the field. The age at which the pole is produced, when not extended by the removal of leaves, as I have elsewhere shown, is 6 to 7 years.

Suckers are plants which grow out from the roots of the parent tree, and in congenial soil are produced in 12 to 18 months. From this time, on to the third or fourth year, they appear in great numbers, many plants producing as many as 20 to 30 suckers during that period; after which they begin to decrease, until they finally cease to appear. The plant suckers much earlier, and in greater abundance in black or rocky land than in white land. This is easily accounted for. The tendency of the shoots on which the suckers are produced is to grow downwards, and the black soil being shallower than the white, the shoots reach the rock much earlier, and are then turned upwards in their growth until the surface is reached and the suckers appear. I have seen plants suckering on black land, which I was assured had not been planted longer than six months; and at 12 to 18 months, I have seen them suckering most abundantly; while on the white land the suckers do not generally appear until after the second year.

With respect to the taking up and planting of suckers, I think it well, having regard to the speedy production of new plants, to call attention to a method which I have seen practised with very satisfactory results, viz.: In removing a sucker from the parent tree, instead of cutting or breaking off the sucker only, to uproot entirely the white shoot at the end of which it is growing, and cut that off as near the parent trunk as possible. This shoot will be found to be jointed like a sugar cane. After the removal of the sucker, the shoot is cut up into lengths of two or three joints. These bits are then planted in nursery beds, and in a short time each bit will produce as many suckers as there are joints. This method has the two fold advantage of speedily increasing the supply of the new stock, and relieving the parent tree of the support of the suckers.

Field Planting.—The system adopted by those who have engaged largely in planting varies. Some have planted as near as 6 feet each way, others 7 × 7, 7 × 8, 7 × 9, 8 × 8, and 9 × 9. The Munro Company at Abaco plant three rows 8 feet apart with 7 feet interval between the plants, and leave a space of 12 feet between every fourth row. The "Bahama Hemp Company, Limited," which is under the efficient supervision of Mr. Abbott, plant four rows 8 × 8, leaving a distance of 12 feet between every fifth row. Most planters, however, have found it advisable, owing to the rocky nature of the land, not to observe too strict regularity in planting, but while adhering as near as practicable to it, to put the plants in the most favourable spots. Most of the labouring class who have engaged in planting have observed no method at all, but have put the plants in the ground wherever a good "pot hole" or chink in the rock occurs, and have planted much too thickly.

Many planters have planted the spaces between the Sisal plants with some other crop, either ground provisions such as pigeon peas, corn, &c., or cotton. This plan appears to be attended with excellent results, and is one that I cannot too strongly recommend, provided always that such auxiliary crops be not too thickly planted. The slight shelter they afford seems to be beneficial to the Sisal plants in their early growth, and tends to suppress the growth of weeds, thereby lessening the cost of keeping clean the field, beside yielding a remunerative crop. Sweet potatoes should not be planted in a Sisal field, at least not until the plants have attained a growth of a foot and a half to two feet, as the vines very soon cover the field and completely envelop the young plants, and retard their growth.

Cleaning.—Both Messrs. Stoddart and Preston, in their respective pamphlets, urge the importance of thoroughly "cleaning" *i.e.* paring off the roots of the young plants before they are planted in the field. The effect of this practice, however, is undoubtedly to lessen the yield of suckers after the plant has commenced to grow. Such certainly has been the experience of nearly every one engaged in the cultivation in these Islands, to whom I have spoken on the subject; and as the rapid acquisition of plants is at present of primary importance, the practice of cleaning has been discontinned. Of course when plants have been long taken from the ground and the ends of the roots have become dry, or when the roots are so numerous and bulky as to render planting inconvenient, the roots may be *trimmed* with advantage, as the effect of this naturally is to encourage the more rapid production of new roots. This is a practise constantly observed by gardeners in transplanting large rooted plants, but in the thorough "cleaning" as recommended in the above named pamphlets, the eyes which throw out the shoots that produce the suckers are destroyed. As one gentleman connected with a large Sisal Company remarked to me "it is like planting a potato after cutting out the eyes"

It is possible that for this reason the system of cleaning is practised in Yucatan, where as I understand a large proportion of the suckers produced are treated as weeds.

Effect of different soils and aspect on growth.—I have both read and heard it broadly asserted that Sisal will grow and flourish anywhere, no matter how sterile or impoverished the land may be. My observations however do not confirm this. I do not mean to convey the idea that *really good rich* *land* is necessary for its successful cultivation, but merely to remove the impression, if such there be, that the plant will thrive in dry arid sand, or on rocky land void of soil. Worn out "provision" and pine-apple fields appear to be well suited to its cultivation, while on broken, rocky surfaces, containing innumerable "potholes" and crevices, in which is deposited the ordinary black or red earth, the plant luxuriates. Nowhere have I seen it appear more flourishing than on such lands. Certain kinds of white or sandy land, found in large quantities at some Islands, also suit it admirably. One of these varieties, white on the surface from being bleached by the sun, on being turned discloses a dark coloured mixture resembling salt and black pepper, and is known locally by the term "salt and pepper land."

Another still darker coloured sandy soil is termed "Mixed" land. Yet another kind, which although white on the surface, is found to be of a reddish colour an inch or two below, and is very fine and close. These varieties doubtless possess some organic matter, and are not to be confounded with the loose coarse sand found in scrubby plains and bay ridges, producing a natural growth of stunted palmettos and low brush, and on which nothing else will grow. Persons who have seen Sisal, cocoanuts and guinea corn growing on the white land that fringes the Eastern shore of Andros, and also on the white land of Abaco, Grand Bahama and Harbour Island, will readily understand the description of soil to which I have reference. The Sisal plants growing opposite "The Caves." in the Western part of New Providence, afford another illustration.

In selecting such land for planting, the height of the indigenous growth will in general afford sufficient indication of its adaptability to Sisal. Where this attains to ten or fifteen feet, the land is all right, but where there is only a dwarfed growth of three or four feet, the soil is too poor to cultivate anything on. It is however gratifying to know that there is but a small percentage of such land in the colony.

With respect to aspect, I think the general experience is that hilly situations have a marked beneficial effect on the growth. Plants growing on the slope of a hill especially a hill facing the prevailing direction of the wind, grow much more rapidly than those on low level land. Never mind how rocky the surface may be, if it is loose broken rock, with plenty of interstices containing a little soil in which the roots may ramify, the plants will grow rapidly and sucker abundantly. The plant is one that admittedly rejoices in plenty of air, and it is just such situations and soil that best meet this requirement.

In the preparation of the land for planting, too much care cannot be bestowed. Burning should never be performed in dry weather, or the soil, which in most cases is merely a superficial deposit of vegetable mould, will be destroyed. . . . . . .

Crop.—The length of time required for the production of the first cutting of leaves may, I think, safely be regarded as four years from the time of planting. A great deal depends upon the size of the plants when transplanted, but if they be of a suitable size, say from 12 to 15 inches, without doubt the leaves will attain a length of 4 to 5 feet and be fit to cut, well within the period named. I have seen thousands of plants with leaves from 2 to 3 feet long that had been growing only 2 years; and I have also seen plants, that I was told were three years old, from which leaves had been already cut.

For the present, the yield per acre with us, can be only a matter of calculation, in consequence of the industry having been so recently begun; but sufficient positive experience has been derived, to determine this point with approximate accuracy. The number of leaves cut from many plants of four years growth and upwards, has given an average of forty leaves per tree, with an average weight of 1½lbs. per leaf, and a yield of 4% of cleaned fibre. With an average of 600 plants to the acre, and 40 leaves weighing 60lbs. to each plant, the yield would be 36,000lbs. of leaf and 1,440lbs. of cleaned fibre. If the estimate be reduced to 35 leaves, there will be 31,500lbs. of leaf and 1,260lbs. of fibre, and this is certainly a very modest estimate. To guard against all possible disappointment, however, the yield per acre can be safely placed at half a ton. The plant, I firmly believe, is capable of yielding a much larger percentage of fibre than is at present obtained, if a machine can be produced that will obviate the great waste incurred by those now in use. The matter is one of such urgency, there can be little doubt that the want will ere long be supplied.

Much of the success of the industry will depend in a large measure, on the shipments of fibre being of excellent and regular quality. Too much care cannot be taken to ensure this result. If the fibre once gets a bad name, the price will rule low for years to come; and therefore it would be most unpardonable, if by careless methods of preparation, we lost the high character which the fibre has already acquired, in the markets in which it has been introduced.

Weeds.—I have not observed very much difference in the weeds that grow on the several Islands. Wild ochra, wire weed, and shepherd's needle are encountered everywhere, from Grand Bahama to Inagua. Another weed that is most plentiful and troublesome, and of which there are three or four varieties, is known by different names—namely—bark birch, white bark, black bark, bark, cough bush, glove bush, &c. The above weeds do not generally make their appearance in newly cut fields until after the first year, the cleaning during that period, being confined to the removal of the growth on the stumps of trees left standing in the field. This is termed "sprig weeding." In old fields, and especially those on white land, weeds grow exceedingly rank, grass of various kinds such as bur-grass, bed-grass, wire-grass, &c., is also very abundant, but on white land, is easily removed with the hoe.

In the fields in the pine forest the weeds most abundant are the wild potato—also known as wild yam—and a coarse fern or bracken. The vines of the wild potato are very troublesome, for they entwine themselves around the centre leaves of the Sisal plants and prevent their unfolding and expansion. The growth of the fern is very rapid, but it is easily pulled up; and I question much whether its presence is hurtful to the field.

All of the weeds above named, with the exception of the wild potato and fern, are generally eaten by sheep, and at Long Island some planters utilize these animals for weeding. Mr. Simms at Long Island, has his Sisal field planted with ground provisions as well. He told me that his plan is, after gathering his crops of provision, to turn a flock of sheep into the field to eat the grass and weeds. This they speedily accomplish, and all there is left for him then to do, is to "sprig weed." The plan appears to me to be one that should recommend itself to those interested, not only on account of its cheapening the cost of weeding, but also for the great benefit the land must necessarily derive from the sheep. Mr. Simms was positive in his assurance, that the sheep do not trample the plants when they are a foot or more high, but on the contrary, carefully avoid them."

The following extracts are taken from a very interesting Report by Mr. Charles Richard Dodge, just issued by the United States "Department of Agriculture :"—

"The imports of Sisal hemp fibre into this country from Yucatan for the fiscal year ending June 30, 1890, amounted to 28,312 tons, in round numbers, worth $4,330,300, and for the year previous the imports amounted to over 35,000 tons. This does not take into account the imported manufactures from Sisal hemp, which are considerable, the value of which can not be given. It is said that the United States purchases over 80 per cent. of the marketable fibre produced in Mexico. . . . .

The history of the introduction of the plant into Florida, by Dr. Henry Perrine, between 50 and 60 years ago, is almost too well known to repeat here, though a few brief statements may not be out of place.

Familiar with the account of Dr. Perrine's efforts to obtain a grant of land in Southern Florida, upon which to pursue his experiments in the culture of this plant, as well as the story of the tragic ending of the enterprise, it has been my good fortune to obtain from Mrs. Hester Perrine Walker, of Fernandina, Fla.—a daughter of the Doctor and an eye-witness to the Indian Key massacre—some interesting and more detailed statements regarding the introduction of the plant by Dr. Perrine, from which the following facts are gleaned :—

Mrs. Walker informs me that the first introduction of the plant from Yucatan occurred in the years 1836 and 1837, a few plants having been sent to the Royal Botanical Gardens of Cuba at the same time. Of the plants brought to Florida, part were taken to Indian Key and the others were planted upon "The Indian Hunting Ground," on the borders of Biscayne Bay. It is also stated that when these plants had multiplied to some extent the Officers at Fort Dallas, at the mouth of the Miami River, 12 miles from this locality, were in the habit of gathering the young ones to send to greenhouses in the North, and also to other posts where they were grown as ornamental plants. One of the results of this practice was to introduce the plant into many new localities in Florida, where it soon obtained a foothold. The plants set out on Indian Key multiplied very fast, and a few years after the destruction of the enterprise, and the death of Dr. Perrine at the time of the Indian massacre, a schooner load of the young plants were gathered and taken away, though it is not stated where they went.

Mrs. Walker writes further :—

'After my father's death and our miraculous escape from the Indians, Congress passed a supplementary act, giving to my mother and her children the same rights and privileges that were vested in him. In accordance with that act my mother hired men to plant on every section of the Perrine grant. This supplemental act was passed by the Congress of 1840 and 1841 ; whether in the first or second session I can not tell. The general planting of the Perrine grant occurred in 1846, by our agent, Mr. Charles Howe, who took six men with him upon the land for the purpose. This grant consisted of a township 6 miles square, lying on Biscayne Bay, embracing portions of three sections, as allowed by the Land Office. We secured, in 1846, thirty-six families of Bahamians to go upon the grant to fulfil the condition of a settler upon each section. The men came over to build their houses and plant their gardens preparatory to bringing their families, when they were driven or frightened away by the Indians and could not be induced to return. It was about this time that the agave was planted upon each section.'

Mrs. Walker also states that the other agaves were introduced with the *sisalana*, all of which were called "century plants." Many other plants were introduced, in all some two hundred varieties, which were growing in boxes on the premises of Dr. Perrine and Mr. Howe, Indian Key, preparatory to the removal of the "grant" as soon at the war should cease. These were nearly all burned or destroyed at the time of the massacre, August 7, 1840.

From this first introduction of the *Agave rigida* into Florida the plants spread rapidly, especially on the mainland, being commonly transplanted to the gardens of the early settlers of South Florida chiefly for the sake of ornament. In 1842 the armed occupation act was passed by Congress, which gave a homestead of 160 acres to any person who occupied a tract 5 years. Mr Robert Ranson of Titusville, Fla., makes statements in this connection as follows :

'This resulted in a number of heads of families settling along the Indian River in the neighbourhood of Fort Capron, and on nearly every one of these old settlements a small patch of Sisal hemp may be found grown into a dense thicket, descended from one or two parent plants set out over 45 years ago. These facts are considered worthy of mention, as showing that while every other evidence of former cultivation has long since disappeared, the Sisal hemp, regardless of forest fires, weeds, and neglect, still holds its own and spreads year by year.' . . . . .

As regards soil, moist or rich land is unsuitable, because of the lesser yield of fibre. Our correspondent, Mr. Ranson, writes with positiveness upon this point, as follows :

'The fact of the plant itself flourishing better may be attributed to a combination of conditions existing both in the soil and surrounding atmosphere, principal among which I notice the presence of salt making it retentive of moisture, and of lime phosphates resultant from decaying shells. Land bordering on the Atlantic coast, which is evidently alluvium to a comparatively recent date, is generally considered too poor in the constituents necessary to plant life to make it worth while to attempt any cultivation upon it, and whilst this may be true as regards a lack of decomposed vegetable matter yet the shelly, saline sands will be found to suit such plants as the yuccas, agaves, etc., both chemically and physically better than the rich, black hummack lands.' . . . . .

The soil in the Merida district of Yucatan is described as stony and sterile and composed chiefly of disintegrated lime-rock. This region is only a few feet above the sea-level, and the whole Sisal country is described as low and flat. . . . . .

During my recent visit to Florida the bad effect of shade upon large plants was noted in several marked instances, the plants being less thrifty, and the leaves sometimes so spindling and thin as to have lost their rigid habit and to be bent and drooping. . . . . .

Upon the subject of cultivation and care of the plantation, Mr. Edgar Bacon makes suggestions as follows:—

'Experienced growers use 650 plants to the acre in rows 11 feet by 6 feet distant from each other. This will give room for the labourers to walk between the rows without being wounded by the terrible spurs, which like a cluster of keen spears make each plant a menace to the unwary. Besides this the closer planting would result in the piercing of innumerable leaves every time the wind blew, and the consequent destruction of much fibre. Stabs and bruises mean discoloration, and the expense of sorting damaged lots apart from the proportional loss would be an added and not insignificant item in the labor account of a plantation. Many people who have caught the sisal fever are planting acre after acre expecting nothing less than that the farms, when planted will take care of themselves. To be successful in this enterprise requires unceasing activity and care. One must be Argus eyed. One season of poor prices with the consequent discouragement which is apt to follow in the case of nine small proprietors out of ten, in a country where the peasantry are all negroes, will result in an overgrowth of suckers and the poling of mature plants till nothing short of absolute clearing and starting anew will save the farms. There is no cultivation where system and perseverance are more necessary to success. The dropping of the seed from a single "pole," if not watched and attended to immediately, will produce little spears enough to destroy a hundred plants, and I have frequently seen a dozen suckers start up around and under the leaves of their parent. After such crowding, the leaves would be worthless, even could they be reached; but no man, unless arrayed in metal armour strong and stout enough to withstand the thrust of steel, would be so foolhardy as to attempt to penetrate such a growth. What I want to impress is the fact that without that patient and systematic care which I nowhere observed as characteristic of the unled negro, a field of sisal is as valueless as a field of mullein.'

It is desirable that the young plants be set out in perfectly straight rows and upright, for if not, and they grow up at angles in all directions, there will be difficulty in getting between them when the leaves are harvested. Regarding the suckers, there is no question but that they should be removed, for to allow them to remain will be a positive detriment to the parent plants. If they are not needed for the planting of new fields they should be thrown away. In setting out these suckers in Yucatan the planting is said to be very simply accomplished: a little hole is dug and the plant introduced, after which it is propped up by a few stones and left to take care of itself until the time for taking off the first leaves. When cultivating suckers in the nursery, the practice in Florida is to set them out 10 or 12 inches apart in rows, where they remain until large enough to set out in the fields. Suckers are not relied upon alone for the propagation of the plant. When the old plant flowers it sends up a stalk, or "pole," as it is called, to the height of 15 or sometimes 20 feet. After the tulip-shaped blossoms which appear have begun to wither there now starts forth from the point of contact with the flower-stalk a bud, which develops into a tiny plant, which, when grown to the length of several inches, becomes detached and falls to the ground. Such "pole plants" as come in contact with the soil take root, and in a very short time are large enough to transplant.

In the Bahamas these flower-stalk plants are largely utilized in establishing Sisal fields, and with as good results as where the suckers alone are used. Precisely the same course must be pursued in Florida.

A single "pole" or "mast" produces from one to two thousand plants, while only a few suckers are formed at the base of each old plant. . . . .

The prohibitory regulations of other countries, from which supplies might be obtained, make it obligatory upon the people of Florida to protect themselves. In a letter from Mr. Van Buren upon this subject received last fall, he says:

'The regulation of the Bahamas make it impossible for us to get the plants, except at a large cost, $49 per 1,000 and a risk of fine and imprisonment besides. I have also a letter recently from the United States Consul at Honduras, stating the same facts, and that the price there would be $50 per 1,000, the Government having imposed heavy duties to prevent their exportation. In view of these facts I would respectfully suggest that our Government should take steps to prevent plants being exported from our country.' . . . .

In establishing Sisal hemp plantations, it should be understood at the outset that small plantations, put out by individuals, isolated from each other, will not pay. A large tract is necessary for economical production of fibre, that the work of cutting the leaves and shipping the fibre may be systematically continued, for the most part, through the year. This is the system in vogue in Yucatan and the Bahamas, and we must follow it in Florida. Mr. Cleminson, writing upon this point, says:

'With regard to my own experience in Florida, it is certainly experimental, as I have had no returns. I have 50,000 plants one year old in nursery form, and 10 acres planted out with 2-year old plants. So far as the growth is considered it is satisfactory, but it requires about 500 acres to successfully enable one to operate machinery economically.'

In the case of individual growers n a community, the desired result may be attained by co-operation, and particularly when the plantations are reasonably contiguous. This will enable securing the fibre without undue expense for transportation of the raw material to the machine. . . . .

The following is from a Report by Consul Thos. J. McLain :—

'The progress made in the development of Sisal culture in the Bahamas during the past twelve months is marvellous. One year ago there was scarcely a dollar of foreign capital, and very little local, invested in this business in the colony, while to-day parties from Great Britain, Canada, and Newfoundland, representing large resources, are interested in Sisal, have bought tens of thousands of acres of Government land, and are industriously engaged in clearing and planting the same to the full measure of their ability to procure the material. A local stock company styled the Bahama Hemp Company, organized and managed by Nassau capitalists exclusively, has also purchased a large tract of land and is developing the same, whilst thousands of acres are being planted in every direction by individual owners of small pieces. American capital up to this date, I regret to say, for it is to its own disadvantage, has been conspicuous by its absence. One company, however, styled the Inagua Hemp Company, organized under the laws of the State of New Jersey, with D. D. Sargent, United States Consular Agent at Inagua, as manager, has lately procured about 1,200 acres at Inagua and has begun operations.

'Messrs. Munroe & Co., of St. John's, Newfoundland, have obtained a grant of 18,000 acres of crown land at Abaco, and are planting the same. Another tract of 20,000 acres has been allotted to a London company on the same island. Mr. Alex. Keith, of Edinburgh, Scotland, has taken 2,000 acres Andros Island, and is working upon it. But the largest demand has been lately made by two London companies, who are said to be applying for not less than 200,000 acres between them ' "

The Government of the Bahamas stated in July that "persons engaged in the industry are increasing their cultivation, and capitalists from abroad are still investing therein."

In order to encourage the planting of Sisal in Jamaica, the Government has imported lately from Florida 25,000 plants of the same variety as grows in the Bahamas. This is in addition to over 51,000 already supplied to planters, and to over 20,000 planted in the Hope Gardens. The plants are available for distribution at a uniform rate of £5 7s. 6d. per 1,000, 10s. 9d. per 100, 1s. 1d. for 10, or 1½d. for one. It is thus possible for any one to obtain a few plants for experiment at a very small expense, or in large quantities for laying the foundation of future fibre farms. Application should be made to the Director of Public Gardens and Plantations, Gordon Town P.O.

No. 25. November 1891.

BULLETIN

OF THE

BOTANICAL DEPARTMENT,

JAMAICA.

CONTENTS:

PRICE—Two-pence.

JAMAICA:
GOVERNMENT PRINTING ESTABLISHMENT, 79 DUKE STREET, KINGSTON.
1891.

FERNS: SYNOPTICAL LIST—VI.

Synoptical List, with description, of the Ferns and Fern-Allies of Jamaica, by G. S. Jenman, Superintendent, Botanical Gardens, Demerara (continued.)

Tribe IV.—*Cyatheæ.*

Sori subglobose, on elevated (rarely superficial) receptacles on the backs of the veins; involucres nfe rior (mostly absent in *Alsophila.*)

7. *Alsophila.*—Involucres nearly or wholly absent.
8. *Hemitelia.*—Involucres lateral, sepal-like.
9. *Cyathea.*—Involucres cup-shaped or hemispherical.

Genus VII.—*Alsophila.*

Sori subglobose; receptacles elevated or rarely superficial; sporangia generally densely aggregated and obovate cuneate, rarely few and orbicular; involucres quite absent or rudimentary; fronds uniformly compound, and veins free.

This genus is distinguished by the general absence of involucres, but in several species a thin microscopical film or scale exists under the sori.

a. Fronds bipinnatifid.
  b. Veins simple.
    1. *A. sessilifolia*, Jenm.
  bb. Veins forked.
    2. *A. aspera*, R. Br.
    3. *A. parvula*, Jenm.
    4. *A. infesta*, Kze.
    5. *A. armata*, Presl.
aa. Fronds tri-quadri-pinnatifid.
    6. *A. pruinata*, Kaulf.

1. *A. sessilifolia*, Jenm.—Stem stout, reaching several ft. high; stipites 2-2½ ft. l. prickly; fronds ample, tripinnatifid, 8-9 ft. l. 3-3½ ft. w., rachis stramineous, prickly; pinnæ sessile, 1½-2 ft. l. 6-8 in. w. light green, paler beneath, chartaceous, slightly ciliate on the ribs and veins beneath; pinnulæ apart, 3-3½ in. l. ¾ in. w. all quite sessile, acuminate, cut ½ or ⅔ to the costules into rather broad rounded or sub-acute lobes 2-4 li. b; sori reaching to the top of the segments, rather nearer the margin impressing the surface on the upper side; receptacles naked.—Journ. Bot. n. s. vol. XI. p. 325.

Mansfield near Bath: Wilson in Herb. Kew No. 520 and in Herb. Brit. Mus No. 513 a 1 and 520; gathered in 1858, and described in the note attached as possessing a strong prickly trunk, covered with roots, 14 ft. high and 1 ft. 10 in. in circumference, the leaf and stipe together being 11 ft. 6 in. l. The thinner texture, pale color, sessile pinnæ and simple veins distinguish it from its allies. It may be a non-indusiate state of *Hemitelia Wilsoni*, Hook, which it very closely resembles.

2. *A. aspera*, R. Br.—Stem rather slender, and of medium height, with dark coloured vestiture above; stipites few, dark, prickly beneath, 3-3½ ft. l. clothed with bright chestnut scales, fronds tripinnatifid, 5 or 6 ft. l. 3-3½ ft. w. dark green, subcoriaceous; pinnæ 1¼-1¾ ft. l. 5-8 in. w. stipitate, not close, lowest a little reduced; pinnulæ almost touching, or more or less apart, nearly or quite sessile, serrulate- acuminate; segments rounded, broadish, oblong, ¼-½ in. l. 1½-2½ li. w. the edges serrulate; costæ and costulæ rusty pubescent above, a few dark bullate scales on the ribs beneath; veins once forked, 5-7 to a side; sori medial, copious, situated at the forking of the veins.

Hook. Sp. Fil. t. 19 B.; Plum. Fil. t. 3. *A. nitens* J. Sm.
  Var. *major.* Pinnulæ, 1 in. w. 3½-4 in. l.
  Var. *minor.* Pinnulæ ½ in. w. 1½-2 in. l.

Abounding in forests and half open situations from 1,000-4,000 ft. alt. and extending through the eastern parishes. The stem is rather slender and of low density, usually 5-10 ft. high, but reaching 15 ft; fronds relatively large and few. The dark colour, and dark chestnut scales distinguish it at sight. A slight scale-like involucre may be detected on removal of the sori by careful microscopical examination. A large lax state which might be called var. *arundinacea* gathered by Wilson (his no. 689 Herb. Brit. Mus.) he describes as having several stems from a single rootstock.

3. *A. parvula*, Jenm.—Stem slender, reaching 30 ft. high, scarred, clothed at the top with pale scales; stipites few or several, 1-1¼ ft. l. slender, curved, pale brown, with short blunt spines beneath and at the base pale chaff coloured scales; fronds 3-4 ft. l. 1-2½ ft. w. pendent in the outer half, light

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Note.—In the sequence intended, this Tribe would have preceded Tribes II & III but for the loss of the MSS. in transit.

green, paler beneath, chartaceous, tripinnatifid; pinnæ ¾-1 ft. l. 4-6 in, w. shortly acuminate, not sessile, pubescent on the costæ above; pinnulæ, except the basal ones, sessile, serrulate-acuminate, 2½-3 in. l. ⅓rd-⅔rd in. w. deeply pinnatifid; final segments oblong, blunt, 3-5 li. l. 1½-2 li. w. crenulate-dentate a few small bullate pale scales in the axils beneath; veins once forked, sori copious, ascending half or two-thirds up the segments; attached near the forking.—*Hemitelia*, Jenm. in Journ. Bot. n. s. vol. viii, p. 258.

Common in shaded and open situations at 2,000-3,000 ft. alt. in both the eastern and western parishes. It differs from the preceding in its smaller more numerous fronds, pale colour, chaff-coloured vestiture, deeper cutting of the pinnules, and slighter, but much denser, stem, which reaches eventually double or treble the average height of the stem of that, and is about as thick as a broom stick A slight scale-like involucre may be detected by the aid of a lens in some specimens beneath the sori. The pinnæ resemble in form and size those of *Cyathea dissoluta* very closely.

4. *A. infesta*, Kze.—Stem rather slender, reaching several ft. high, prickly and clothed above with pale scales; stipites prickly, with scales like those of the stem at the base; fronds spreading, dark green, rather frost coloured beneath, chartaceous, tripinnatifid; pinnæ 1¼ ft. l. or over, 5-6 in. w. not sessile, acuminate; pinnulæ 2-3 in. l. ¾-1 in. w. near, sessile (or the lower not so) serrate-acuminate, cut deeply into flat, toothed or crenate, obtuse-acute, final segments ¼ in. l. by 2 li. w. with a sharp cartilaginous sinus between, a few dark bullate scales on the costulæ beneath, otherwise naked; veins 2-3 times forked, the sori at their primary forking.

"Heamy Estate, 3,000 ft." alt., Wilson, No 517, in part, Herb. Kew. Grisebach also ascribes it to Macfadyen, but later collectors have not found it Wilson's specimens differ in slight particulars from the mainland form, but agree entirely with those of *A. alutacea*, Kze, w hich Mr Baker unites with *infesta*. Wilson sent it, unrecognized, mixed with specimens of a form of *A. aspera*, to which the note regarding the character of the caudex on his label refers.

5. *A. armata*, Presl.—Stem attaining many feet high, 2-4 in.diameter, clothed above with chaff-colored scales, stipites clothed with similar scales, and freely armed with curved sharp prickles; fronds large, 4-6 ft. l. 2-3 ft. w. tripinnatifid, densely pilose, pale green, rather flaccid, at length chartaceous; pinnæ nearly opposite, 1-1½ ft l. 4-6 in. w. acuminate, sessile; pinnulæ sessile, close, ⅓-½ in. w. 2½-3½ in. l. serrate-acuminate, deeply pinnatifid, segments oblong, blunt, subfalcate, crenate-serrate, 3 li. l., 1 li w.; veins forked; sori small, copious; receptacle slightly scaly.

Common, scattered or gregarious, on declivitous wayside banks, in open valleys, or in light forest, from 2,000-,5000 ft. alt. or rather higher, extending to the hills of the central and western parishes. A rival of *Cyathea arborea*, whose place in open situations it takes at higher altitudes, in charming gracefulness. It is perhaps the tallest of the local tree ferns, and frequently occurs from 30-50 ft. high, the head gradually diminishing in size as the stem lengthens. Occasionally the trunk is branched, bearing two or more crowns. Easily recognized by its copious soft pubescence, and pale chaff-coloured scales. In J. Smith's ferns in the British Museum there are specimens of *A. ferox*, Presl, ascribed to Jamaica, from Wilson, a mainland species only found in Trinidad or the islands, much resembling this, but more prickly, and otherwise well distinguished by its dark coloured scales, glabrous surfaces and arundinaceous stems.

6. *A. pruinta*, Kaulf.—Stem short, rarely 3 ft. high, stout, clothed densely with laniferous scales; stipites 3-6 ft. l. or more, arching, faintly impressed, rather polished, naked, except at the base; fronds 4-6 ft. l. 3-5 ft. w. sub-deltoid, tripinnate, pale green above, frost coloured beneath, coriaceous, costæ and costulæ pubescent above, the pinnulæ lanate on the ribs beneath; pinnæ large apart, petioled lowest pair deflexed and a little reduced, next above 1½-2½ ft l. 6-10 in. w.; pinnulæ lax, petiolate, 3-6 in. l. 1-1½ in. w. serrate-acuminate, the lowest segment situated on the superior side; tertiary segments ½-¾ in. l. 1½-3 li. w. acute, deeply cut into deltoid lobes in which the veins are pinnate; sori at the base of the lobes at the apex of the lowest venule on the upper side near the crenulate sinus; sporangia few rather large, roundish, mixed with copious lanate scales.—*Polypodium*, Swartz. *Lophosoria*, Presl, Plum. Fil. t. 33.

Very plentiful in forest shade from 3,000 ft. alt. to the highest ridges. The caudex which is 3-4 in. in diameter, buds and throws up from the base a number of minor stems about half the size of the primary one. The petioles are sometimes as much as 10 ft. l. giving the fronds an immense spread. In shape of frond, character of vestiture and scant number of capsules, it differs materially from all the other species.

Genus VIII.—*Hemitelia.*

Sori subglobose, receptacle elevated, often cleft and bilobed, scaly, situated on the back of the veins near to or distant from the forking; sporangia numerous and densely packed; involucres partial, embracing the sori from the inner side beneath, sepal or kidney-shaped and bilobed and shallowly quite circular: fronds generally ample; veins free or the costal united.

The size and form of the involucres, upon which this genus depends for its special character, are not very definite, and show a gradual passage from *Alsophila*, in which they are quite absent or merely rudimentary and only discernible by close microscopic scrutiny, into the cupshaped involucres of *Cyathea*; so that but for the disadvantage of upsetting established names, the three genera might well be merged into one.

a. Lowest pair of opposite veins united, forming a costal arch; those above free.—*Cnemidaria*, Pr.

1. *H. Imrayana*, Hook.
2. *H. horrida*. R. Br.

aa. Veins all free.—*Euhemitelia.*

3. *H. Wilsonii*, Hook.
4. H. Sherringii, Jenm.

1. *H. Imrayana*, Hook. Jenm.—Stems short, stout, erect; stipites erect, scaly at the base and prickly; fronds bipinnatifid, the apex simply pinnatifid with entire lobes, chartaceous, bright green, naked, or the ribs slightly tomentose beneath, pinnæ spreading, approximate, or the lower distant, in opposite pairs, becoming alternate above, 6-10 in. l. 1½-2 in. or over b., sessile, the acuminate apex entire, within this cut down ¾ to the costæ into flat acuminate sub-acute or rounded lobes 1-1¼ in. l. from the acute or rounded sinus, ¼-½ in. w. margins even, or crenate-dentate at the point; veins fine, close, once forked or in fascicles of 2-3 running parallel to the margin, the opposite basal pair uniting, forming a longitudinal costal arch from rib to rib with branches running to the sinus; sori forming a direct or slightly sinuous line just within the margin: involucres shallow, thin, simple or often at length bilobed.—*H. grandifolia*, Hook. Sp. Fil. Vol. I. t. 14, B. . . Grisebach, Fl. B. W. I. I. p. 706. Plum. Fil. t. 26 (double lines of sori wrongly shown.)

Gathered by Miss Taylor, Wilson, and of late years, by Sherring near Bath. I include under this all the West Indian specimens which I have seen, except those of Trinidad, hitherto ascribed by authors to *grandifolia*, a species which, as I regard it, is confined to Trinidad and the mainland, and which is quite distinct. For the latter (*H. grandifolia*, Spreng,) as here understood, Hooker's figure in vol. I, Sp. Fil. t. 14 a. under the name of *H. obtusa*, Kaulf. is absolutely correct. The latter is a relatively slender plant, with pinnæ of a uniform width from the base outwards to where they narrow to the point, cut only half way to the costæ into close (the sinus not open) broadly rounded lobes, of thin texture the line of sori decidedly intramarginal or nearly medial.

In *Imrayana* as here intended, the pinnæ are a different shape to those of *grandifolia*, texture thicker, sori nearer the margin and sinuses open. On the same frond, in different pinnæ, it often occurs that the segments vary from acuminate, acute, to round pointed, Hooker's figure B. quoted above, representing exactly, under the name of *grandifolia*, the last state, Hooker finally united his *Imrayana*, as a small variety, with *horrida*. I have Dominica specimens, and agree with this conclusion, but the name may be maintained for the Jamaican and other West Indian plants hitherto ascribed, but which do not properly belong to *grandifolia*, as Sprengel's plant of that name is here understood.

2. *H. horrida*, R. Br.—Stem short, 6-10 in. thick; stipites erect, strong armed with short strong spines and scaly at the base; fronds ample, erect bipinnatifid 4-7 ft. l. 2½-3½ ft. w. subcoriaceous, glabrous. or the ribs beneath glabrescent-tomentose dark green and glossy above, beneath pale; pinnæ spreading or erect-spreading, 1-2 ft. l. 4-8 in. w. sessile and opposite, or nearly so, the acuminate point entire, deeply pinnatifid; pinnulæ close, with an acute or slightly open sinus between, 2-3½ in. l. ½-⅝ in. w. the connected bases slightly dilated, tapering to the slightly serrated acuminate points, the margins within this entire; veins fine, close, in fascicles of 4-5 usually 4, which run parallel into the margin, the opposite basal pair united forming a costal arch below the sinus to which a vein runs from the angle; sori forming a rather crowded simple or pseudo-double straight or sinuous row shortly within the margin; involucres thin, bilobed, often nearly surrounding the sori, but open on the outer side.—Hook, Sp. Fil. vol. I. t 15. and Fil. Exot. t. 69; Plum., Fil. t. 8.

Var. *H. Hookeri*, Fee.—Very robust, the larger pinnæ fully pinnate at the base, the inferior pinnulæ sinuate or shallowly lobed within, the lowest pair pinnatifid on the lower side; lines of sori deeply sinuous; veins more open and more branched.

Frequent in damp forests, especially near banks of streams, from the lower hills up to 4,000 ft alt. The short thick trunk is clothed with the persistent decaying fibres of past petioles. Occasionally it is found in open situations, when generally it does not attain more than half its maximum size, and the sori run in straight lines.

3. *A. Wilsoni*, Hook.—Stem several feet high, scaly above; stipites 2-3 ft. l. clothed with scales at the base; fronds ample, bipinnatifid, 4-5 ft. l. 2½-3 ft. w., chartaceous, pellucid, naked or the ribs beneath slightly tomentose, and with the costæ sprinkled with few or several deciduous whitish scales; pinnæ 1½ ft. l. or over, 5-8 in. w. shortly stipitate or sessile, alternate, bipinnatifid, the apex pinnatifid, pinnulæ alternate, the inner free, sessile, the outer adnate, spreading, deeply pinnatifid, or only lobed or subentire, as are the outer ones, acuminate and serrate-entire at the apex, 3-4 in. l. ½-¾ in. w.; segments straight or subfalcate, close with a narrow sinus, entire or the rounded point crenate, 1½-2 li. w.; veins all free, the lowest excurrent above the sinus, regularly pinnate, or fascicled in the less cut pinnulæ, the branches simple or once forked; sori medial; receptacles scaly; involucres conspicuous, bilobed, thin, brown.

Infrequent or local in most situations from 1,000-3000 ft. alt. in the eastern parishes, gathered by Wilson at Mansfield near Bath, and since by Syme, Sherring, and Hart near Mount Moses, at Claverty Cottage and other places. The specimens present two states: in one the pinnulæ are sub-entire or lobed only in the outer part, the inner half being narrowed, and the base fully adnate; in the other they are uniformly and deeply pinnatifid throughout and the base is free but quite sessile. Wilson describes the trunk as slender and several feet high; Syme says eight feet.

4. *H. Sherringii*, Jenm.—Stem reaching 10 ft. high, 3-4 in. diameter; stipites stout, 2-2½ ft. l. freely armed with short straight spines, dark chestnut, rusty furfuraceous, the upper side densely clothed with dark castaneous attenuated pale-edged scales; fronds ample, tripinnatifid, 5-6 ft. l. 2½-3 ft. w. pellucid, subcoriaceous, bright green, pale beneath, naked except on the ribs which are pubescent; rachis stout, prickly at the base, muricate upwards, puberulous, rather scaly and furfuraceous in the axils; pinnæ acuminate, petiolate, 1½-2½ ft. l. 7-9 in. w.; pinnulæ contiguous, the outer and inner rather more apart, the inferior not quite sessile, 3½-5 in. l. 1 in. or rather over w. the apex tapering to a serrate-acuminate point, deeply pinnatifid almost to the costules; segments 5-8 li. l. 2-2½ li. w., linear-oblong, subfalcate, rounded, the inner open with a rounded or acute sinus between; veins once forked from near the base, 7-9 to a side; sori inserted at the forking, forming a line against the midrib; receptacles densely ciliate; involucres shallow, circular, the thin margins entire, lobed or incised.

Rose Hill, in the Port Royal mountains, 4,000 ft. alt. collected by R. V. Sherring in 1886. A large species, nearest allied to *Wilsoni*, from which its more robust growth, more deeply and uniformly pinnatifid pinnulæ, all of which up to the pinnatifid top of the pinnæ are free at the base, and shallow calyciform involucres, distinguish it. The latter character shows a decided passage into *Cyathea.*

(To be continued.)

CURING NUTMEGS.

The following letter has been received from a most successful Nutmeg grower in Grenada. The details so very kindly and readily given, will be of great service to those who are beginning the export of Nutmegs:—

"In answer to your enquiry as to the mode adopted for preparing Nutmegs for the London Market, I will tell you exactly what is done on my estate. The process is very simple.

The Nutmegs are picked up from under the trees every day except Sunday. On being brought into the boucan, the mace is peeled off, and pressed flat between heavy blocks of wood, where it is left for 2 or 3 days, then put into a case and left, till it reaches the proper colour.

The Nutmegs are put into receptacles (with fine-wire mesh bottoms, so that the air can pass,) inside the boucan, and left there for three weeks or a month, in fact until the nut begins to shake inside the shell. They are then shown the sun for a couple of hours a day for two or three days. After this they are cracked. Great care is necessary here, for if the outside shell is struck too hard it makes a black spot in the Nutmeg which affects the value considerably.

When cracked, the nuts are sorted according to size, put into ordinary flour barrels and shipped. By last mail the average of my prices was about 2s. 6½d. a lb. In the shipment was included a case of pure rubbish, small shrivelled worm-eaten nuts fetching about 1s. lb."

EXPERIMENTS IN THE CULTIVATION OF VEGETABLES.—III.

PEAS.

Results have already been published in Bulletins 20 and 24, on the growth of Vegetables. The tables given below are a continuation of those on the Peas, presented by Messrs. Carter of High Holborn, London.

Names of Peas.	Date of Planting, April.	First appearance above Ground.	Days from Planting.	Date of First Bloom.	Days from Planting.	Pods of Edible Size.	Days from Planting.	Days Fit for Table Use.	First Seeds Ripe.	Days from Planting.	Last Seeds Ripe.	Days from Planting.	Number of Pods on a Plant average.	Number of Peas in a Pod average.	Mean Average Temperature.	Minimum Temperature.	Maximum Temperature.	Average Maximum.	Average Minimum.	Rainfall.	Number of Days on which Rain fell.	Height in Feet.	Time of Cooking in Minutes.	Quality.
McLean's Blue Peter ..	3rd	14th	11	9.5	36	3.6	61	10	26.6	84	15.7	103	3.0	3.0	65.2	53.2	73.9	70.1	60.4	28.4	44	.	13	3
American Wonder or Emerald ...	4th	14th	10	9.5	35	3.6	60	No	seeds r	ipen	ed. D	ead.	15.7	91	65.2	53.2	73.9	70.1	60.4	28.48	44	2	14	4
Bishop's Long Pod'd ...	4th	12th	8	28.5	54	16.6	73	16	No see	ds ri	pened.	Dead.	...	...	65.2	53.2	73.9	70.1	60.4	28.48	44	3	19	5
McLean's Little Gem ...	4th	13th	9	12.5	38	3.6	60	12	15.7	102	15.7	102	2.0	2.50	65.2	53.2	73.9	70.1	60.4	28.48	44	2	15	4
Abundance ...	4th	13th	9	20.5	46	16.6	73	28	15.7	102	15.8	133	8.0	4.25	65.5	53.2	77.4	71.1	59.9	34.39	56	2	15	3
Carter's Little Wonder ...	4th	14th	10	20.5	46	.	Pro	duced	no pea	s.	Dead.	...	15.7	91	65.2	53.2	73.9	70.1	60.4	28.48	44	2	...	.
Carter's Pride of Market ...	4th	14th	10	20.5	46	...	Pro	duced	no pea	s.	Dead.	...	..	...	65.2	53.2	73.9	70.1	60.4	28.48	44	2	...	.
Carter's Stratagem ...	4th	14th	10	22.5	48	9.6	66	28	15.7	102	15.7	102	2.0	2.0	65.2	53.2	73.9	70.1	60.4	28.48	44	3	16	2
Kentish Invicta ...	4th	12th	8	9.5	36	25.5	51	20	15.7	102	15.7	102	6.20	3.40	65.2	53.2	73.9	70.1	60.4	28.48	44	3	15	2
Omega ...	4th	14th	10	25.5	51	..	Pro	duced	no pea	s.	Dead.	15th	July	91	65.2	53.2	73.9	70.1	60.4	28.48	44	3	...	.
Carter's First Crop or Ringleader	4th	12th	8	9.5	35	28.5	54	14	15.6	72	30.6	87	4.0	3.50	64.8	53.2	73.9	69.8	59.9	27.86	40	3	17	4
Carter's Blue Express ...	4th	12th	8	9.5	35	28.5	54	15	15.6	72	30.6	87	5.0	2.50	64.8	53.2	73.9	69.8	59.9	27.86	40	3	12	3
Carter's Anticipation ..	4th	14th	10	22.5	48	10.6	67	16	28.6	85	15.7	102	3.0	5.0	65.2	53.2	73.9	70.1	60.4	28.48	44	3	15	3
Laxton's Alpha ...	4th	12th	8	9.5	36	3.6	60	14	17.6	74	4.7	91	6.0	3.25	65.2	53.2	73.9	70.5	60.0	23.31	41	4	12	2
Carter's Balmoral Castle ...	4th	12th	8	28.5	54	11.6	68	20	26.6	83	30.7	117	6.0	5.0	65.3	53.2	75.9	70.6	60.0	33.38	50	4	14	1
Early Sunrise ...	4th	13th	9	12.5	39	11.6	68	12	1.7	88	30.7	117	3.0	4.0	65.3	53.2	75.9	70.6	60.0	33.38	50	4	15	4
Laxton's Fillbasket ...	4th	12th	8	28.5	54	8.6	65	10	1.7	88	30.7	117	4.0	4.0	65.[illegible]	53.2	75.9	70.6	60.0	33.38	50	4	16	5
Carter's Wonder of the World ...	4th	13th	9	26.5	52	1.7	88	20	10.7	97	11.8	129	3.0	2.0	65.4	53.2	75.9	71.0	59.9	34.23	55	4	16	2
Laxton's William 1st ...	4th	12th	8	9.5	36	8.6	65	12	18.6	75	2.7	89	8.0	4.0	64.8	53.2	73.9	69.8	59.9	28.21	41	4	...	.
Sturdy ...	4th	14th	10	28.5	54	13.6	70	28	15.7	102	15.7	102	3.50	2.25	65.2	53.2	73.9	70.1	60.4	28.48	44	4	16	3
Hundredfold or Cook's Favourite	4th	13th	9	28.5	54	15.6	72	30	8.7	95	8.7	95	2.30	3.0	65.3	53.2	73.9	70.7	59.9	28.21	41	4	15	4
Dickson's Favourite ...	4th	13th	9	26.5	52	11.6	68	30	15.7	102	15.7	102	4.0	2.50	65.2	53.2	73.9	70.1	60.4	28.48	44	4	14	4
Sugar Dwarf ...	4th	13th	9	28.5	54	13.6	70	20	15.7	102	15.7	102	3.0	3.80	65.2	53.2	73.9	70.1	60.4	28.48	44	2	16	3
Carter's G. F. Wilson ...	4th	13th	11	28.5	54	9.6	66	30	No	seed	s ripen	ed. D	ead.	15.8.91	65.5	53.2	77.4	71.1	59.9	34.39	56	3	15	2
Laxton's Supreme ...	4th	12th	8	20.5	46	9.6	66	34	5.7	92	11.8	129	5.0	3.0	65.4	53.2	74.9	71.0	59.9	34.23	55	3	15	3
James's Prolific ...	4th	13th	9	20.5	46	9.6	66	No	seeds ripen	ed.	D	ead.	...	15.8.91	65.5	53.2	77.4	71.1	59.9	34.39	56	4	16	4
Dignity Carters ...	4th	12th	8	20.5	46	9.6	66	20	8.7	95	8.7	95	3.50	4.00	65.3	53.2	73.9	70.7	59.9	28.21	41	4	14	1
Duke of Albany ...	4th	12th	8	28.5	54	11.6	68	20	8.7	95	8.7	95	4.00	3.70	65.3	53.2	73.9	70.7	59.9	28.21	41	4	14	1
Champion of England ...	3rd	13th	10	26.5	52	11.6	68	20	16.7	103	15.7	102	3.00	3.00	65.2	53.2	73.9	70.1	60.4	28.48	44	5	15	2
Laxton's Prolific ...	4th	12th	8	20.5	46	9.6	66	34	6.7	93	8.7	95	3.00	4.00	65.3	53.2	73.9	70.7	59.9	28.21	41	4	16	4
Carter's Progress ...	3rd	13th	10	3.6	61	9.7	97	28	28.7	115	11.8	129	10.20	3.70	65.4	53.2	75.9	71.0	59.9	34.23	55	5	14	1
Carter's Telephone ...	3rd	14th	11	28.5	55	9.6	66	38	15.7	102	15.7	102	2.10	4.00	65.2	53.2	73.9	70.1	60.4	28.48	44	5	14	1
Carter's Empress ...	3rd	14th	11	28.5	55	11.6	68	30	15.7	102	11.8	129	7.70	2.00	65.4	53.2	75.9	71.0	59.9	34.23	55	5	15	3
Carter's Telegraph ...	3rd	14th	11	25.5	55	11.6	68	26	8.7	97	8.7	95	3.00	3.00	65.3	53.2	73.9	70.7	59.9	28.21	41	5	14	1
Ne Plus Ultra ...	3rd	12th	9	3.6	61	5.7	94	39	15.7	102	15.8	133	5.80	5.00	65.5	53.2	77.4	71.1	59.9	34.39	56	8	20	2
Tall Sugar ...	3rd	12th	9	28.5	55	5.7	94	20	15.7	102	15.8	133	5.00	5.00	65.5	53.2	77.4	71.1	59.9	34.39	56	7	15	3
Emperor of the Marrows ...	3rd	12th	9	6.6	64	1.7	91	20	15.7	102	15.8	133	15.90	2.26	65.5	53.2	77.4	71.1	59.9	34.39	56	8	19	3
British Queen ...	3rd	12th	9	6.6	64	1.7	91	24	15.7	102	15.8	133	10.00	2.24	65.5	53.2	77.4	71.1	59.9	34.39	56	8	21	3
Carter's Elephant ...	3rd	12th	9	3.6	61	1.7	91	27	15.7	102	15.8	133	13.00	2.61	65.5	53.2	77.4	71.1	59.9	34.39	56	8	20	3
Marvel	4th	12th	8	28.5	54	9.6	66	12	30.6	87	15.7	102	5.00	3.00	65.2	53.2	73.9	70.1	60.4	28.48	44	4	16	2
Sharpe's Invincible ...	4th	12th	8	28.5	54	11.6	68	18	30.6	87	15.7	102	2.00	3.00	65.2	53.2	73.9	70.1	60.4	28.48	44	4	14	3
Advancer ...	4th	12th	8	20.5	46	3.6	60	13	17.6	74	2.7	89	3.00	3.00	64.8	53.2	73.9	69.8	59.9	28.21	41	3	15	3
Princess Royal ...	4th	12th	8	28.5	54	9.6	66	20	28.6	85	8.7	95	4.40	3.25	65.3	53.2	73.9	70.7	59.9	28.21	41	5	14	4

Note.—Abundance is still the best, the very tall Peas getting battered by wind, and the short Peas are not able to withstand the heavy rains. W. C.

Names of Peas	Date of Sowing.	First appearance above ground.	Days from Planting.	Date of First Bloom.	Days from Planting.	Pods of edible size.	Days from Planting.	Days fit for Table use.	First Seeds ripe.	Days from Planting.	Last Seeds ripe.	Days from Planting.	Number of Pods per Plant average.	Number of Peas per pod.	Mean average Temperature.	Minimum Temperature.	Maximum Temperature.	Average Maximum.	Average Minimum.	Rainfall.	Number of Days on which Rain fell	Height in feet.	Time of Cooking in Minutes.	Quality.
Carter's Little Wonder ...	18th day of May.	Failure. Did not flower.																						
Pride of the Market (Carters) ..		Failure. do.																						
Carter's First Crop or Ringleader...		24.5	6	16.6	29	12.7	55	14	10.8	84	30.8	104	4.8	2.45	65.6	56.2	77.4	71.3	59.9	21.91	39	3	15	2
" Anticipation ...		Failure. Produced a few weak flowers which did not set																						
" Blue Express ...		24.5	6	18.6	31	2.7	45	10	18.7	61	4.8	78	5.2	2.90	65.2	56.2	75.4	71.4	59.1	19.25	31	3	30	bad.
" Wonder of the World ...		25.5	7	20.6	33	2.7	45	10	22.7	65	11.8	85	2.5	2.00	65.2	56.2	75.4	71.4	59.1	19.41	35	3	20	4
" Stratagem .		24.5	6	14.7	57	31.7	76	20	17.8	91	1.9	106	4.00	3.00	65.6	56.2	77.4	71.3	59.9	21.91	39	3	15	2
" Balmoral Castle ...		25.5	7	29.6	42	18.7	61	20	7.8	81	1.9	106	5.0	5.26	65.6	56.2	77.4	71.3	59.9	21.91	39	3	15	2
" Dignity ...		Failure. Not one seed grew.																						
" Empress ...		do. Produced no flowers.																						
" Telegraph ...		do. do.																						
" Progress ...		25.5	7	10.7	53	1.8	75	30	13.8	87	15.9	120	4.0	3.0	65.7	56.2	77.4	71.5	59.9	27.09	48	4	...	...
" G. F. Wilson ..		25.5	7	25.6	38	10.7	53	18	7.8	81	1.9	106	4.0	3.0	65.6	56.2	77.4	71.3	59.9	21.91	39	5	15	4
" Telephone ...		25.5	7	30.6	43	20.7	63	26	7.8	81	27.8	101	4.0	5.16	65.6	56.2	77.4	71.3	59.9	21.91	39	5	15	1
Sturdy ...		Failure. Produced no flowers.																						
Duke of Albany ...		25.5	7	28.6	41	18.7	61	20	7.8	81	15.8	89	3.6	2.20	65.6	56.2	75.4	71.3	59.9	20.26	36	4	14	1
Tall Sugar ...		26.5	8	17.7	60	31.7	74	24	1.9	108	24.9	129	8.0	3.00	65.6	56.2	77.4	71.3	59.9	32.79	53	8	14	3
British Queen ...		25.5	7	20.7	63	7.8	81	14	7.9	114	24.9	129	9.0	2.0	65.6	56.2	77.4	71.3	59.9	32.79	53	8	...	...
James Prolific ...		Failure. Produced a few weak flowers which did not set.																						
Omega ...		25.5	7	20.6	33	24.7	67	16	2.8	76	15.9	120	2.5	2.00	65.7	56.2	77.4	71.5	59.9	27.09	48	3	15	2
Marvel ...		25.5	7	29.6	42	24.7	67	20	3.8	77	18.8	92	5.0	2.40	65.6	56.2	74.4	71.3	59.9	21.66	38	4	15	1
American Wonder or Emerald ...		Failure. Produced no flowers.																						
William the First ...		24.5	6	14.6	27	30.6	43	30	14.7	57	14.8	88	6.2	2.71	65.6	56.2	74.4	71.3	59.9	19.41	35	4	15	3
Bishop's Long Pod'd ...		Failure. No flowers.																						
Princess Royal ...		25.5	7	24.6	37	24.7	67	20	7.8	81	30.8	104	8.00	3.00	65.6	56.2	77.4	71.3	59.9	21.91	39	4	16	4
Kentish Invicta ...		24.5	6	14.6	27	14.7	57	20	2.8	76	30.8	104	14.4	3.00	65.6	56.2	77.4	71.3	59.9	21.91	39	4	25	6
Emperor of the Marrows ...		26.5	8	20.7	63	7.8	81	20	8.9	113	24.9	129	4.0	3.00	65.6	56.2	77.4	71.3	59.9	32.79	53	8	...	...
Ne Plus Ultra ...		25.5	7	16.7	59	1.8	75	26	8.9	113	24.9	129	10.5	3.15	65.6	56.2	77.4	71.3	59.9	32.79	53	8	...	...
Laxton's Prolific ..		25.5	7	26.6	39	22.7	65	20	7.8	81	7.9	112	6.7	4.30	65.7	56.2	77.4	71.5	59.9	24.74	42	4	...	...
Champion of England ...		26.5	8	8.7	51	1.8	75	20	7.8	81	7.9	112	6.2	3.30	65.7	56.2	77.4	71.5	59.9	24.74	42	5	..	...
Sugar Dwarf ...		A failure.																						
Hundredfold or Cook's Favourite...		25.5	7	28.6	41	8.7	51	21	7.8	81	17.8	91	4.0	4.0	65.6	56.2	74.4	71.3	59.9	21.66	38	4	...	...
Dickson's Favourite ...		25.5	6	30.6	43	14.7	57	20	7.8	81	20.8	94	3.0	4.50	65.6	56.2	74.4	71.3	59.9	21.66	38	4	...	...
Laxton's Fillbasket ...		25.5	7	1.7	44	13.7	56	18	7.8	81	17.8	91	4.0	4.0	65.6	56.2	74.4	71.3	59.9	21.66	38	4	16	5
Laxton's Alpha ...		25.5	7	16.6	29	30.6	43	30	2.8	76	17.8	91	4.0	1.0	65.6	56.2	74.4	71.3	59.9	21.66	38	4	12	1
McLean's Blue Peter ...		Failure. Did not flower.																						
McLean's Little Gem ...		do. do.																						
Laxton's Supreme ...		25.5	7	22.6	35	10.7	53	14	7.8	81	24.8	98	12.9	3.0	65.6	56.2	77.4	71.3	59.9	21.76	38	4	15	1
Abundance ...		25.5	7	24.6	37	8.7	51	28	7.8	81	7.9	112	16.3	4.25	65.7	56.2	77.4	71.5	59.9	24.74	42	3	14	1
Advancer ..		24.5	6	28.6	41	4.7	47	26	24.7	67	7.8	81	4.0	4.0	65.2	56.2	75.4	71.4	59.1	19.25	31	3	28	4
Early Sunrise ...		Failure. Did not flower.																						
Sharpe's Invincible .		do. do.																						

NOTE.—Abundance is still far and away the best pea, the qualities noted in the first crop still holding good.—W. C.

NAMES OF PEAS.

McLean's Blue Peter.
American Wonder
Bishop's Long Pod'd
Carter's Pride of the Market
Abundance
McLean's Little Gem
Carter's Stratagem
Carter's Little Wonder
Kentish Invicta
Omega
Carter's First Crop or Ringleader
Advancer
Carter's Anticipation
Carter's Blue Express
Carter's Wonder of the World
Carter's Balmoral Castle
Sharpe's Invincible
Early Sunrise
Sturdy
Laxton's Alpha
Laxton's Fillbasket
Princess Royal
William the First
Laxton's Supreme
Sugar Dwarf
Hundredfold or Cook's Favourite
Dickson's Favourite
Carter's G. F. Wilson
James's Prolific
Carter's Dignity
Duke of Albany
Telegraph, (Carter's)
Telephone, (Carter's)
Carter's Progress
Carter's Empress
Marvel
Champion of England
Laxton's Prolific
Emperor of the Marrows
Tall Sugar
Ne Plus Ultra
Carter's Elephant
British Queen

Sown on the 26th day of June, 1891.

Germinated freely in from 7 to 9 days.

July was a hot dry windy month. On the 20th, 21st, 22nd and 22rd especially very high winds prevailed, while the rainfall for the month was only 4.32, and the good done by the rain was entirely neutralized by the drying effects of the wind.

August also was very dry, 2.69 of rain only falling during the month, and as this crop had been doing very badly during July, this destroyed all hopes of a crop, the largest yield per 100 plants being 0.12 pods. This crop is best described as a total failure.

The mean average Temperature for the months of July and August was 66.6 Fah.

No peas were sown during the months of July, August and September.

W. C.

No. 26. December 1891.

BULLETIN

OF THE

BOTANICAL DEPARTMENT,

JAMAICA.

CONTENTS:

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JAMAICA:
GOVERNMENT PRINTING ESTABLISHMENT, 79 DUKE STREET, KINGSTON
1891.

FERNS: SYNOPTICAL LIST—VII.

Synoptical List, with descriptions, of the Ferns and Fern-Allies of Jamaica, by G. S. Jenman, Superintendent, Botanical Gardens, Demerara (continued.)

Genus IX. *Cyathea.*—Sori hive-shaped, or subglobose, on the back of the veins; receptacles elevated and comical, generally setiferous, often c eft in two; sporangia copious, densely aggregated, obvate-cuneate; involucres of two forms: first, dimidiate, circumsessile and bowl-shaped, remaining entire after maturity; second hemispherical, or entirely enveloping the sori at first, very thin, becoming at length much ruptured and broken down into irregular parts; trunk usually tree-like; fronds as a rule ample; veins free.

The larger number of the tree-ferns of Jamaica belong to this genus, which is conspicuously represented in all situations from the lowest to the highest altitudes, as a rule preferring the moist and especially the cool, avoiding the dry and arid regions. The form of the involucre, which is like a sphere cut transversely with even edge, or, in the other case, whole or broken down irregularly, divides the genus nearly equally.

a. Involucres cup or bowl-shaped, with even margin permanently entire.

b. Fronds bipinnate only.

1. *C. Nockii*, Jenm.
2. *C. pubescens*, Mett.

bb. Fronds tripinnatifid.

3. *C. jamaicensis*, Jenm.
4. *C. arborea*, Smith.
5. *C. elegans*, Heward.
6. *C. nigrescencs*, Jenm.
7. *C. concinna*, Jenm.
8. *C. Tussacii*, Des.

aa. Involucres hemispherical—that is completely enveloping the sori at first, subsequently broken down irregularly; very fragile.

b. Fronds tripinnatifid.

9. *C. insignis*, Eat.
10. *C. gracilis*, Griseb.
11. *C. dissoluta*, Baker.
12. *C. Schanschin*, Mart.
13. *C. furfuracea*, Baker.
14. *C. monstrablia*, Jenm.

bb. Cutting uncertain.

15. *C. conquisita*, Jenm.
16. *C. pendula*, Jenm

1. *C. Nockii*, Jenm.—Stem less than 2 in. thick, only a few inches l. procumbent and rooting from the under side, corrugated; stipites tufted, few or several, erect, not prickly, rusty-tomentose beneath, above clothed with dark brown scales, the dwindling pinnæ reaching to the base; fronds erect, spreading, plume-like, 2-4 ft. l. 5-10 in w. subcoriaceous, dark green glossy, the under pale; rachis subangular, channelled, rusty-puberulous, and fibrillose with small whitish grey linear scales which extend to the costæ; pinnæ spreading, 1-2 in. apart from rib to rib, sessile, fully pinnate, 3-6 in. l. $\frac{3}{4}$-$1\frac{1}{4}$ in. w. serrate-acuminate; segments slightly apart, $\frac{1}{2}$-$\frac{3}{4}$ in. l. $1\frac{1}{2}$-2 (or the basal 3) li. w. curved, the obliquely acute, and rather mucronate, apex serrate, the inner ones more or less rounded and free at the base, the basal pair largest and lobed or pinnatifid, the outer adnate; veins generally once forked from the base; sori inserted at the forking, close along the mid-rib, not reaching the apex; involucres cup-shaped rather pruinose, the margin often compressed; receptacles setiferous.

Common on a limited area of the disintegrated acclivous forest slopes near Vinegar Hill, a short way below the Government Cinchona Plantations, 4,000–5,000 ft. alt., and less abundant just below Belle Vue, the site of the official residences, where Nock and I first found it in 1874-75. A singular species, distinguished locally by the caudex not being arborescent; and the small size of the fronds. The vestiture resembles somewhat that of *C. Tussacii*, but is much less dense. In the largest fronds the dwindling pinnæ at the base become abortive, passing into linear filiform glands. Where exposed to the sun the fronds are not more than 2 ft. l., very coriaceous, the edges of the segments reflexed. The habit is that of a large *Nephrodium.* There is a frond in the Kew Herb., gathered by Wilson, the locality not marked.

2 *C. pubescens*, Mett.—Stem stout, reaching many ft. high, densely tesselated above, rather prickly; stipites stout and sharply armed, clothed with narrow chesnut scales, the reduced pinnæ reaching nearly or quite to the base; fronds erect or erect-spreading, 6-8 ft. l. $1\frac{1}{2}$-$2\frac{1}{2}$ft. w. base tapering apex rather acute than acuminate, very coriaceous, upper side crinkly, dull dark green, underneath pale and rather glaucous; rachis and costæ dark brown, rusty-puberulous beneath, coated above with rusty adpressed tomentum; pinnæ very numerous, close, horizontal, $\frac{3}{4}$-$1\frac{1}{4}$ ft. l. $1\frac{1}{2}$-$1\frac{3}{4}$ in. w. serrate-acuminate, quite sessile, fully pinnate at the base only, but above this pinnatifid almost as deeply;

segments ¾ in. l. ⅛ in w. close, subfalcate, all but the inferior adnate, bluntish or acute, the margin crenate-serrate and subreflexed, ribs beneath fibrillous; veins evident, once forked from near the base, close; sori situated below the forking, small forming a continuous row close against the mid-rib reaching half or two-thirds up the segment; involucres cup-shaped, dark brown; receptacles setiferous.

Very generally abundant in forests of the slopes of the highest ridges and peaks of the main mountain ranges in the eastern parishes, A particularly fine plant, of a quite remote alliance as regards habit, and one of the two or three tallest Jamaica tree ferns, attaining a height of 40 ft. or more the shuttle cock-like dark head very often pushed through, and held clear above, the crown of the forest. The trunk is really about 6 or 8 in. in diameter, but occasionally becomes very stout (as much as one's extended arms can embrace) in the lower half or third by the abundant emission of aerial rootlets, which form a matted coating, clothed in turn, ten or fifteen feet from the ground upwards, with *Trichomanes trichoideum,* the glistening sheen of which seen through the dripping moisture is one of the most beautiful features of the forest of this high range.

3. *C. jamaicensis,* Jenm. -Stem tall reaching 12-14 feet high, smooth and naked below, scaly at the top; fronds ample. several ft. l. 1½-2ft. w. acuminate, tapering below, the reduced pinnæ extending to the base of the stipites, tripinnatifid, firm, naked but with a few minute scales on the costulœ and ribs beneath, the costæ pubescent above, puberulous beneath, rachis and costæ a light wood-brown; pinnæ spreading, sessile, acuminate, ⅔-1 ft. l. 2-2½ in. w. approximate; pinnulæ sessile, 1-1½ in. l. ¼- hardly ½ in. w. deeply pinnatifid, serate-entire at the apex; lobes varying from deltoid to oblong, about 1 li. w. 1-2 li. l. from the midrib to the blunt or subacute point; veins simple or the basal once-forked, 3-5 to a side; sori close to the castulæ, situated at the base of the veins, one or two to each lobe; involucres thin, dark brown, small and shallow with the receptacles exserted above the entire rim.

Wilson n. 686 in the Brit. Mus. Herb., John Smith's collection, gathered at Mansfield near Bath. It comes nearest the Cuban *C. balan ocarpa,* Eaton, which has not so far been found in Jamaica, from which it differs by the pinnatifid pinnæ less vestiture of leaf surfaces, and shallow saucer-like (rather than bowl-like) involucres, as in *C. arborea.* According to Wilson's note, the fronds are very long, with no clear petiole, or hardly any, the pinnæ dwindling to the base; and judging by the rachis, which is smooth and glabrous, they are probably nearly or quite unarmed. It may possibly present in the most developed state broader pinnulæ than Wilson's specimen shows.

4. *C. arborea,* Smith.—Stem reaching 30 ft. high, stout, the surface even and tesselated, clothed above with a dense coating of linear inch-long chaff-like scales; stipites articulate leaving a clear even-faced scar 1-1½ ft. l. scabrous with small warts but destitute of prickles; densely clothed with lanceolate pale chaff-coloured scales; fronds 6-8 ft. l. 3-4 ft. l. w. tripinnate, chartaceons, pale green, naked or with a few scattered minute deciduous whitish scales on the ribs beneath, costæ and costulæ slightly ciliate above, rachis stramineous or occasionally brown; pinnœ spreading, rather snddenly acuminated, 1½-2 ft. l. 7-10 in. w. approximate in the outer pa:t and sessile or subsessile, the lower more distant, the petioles gradually lengthening to 1-2 in. in the lowest reduced ones; pinnulæ close, all but the inferior sessile, 4 to 6 in. l. ¾-1 in. w. fully pinnate at the base, above this pinnatifid almost to the costæ, the point finely attenuated and serrate; segments about ½ in. l. 1-1½ li. w obtuse or acute, subfalcate, serrate throughout but more deeply along the sides, connected at the base, otherwise open between; veins once forked, pellucid; sori close to the rib, situated at the forking, ascending about two-thirds of both pinnules and segments: involucres brown, membranous, shallow and saucerlike, with the scaly setiferous, usually cleft, receptacle protruding .—*Filix arborescens.* Plum. Fil. t. 1 and 2 *Polypodium arboreum,* Linn. *C. Serra,* Willd. Hook Sp.Fil.vol. 1 t. ix.

Abounding in great profusion among the lower hills, and ascending to about 2,500 ft. alt; gregarious, often covering acres on fully exposed slopes, everywhere shunning shade. A most beautiful plant, forming a conspicuous and delightful feature of the hill and wayside vegetation. The name was adopted from Plumier, whose figures, cited above, though somewhat artificial and exaggerated, no one acquainted with the plant in its wild state could for a moment mistake. But while these figures have been uniformly quoted by authors, the name has been long misapplied to other species. It is however so entirely appropriate in its original application—the plants forming unmixed groves, while the stems constitute the only wood used, or easily procurable, in certain districts as posts in the houses of the peasantry, no other species being applied to any such purpose—that it would be a pity not to restore it. "From these Trees growing on the mountains of Hispaniola, the Spaniards argued the fertility of that soil: making ferns grow to such a vast bigness, which in Europe were so inconsiderable."—*Sloane.*

5. *C. elegans,* Heward.—Stem several feet high, 3-4 in. thick, often prickly, the scars rough with protruding fibres; stipites 1-2 ft. l. dark brown, puberulous or scurfy, prickles scant and variable in size, scales scant, subulate, dark brown, confined to the inner side of the base; fronds ample, tripinnate, chartaceous or coriaceous, dark green, rachis and costæ puberulous beneath, costulæ and ribs slightly scaly there, and with the costæ rusty-tomentose above, all bright or dull brown, other parts naked; pinnæ approximate, 1½-2¼ ft. l. 5-9 in. w. lower shortly petiolate; pinnulœ approximate, sessile, serrate-acuminate, 3-4½ in. l. ½-1 in. w. fully pinnate at the base, above this almost as deeply pinnatifid; segments close, subfalcate, bluntish or acute, crenate-serrate, ¼-½ in. l. 1-2 li. w. veins once or twice forked; sori attached close to the forking, against the midrib, ascending from the base two-thirds upwards; involucres deep, chestnut, thin.—Sloane's Hist. p. 95. t. 56. Herb. pp. 133. 134 *Polypodium speciosum* Linn. *C. Grevilliana,* Mart., *C. arborea* var *pallida,* Hook.

Common in forests among the lower hills, and ascending to 4,000 ft. alt. where it appears on banks and waysides exposed to the sun, and is sometimes in such open situations slightly contracted in the segments. This and *arborea* are the two lowland tree-ferns, and as the latter avoides shade, so this avoides exposure, creeping out however in the cool higher regions where the sun is less intense. The fronds in young plants are more or less persistent, and, in sheltered situations, often hang pendent, densly littering the trunk, till in course of time they decay and fall away. The rachis is asperous or prickly at the base, and there are usually a pair of abortive pinnæ near the base of the stipites, distant from the lowest normal pair.

6. *C. nigrescens*, Jenm.—Stem erect, several feet high, 3-4 in. thick, prickly, the scars rough with decaying fibres ; stipites spreading, strong 1-1½ ft. l. very prickly, dark, scurfy and somewhat scaly ; fronds spreading ; about 6 ft. l. 3-4 ft. w. tripinnate, coriaceous and stiff, rigid when dry, dark green above, pale or glaucous beneath, costa and costulæ rusty-tomentose above, and, with the ribs naked or puberulous beneath, other surfaces naked ; rachis very dark chestnut, or blackish, glossy but puberulous ; pinnæ approximate, 1½-2 ft. l. 6-8 in. w. stipitate or sessile, serrate-acuminate ; pinnulæ approximate, sessile or the inferior shortly stipitate, the apex shortly acuminate and serrate-entire, 2½-4 in. l. ½-¾ in. w. fully pinnate at the base, almost as deeply pinnatifid above this ; segments close or the inferior open, sightly curved or not, obtuse or acute, ¼-½ in. l or nearly so, 1½-2 li. w. the edge even and reflexed when dry ; veins once forked from the base ; sori at the forking, against the midrib confined to the base or ascending half or two-thirds up the segment ; involucres deep, pale or dark coloured, entire —*C. arborea* var. *nigrescens*, Hook. *C. arborea*, Sm. in part.

Frequent and widely scattered in both wooded and open situations from 2,500 or 3,000 ft. to 6,000 ft. alt. extending to the central and western parishes ; common where found but not so abundant anywhere in numbers as some of the other species. The dead fronds generally hang about the trunk, from which they part slowly, leaving a rough surface. Its different colour—varying, however, in the vascular parts from dark brown to nearly black—rigid texture when dry, entire, even-edged segments and greater prickliness—the spines being particularly sharp—distinguish it from *elegans*, its nearest ally, with which, as a variety of "*arborea*," it has hitherto been associated.

7. *C. concinna*, Jenm.—Stem very stout, rough-surfaced, reaching 15 ft. high ; stipites stout, armed, puberulous-furfuraceous, and sparsely clothed with dark scales at the base ; fronds ample, spreading, bi-tripinnatifid, sub-coriaceous, dark green above, pale or glaucesent beneath ; rachis, costæ and costulæ light or dark brown, pubescent above, beneath puberulous, costulæ and ribs slightly ciliate beneath and sprinkled with minute pale deciduous bullate scales ; pinnæ alternate, 1¼-1½ ft. l. 2½-3½ in. w. sessile, acuminate ; pinnulæ quite sessile, 1½-2 in. l. 2-4 li. w. with an entire or serrulate acuminate point, lobed or pinnatifid within ½-¾ to the costules, or the fertile contracted and lobate entire in the inner half or third immediately above the base which is usually normal ; segments oblong or deltoid-oblong, acute, even-edged, about 1 li. w. 1½-2 li. l. from the base, the contracted ones rounded a li. or less each way, the edge often incurved over the sori ; veins simple ; sori forming usually a single row on each side of the costules ; involucres cupshaped, delicate, entire. *C. arborea* var. *concinna*, Baker. *Journ. Bot.* 1881. 52.

Common in forests, of the higher ranges between 5,000-7,000 ft. alt. gathered on the slopes of St. Catherine's peak, and below New Haven Gap, where it prevails in great abundance, and elsewhere in the Blue Mountain range. Though the pinnæ and pinnulæ are of the same relatively reduced size, the characteristic contraction of the final segments is not constant if it occurs at all, in the sterile fronds. It differs from the two preceding by the much stouter and taller trunk, much narrower pinnæ and pinnulæ, the latter often contracted and irregularly lobed, and the simple veins, only the basal of which in each segment are fertile. Like *Tussacii*, in the resting season, in late spring or toward midsummer, it sometimes drops all its fronds, the large stout trunk, a uniform diameter from top to bottom, standing, post-like, till growth begins again. Mr. Baker has lately in the *Annals* of *Botany* referred this to *Jamaicensis*, but my memory and descriptive notes of it lead me to think it distinct.

DRIED BANANAS AND PLANTAIN MEAL.

The following paragraphs, taken from a Report of Mr. W. C. Meaden on the working of the Convict Farm in Trinidad, may be useful to those who are thinking of trying this industry in Jamaica. Small bunches can be utilised in this way instead of going to waste.

Dried Bananas.

"Drying bananas in the open air proved a failure owing to dust, insects, &c.

This however has been remedied by the Hot Air Fruit Drier, properly known as the "Etna Pneumatic Drier," and I am happy to report in favor of the good work done by the machine. . .

The fruit can be dried within 24 hours at a temperature from 130° to 160° ; higher than this the fruit hardens. The drying is done here in the day time and the fire put out at night ; any kind of fuel answers for firing, from patent fuel to cocoa wood chips. The fruit should be as large as possible, and quite ripe, the skin to be removed and the fruit then lightly scraped. Whilst in the drier the fruit to be turned twice or three times carefully to ensure an even drying. . .

Drying the bananas opens up a way of utilizing the fruit that no other means offers. It overcomes the difficulty of bad roads, remote districts and other drawbacks the planter has to face in getting his banana to market. It also does away with the risk of handling and of the sea voyage.

Dealing with the first item of the account sales, below, *i.e.*, 97 boxes. This number represents the result of drying 6 bunches, weighing an average of 62 lbs. for ripe bunch. A loss of one-third takes place in the peeling and drying process. The 97 boxes contained one pound of dried fruit each, and sold for $19.40 at 20 cents per lb. box, or, after deducting freight charges, $15.47 a fraction under 16 cents per lb.

A bunch weighing 52 lbs. less one-third in drying = 17 lbs. dried fruits and sold for 16 cents per lb. This is at the rate of $2.72 per bunch. A further charge of 53 cents must be considered in producing the bunch. This would cover purchase of land, clearing woods, draining, planting, weeding, cutting, drying, fuel, boxes and packing. I have not included cost of dryer as that would be but a fraction on each bunch dried. Now after deducting the above we have a clear profit for the grower of 2.19. . . .

An order is now on hand for 2 cwt. for London at 6d. per lb. in bulk, the consignee doing the retail packing and advertising. As the fruit is something new it is being sought after, and all that can be dried is being profitably disposed of. I may add that the fruit drier does its work well, turning out the fruit in a uniform color. Attention must be paid to this, and also that fruit is nearly as possible one size only be dried, as this facilitates packing. Small ones can be used for stock, &c.; twelve good sized fruit weigh one pound.

Account sales of dried bananas ex s.s. *Portia* sold on account and risk of Gordon Grant & Co., Trinidad:—

97 Boxes dried bananas at 20 cents	$19.40	
1 Box do. do. at auction	1.30	20.70
Charges—		
Duty $1.45, freight per B. Lading	$ 3.80	
Advertising—Auctioneer's Commission 5 per cent.	0.06	3.86
Net proceeds		$16.84
Less cost P. O. Order		21
		$16.63

E. & O. E.

Geo. Robinson & Co.

St. John, N.B.,
24th January, 1891.

Plantain Meal.

"Last Mail a sample of 7 lbs. of meal, prepared from the Moko Plantain, was forwarded to London, and for which the correspondent offered sixpence per lb. Receipts were also supplied for preparation in cooking. Great attention has been drawn to banana meal by the observations made by Mr. H. M. Stanley in his book 'Darkest Africa,'' and which, as an advertisement, should not be lost sight of. No banana gives such an excellent meal as the 'Moko,' or so agreeable in flavour and taste. The preparation of the meal is as follows:—The green Moko was skinned, sliced thin* and dried in the fruit drier; then ground fine in an ordinary corn mill, and afterwards sifted through a muslin sieve: this latter removes any fibre and leaves a delicate fine meal. The slices dry in two hours. A 15 lb. bunch will yield 3 lbs. of prepared meal which at 6d. per lb. is 1s. 6d. per bunch. Two women could prepare 56 lbs. of meal per day. The cost of production, packing, &c., has to be considered, but the price obtained must be considered a satisfactory one; at least it is better than that now obtained, which may be said to be nil."

GINGER.

Ginger is the dried root-stock of *Zingiber officinale,* a plant with leafy stems, 3 or 4 feet high, distinct flowering stems 6 to 12 inches high with small, yellow and purple flowers in a cone-like head.

Soil.—A well-drained clayey loam is suited to this plant.

Cultivation.—The land should be well dug and cleared of weeds. Small pieces or protuberances of the root 1 or 2 inches long are planted during March or April, 4 inches deep and 9 to 12 inches apart. It is well to cover the land with a moulding of dead leaves, weeds, straw, or litter, mixed with manure. In a few months the whole ground will be covered. The flowers appear in September.

Harvesting.—When the stalks wither in the following January or February, it is time to dig up the roots. When the tubers have become mature, and have put forth stems, they are fibrous; but before this takes place, while they are still succulent, and the young stalks are not more than 5 or 6 inches long, they should be taken up for preserving.

Ginger is an exhausting crop on the soil, and should not be planted in the same ground two consecutive years.

Preparation for Market.—"Black Ginger" of commerce is prepared by washing the root in water, boiling for a quarter of an hour, and then drying in the sun. "White Ginger," a much superior article, is prepared from the best and soundest roots, by scraping off the outer dark-coloured part, and then carefully drying without boiling. "Preserved Ginger" is made from the young tubers, which are scalded, washed in cold water, and then peeled. The roots are then covered with a weak syrup, and left for two days. The syrup is then poured off, and replaced by a stronger syrup, and this is repeated two or three times, until the syrup is thick, and the ginger bright and nearly transparent.

Yield.—The yield per acre is said to be 4,000 lbs. and upwards.

Ginger Preserve.

The following has been kindly contributed by a Correspondent who has been most successful in the making of preserved ginger:—

"The price charged for all Jamaica preserves is excessive and defeats its own ends. For instance this ginger, say 1s. for the young ginger to make 12 lbs., 1s. for the first syrup, and for 2nd, allowing 6d. per lb. for lump preserve sugar, the cost of this being 19s. 9d. per cwt. in England, 6d. for the

* N. B.—The slicing should *not* be done with a steel knife.—W.F.

last syrup. In fact 6d. per lb. would more than cover cost of production apart from labour, and the labour is certainly not greater than that bestowed on most English preserves sold at from 4d. to 6d. per lb. The usual statement as to the cost of the manufacture of ginger is as follows :—

It takes 3 lbs. of lump sugar at 9d. per lb. to make one lb. of ginger.

Ginger has to be so much pared away that 1s. worth makes only a few lbs.

The labour is very great and the profit very small.

All these are, I maintain, false statements and have stood in the way of anything like a large and remunerative trade in Jamaica preserves being established. Fortnum and Mason give it as their opinion that the bar to such a trade is that Jamaica preserve cannot be sold in London in 1s. glass jars, the British public will buy a small jar of any foreign delicacy at 1s. when they would refuse a larger one at 1s. 6d. This seems to me a hint worth taking. We ought to popularize our beautiful and delicious preserves by selling them at a small profit which experience has proved again and again results in a much larger gain in the long run. For instance, can any Jamaican assert that guava jelly costs more to make than the best strawberry jam which is sold in highly ornamental glass jars at 6d. per lb. any where in England. The guavas grow wild here and can be had in profusion for the picking. Jamaican vacuum pan sugar makes the jelly in perfection and can be bought by the barrel at about 2½ per lb., if I am not mistaken, and having made both strawberry jam and guava jelly myself, I can confidently assert that the latter is not half the trouble of the former. My sole object in writing this is that I believe Jamaica is throwing away a large and lucrative trade which might be hers if she would remember her own wise saw "*Greedy choke puppy.*"

Ginger.—Pour boiling water on your ginger and let it steep for a day and a night, then peel and pare away all discoloured and hard parts. Boil a syrup of 1 lb. lump sugar to 6 pints water (this is for 12 lbs. ginger.) Put your ginger into a stone jar and pour the thin *boiling* syrup on it, let this stand for a week or ten days, then draw off the syrup and throw another exactly the same as the last again *boiling* over your ginger, let this stand for another week, then throw off the second syrup and drain the ginger well on a hair sieve, return it to the jar and pour over it the final syrup made as follows :— 12 lbs. loaf sugar to 12 pints boiling water. Stir till the sugar is dissolved for fear it should settle and burn, then boil till it is as thick as good honey, and drops slowly from a silver spoon ; now pour boiling water over the ginger and let it stand till cold when you can put it into the bottles or jars in which it is to remain. Put in the pieces of ginger first as close as they will pack, then fill right up to the cork to leave no room for air. The corks should be new and good, not old ones that have been pierced by cork screws.

PHASMIDÆ OR STICK INSECTS.

On October 2nd, I received from Mr. W. Fawcett a few specimens of a species of stick insect ; and on October 15, Mr. Robert Sidgwick sent me many of the same. All these were collected at Chestervale, where they occurred abundantly on a hedge of *Tecoma capensis*, Lindl. These insects are dark brown, with rudimentary wing-cases, but well-developed wings. With the first lot came a single individual of the female of *Haplopus jamaicensis* (Drury) Westw., which is much larger, being over five inches long, yellowish in colour, and with the wings quite rudimentary Without careful examination, it seemed likely that the many smaller specimens referred to were the male of the *Haplopus*, as that is winged, and only about the same size as the largest of them. But on coming to look more carefully at these insects, it became evident that they could not be male *Haplopus*, from their much stouter thorax, unarmed femora, and various other characters. They also varied in size among themselves, and although all winged, could easily be divided into two lots, one of individuals about two-and-a-half inches long, the other of little ones, little more than an inch and a half long. On dissecting one of the larger ones, I found numerous eggs, thus proving that it was the female, and the little sort the male, of a single species, quite different from any *Haplopus*.

Turning now to the known genera of *Phasmidæ*, we find our species belongs to the genus *Necroscia*, species *N. cyllarus*, Westw. To recapitulate the characters noticed ; *Necroscia** has both sexes winged, and the thighs smooth ; *Haplopus* has the male fully winged, but the female with only rudiments of those organs, and the thighs are slightly spiny ; while finally some other genera, as *Diapheromera*, have both sexes wingless.

The stick-insects cannot well be mistaken for any others : their stick-like shape and long slender legs distinguish them at a glance. The *Mantidæ*, represented by the Praying Mantis, are allied to them and very similar in shape, but at once known by the curious form of the first pair of legs.

Stick-insects are not as a rule very destructive, but occasionally they occur in immense numbers, and do damage by defoliating the trees or bushes on which they feed. In the United States, *Diapheromera femorata*, Say, has proved harmful in this way ; and now we have the case of the Jamaica *Necroscia*.

As to remedies, the insect may be destroyed at various stages of its growth. Dr. C. V. Riley says :—"While the insects are young, they may be destroyed by sprinkling the underbrush in the timber with Paris-green water, whenever the timber is inclosed so that domestic animals can be kept away from the poisoned vegetation." Paris-green may be applied in the proportion of one pound to 100 gallons of water, for the most tender plants ; ranging to one pound to 50 gallons, for those that are less liable to be injured. There are various well-known machines for spraying the liquid on the plant : Dr. C. V. Riley remarks : "A thoroughly atomised weak mixture will, under favourable conditions, prove as efficient as the stronger ones ; but in wet, showery weather weak applications are more liable to be washed off."

* I am indebted to Prof. L. Bruner and Dr. C. V. Riley for the identification of our species as *N. cyllarus* : I had laced it as a *Phasma*, (sens. lat.) It should be mentioned, however, that Mr. W. F. Kirby of the British Museum, to whom I also sent specimens, regards it as a possibly new species allied to the Cuban *Anophelepis Poeyi* of Saussure.

Stick-insects, however, are said to be more easily destroyed in the egg stage. The United States *Diapheromera* drops its eggs on the ground beneath the tree, not attaching them to anything; and there can be little doubt that the Jamaica *Necroscia* does the same. Among the specimens I received from Mr. Sidgwick, was a single loose egg, which had doubtless been dropped by one of the females. The egg of our species is cylindrical with truncate ends, in colour orange, three and a third millim, (a little over ⅛ inch) long, and one and two-thirds millim., broad.

These eggs may be destroyed as suggested by Dr. Riley, "either by digging and turning them under, or by burning over the dead leaves among which they lie." In the case of trees, it might prove as effectual to encircle the trunk with a ring of pitch or any other suitable substance, so as to prevent the young larvæ (which are unable to fly) from ascending. In the case of a hedge, such as the one on which the stick-insects on the Chestervale Property were found, a good plan would be to spread a cloth under the bushes at the time when egg-laying was going on, and gather every morning the dropped eggs and burn them. This would probably be more thorough than the digging under or burning, and would also be less trouble, provided that the hedge was regular and not too extensive. Possibly if the bushes were tapped with a stick at the time of gathering-up, some of the insects themselves would fall and be secured.

T. D. A. COCKERELL.*

CINNAMON.

The Cinnamon-tree (*Cinnamomum zeylanicum*) is a native of the East Indies; it is usually of small size, having leaves with 3 to 5 strong nerves and small yellowish flowers.

The best kind of Cinnamon Bark comes from Ceylon, where it is grown near Colombo from the sea-coast up to an elevation of 1,500 feet.

Soil.—A sandy soil is generally preferred, but red and chocolate-coloured soils are also utilised when free from gravel and rock.

Cultivation.—The seedlings 3 months old are planted out 8 or 10 feet apart. After 2 or 3 years the young trees should be cut down to about 6 inches above ground; and the "garden" is treated similarly to an oak-coppice in England.

Harvesting and Curing.—From the stocks or tools, 4 or 5 shoots are allowed to grow. "These shoots usually come to perfection at the age of from eighteen months to two years, when they are beginning to turn brown on their surface from the greenish epidermis becoming replaced by the production of a corky layer of bark. Such shoots, which are commonly from 6 to 10 feet high, and from ½ to 2 inches thick, are then cut off by a long sickle-shaped knife, called a *catty*, stripped of their leaves, and trimmed with a knife, the little pieces which are removed being kept and sold as *cinnamon chips*. The peeling is then effected by cutting through the bark transversely at distances of about a foot, and by making two opposite or where the branch is thick, three or four longitudinal incisions to connect the transverse ones, and the bark is then readily removed by introducing the peeling knife termed a *mama* beneath it. The pieces of bark are then placed one within the other, and the compound sticks thus produced are bound together into bundles. These are usually left for about twenty-four hours, when the two external layers of bark are carefully removed by scraping; for which purpose each quill is placed on a piece of wood of the required thickness. In a few hours the smaller quills are introduced into the larger ones, and in this way congeries of quills are formed, which generally measure about 40 inches in length. The bark is then kept one day in the shade after which it is placed on wicker trays and dried in the sun; and finally it is made up into bundles weighing on an average about 30 lbs. each. Care is taken to fill up each pipe or congeries of quills with the same kind of bark as that which is outside, and as few joints are placed in each pipe as possible. The finest pipes are usually well filled, as the preservation of the odour and flavour is very much assisted by the exclusion of the air."—(Bentley & Trimen.)

The peeling process should be done during the wettest seasons of the year, when the bark comes off easily. The bark peeled from the middle of the shoot is considered the best kind. A second quality is the bark from the ends of the shoots, and a third from the base. It is advisable to keep these qualities separate.

ARROWROOT.

Arrowroot is the name given to the starch extracted from the tuberous roots of certain plants. In Jamaica, there are two plants used for the purpose, *Maranta arundinacea, Canna edulis,* which latter is sometimes called "Spanish Arrowroot."

Maranta belongs to the ginger family and has yellowish-white flowers. Canna is one of the plants often known as "Indian Shot," and has red flowers.

Soil.—A light loamy soil is the most favourable for these plants.

Cultivation.—The land should be ploughed or forked. Shoots are taken from the old roots, and planted, during May, in holes about 2 feet apart every way. Weeds must be kept down by hoeing.

Harvesting.—When the leaves fade, in about a year's time from planting, the roots are dry, and carefully washed.

Preparation.—The outer skin is removed, and the roots again washed. The roots are then grated, or pounded in wooden mortars, or crushed between rollers. The pulp is put into clear water, and very thoroughly mixed up by stirring. This process separates the starch grains from the fibrous portion which is removed by straining through sieves of progressive fineness. The water containing the starch grains, is allowed to settle, when the water is run off. To obtain the finest article, the washings are

* The writer will be pleased to examine any insects found injurious to plants, if sent to him at the Institute of Jamaica, Kingston; and will give any information he can about them. Full particulars of the injury complained of should always be sent with specimens.—T. D. A. C.

repeated several times, and all contamination avoided with dust, &c., or even iron in the water. The starch is dried on calico trays in the sun, and packed in cases as soon as possible. The fibrous refuse is good feeding for pigs.

Yield.—About 100 lbs. of arrowroot may be obtained from 4 barrels of cleaned roots; and from 25 to 30 barrels from the acre.

BAY RUM.

In answer to applications for information on the manufacture of Bay Rum, I received several letters, the most useful of which was from Mr. H. F. Green, Curator of the Botanical Station in Dominica, paragraphs from which are given below. It was not known, until of late years, from what plant Bay Rum was prepared, but it is now ascertained that the tree is *Pimenta acris*, one of the plants known in Jamaica as Wild Cinnamon:—

"In answer to yours of 18th September, I may inform you that "Bay Rum" is manufactured in Dominica from the dried leaves of *Pimenta acris.*

Bay Rum is procured by distillation, and this in a very simple manner. The leaves are picked from the trees and then dried; in this state they are placed in the retort—which is then filled with water—and the process of distillation is carried on.

The vapour is then condensed in the usual way, and forms what is known as "Bay Oil," a very small quantity of which is required for each puncheon of rum.

The manufacture of Bay Rum is carried on at the northern end of this island, and proves a very lucrative business to those engaged in it, as the plants are plentiful in this district.

The following is an estimate of rum, &c., required:—

1 Pun. Rum—100 gals. about 18 to 19 proof, say at 2s. per gal. ...	£10	0	0
Empty puncheon	1	0	0
$1\frac{1}{2}$ Pint bot. Bay Oil pure to a pun. of rum	0	16	8
	£11	16	8

The rum must be of the strength of 18 to 19 proof or the oil will not amalgamate properly.

NUTMEGS.

My Correspondent in Grenada, who contributed the Notes in the last Bulletin on curing Nutmegs, has kindly sent me the following:—

"In reply to your letter of the 16th November, the generally accepted idea here is, that the proportion of males and females in say 3,000 plants would be as 3 to 1, and I dare say this is about correct, taking an average. Sometimes in my own experience out of 40 or 50 trees close together all have turned out females, and in other instances the case has been reversed and every tree within an area of say 30 yds. square has proved a male.

As a rule nutmegs trees do not declare their sex before they are six to eight years old. If they are planted very close and are bushed up, they do not declare their sex till they are much older, twelve to fourteen.

Under favourable conditions of soil and aspect and when well sheltered from wind, I have known them declare their sex when only four years planted. Male trees as a rule declare their sex much earlier than females.

In answer to your enquiry whether I destroy or graft on to male trees; I am sorry to say I generally destroy all beyond what is considered necessary for purposes of fertilization, but I am quite sure if one had the right sort of man to manage a nutmeg plantation, this might be avoided, and female shoots might be grafted on to strong male stock.

Nothing is easier than the transplanting of nutmeg trees. I have transplanted about 500 this wet season, large trees with nuts on them, in some instances 15 to 20 ft. high, and so far I have lost about 15, or 3 per cent. This is too high an average of losses, but a good number met with a very hot dry period immediately after being transplanted and succumbed.

Nutmeg trees when finally planted out should be at least 25 feet apart, but in the nurseries we put them in at distances of from 4 to 6 ft. apart."

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OF THE

BOTANICAL DEPARTMENT,

JAMAICA.

CONTENTS:

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1892.

REPORT

OF THE

DIRECTOR OF PUBLIC GARDENS AND PLANTATIONS, JAMAICA.

For the Period from 1st October, 1889, to 31st March, 1891.

CONTENTS.

HILL GARDEN, CINCHONA.

Mr. Wm. Cradwick, Superintendent of Castleton Gardens, was transferred to Cinchona in August, 1889, to take charge of the Hill Garden. The Garden has been improved in various ways, careful experiments made, and I have to speak in high terms of the intelligent and painstaking manner in which Mr. Cradwick carries on the work of the Garden. I take the following mainly from his Report.

Homestead Ornamental Garden.—The large border running along the bottom was first thoroughly overhauled, all the plants being taken out, the border properly trenched to a depth of two feet, and manured with nearly 100 barrels of stable manure. A great many plants were taken away altogether as there were too many in the border, All the best plants such as the choice Roses, Abutilons, Azaleas, Chorizemas, a beautiful species of Asparagus, also some young box trees which had been quite covered up by the other plants were replanted in the border, care being taken to give each plant as much light and air as possible.

About 50 tree ferns were brought in from the vicinity of Morse's Gap and planted in the border. Out of these about 30 are growing well, some of them being very fine indeed. Those which succeed the best are the most beautiful species, and *Alsophila armata* may be specially mentioned. Annuals have been planted, not, however, with uniform success, the following especially doing well, Gaillardias, Marigolds, Tagetes, Petunias and Antirrhinums. The two latter were magnificent, the Antirrhinums being particularly fine varieties. The best perennials raised from seed were Pansies and Brompton Stocks. Some wild Begonias planted between *Alsophila pruinata* have flowered exceedingly well.

The flower beds, 15 in number, at the top of the Garden, have all been remodelled and have been twice replanted. Some Ixias and Sparaxis received from Messrs. Wm. Paul of Waltham Cross, England, and planted in the rockery, flowered well, and some bulbs of *Hyacinthus candicans* from the same firm did well, growing 5 feet high. A few Bermuda Lilies received from Mr. James of Bermuda, and planted in the garden, produced very fine flowers and are evidently very desirable plants for a Hill Garden.

New Walks.—At the bottom of the garden three new walks have been made through the forest trees; one a walk of 3 feet in width. one and a half chains in length, dug out to a depth of 9 inches and filled with rough stones, covered with fine gravel; a turnstile has been placed at the top. A new walk has also been made leading from the bottom of the garden through the forest trees to the lower entrance of the nursery and the Superintendent's house; this walk is 5 chains long 5 feet in width, piled on the lower side, also cross piled at distances of 6 feet to prevent the gravel washing off; this walk is also dug out to a depth of 9 inches, filled up with coarse stones covered with fine gravel. A new gate has been placed at the lower end of the walk opposite the lower entrance to the nursery.

A new walk has also been made 5 chains in length 4 feet wide, leading from the top of the last-mentioned walk, up to the House in a northerly direction. The forest trees have been considerably thinned to allow the best of them to develop. Some of the Grevilleas, Pines and Eucalypti are growing fast and promise to make fine specimens.

All the old walks have been re-gravelled; the fence around the garden has been repaired and some creepers planted on it, principally *Tecoma capensis* and Chochos.

Greenhouses.—No. 1. The Fern House. This has been put into thorough repair. New stages on Juniper cedar supports have been erected. all the uprights supporting the roof, and the parallel and upright bars to the side sashes being new. The inside has been repainted in two coats throughout.

No. 2. The plant house has been patched up several times but is still in want of thorough repair.

Nos. 3 and 4. The old plant-raising sheds for cinchona seedlings are being put in repair for the purpose of raising seedlings and also growing more native ferns and orchids.

Great attention has been paid to the native Hill ferns, several additions to the collections having been made. The whole collection has been repotted by Mr. Cradwick himself amd nearly all the species mentioned in my report for 1889, are in a thriving healthy condition.

Solanum columbianum has grown well and flowered for the first time but has failed as yet to set fruit. This is a disappointment as Mr. R. B. White who sent it to me from the Andes, where he found it at an elevation of 6,000 feet, speaks of the fruit as being good.

Nursery.—In the nursery the old tracks which did duty for walks have all been dug out to a depth of 9 inches and filled up with rough stones and covered with fine gravel; the walks have also been piled to prevent the gravel washing off in the heavy rains, the total length of walks which have been re-made in the nursery being 17 chains. Two wooden sheds which were formerly used for Cinchona seedlings and were very unsightly, have been removed.

A large clump of pampas grass which was formerly in the centre of the nursery, has been lifted and re-planted on the east side to form a screen for a piece of ground in which rubbish, leaves, grass, &c., will be stored for manure.

The whole of the nursery, with the exception of a small piece still in hand, has been trenched 2 feet deep and manured, but as the land is miserably poor, it still requires a great deal of manure and good cultivation to render it worth much.

The peach trees fruited during the year, producing large numbers of fruits, many of which were removed. Only about 3 dozen fruits were allowed to ripen which, however, were small and of very inferior flavour.*

A small plantation of Tree Tomatoes, *Cyphomandra betacea,* has been formed, about a square chain in extent in order that an estimate may be formed of their value in foreign markets. Some fruits sent to England, were eaten a month after being gathered and were pronounced to be very good and in excellent condition.

A bed of 250 plants of *Hippeastrum Andreanum* has been made. This plant was first noticed by me in 1890, flowering here and there in the Hills. I collected all the bulbs I could find. and planted them at Cinchona. Mr. Marescaux tells me that he has occasionally seen it in the Port Royal Mountains and there is no doubt that the very dry season caused it to flower abundantly last year. This species was first named and described by Mr. Baker of Kew in 1880, who states that it was discovered by M. André in 1876, in the Andes in "the central cordilleras of New Grenada, alt. 6,000-8,000 feet on the banks of one of the branches of the Rio Cauca." About the time of my finding it here, two papers on *Hippeastrum* appeared in the Journal of the Horticultural Society of England, but no mention was made of this beautiful pink-flowered species. It appears that it is not known in cultivation in England, and I have therefore sent bulbs to the Royal Gardens, Kew, to the Horticultural Society's Gardens, and to Messrs Veitch and Messrs. Carter.

The propagating ground has been transferred to the piece of land formerly used by the Superintendents as a vegetable garden. This piece of land, about 5 square chains in size, has had a new wattled fence erected around it, and 7 beds, each 11 yards long by 2 yards wide, pegged round and filled with good soil in which to place cuttings, seeds, etc. The part of the garden situated around the Superintendent's house, has also been worked over and a series of 17 steps made, leading from the nursery to the main path. The border, leading from the public road to the house, has had a new grass verge planted on the side next the path 18 inches in width, 250 barrels of soil and 50 barrels of

* During the last winter months, these trees were trenched all round, leaving a good portion of the roots exposed. This compelled them to rest during the natural season, and this year the peaches have been remarkably good. I have advocated this plan for all the fruit trees of a temperate climate. I have recommended it also to those who wish to bud and graft oranges, though to do so is quite unnecessary when we can get such admirable seedlings.

manure have been placed on this border bringing it up to the level of the path, 4 very poor coniferæ have been removed, and the border replanted with flowers and flowering shrubs. All the walks around the house have been regravelled.

Pastures.—The small pasture between the nursery and the Superintendent's house has had a new fence of post and wire erected on one side, of one and a half chains in length. Westphalia pasture has been refenced, 35 chains post and wire fence being required to fence it in. The road through the pasture has been twice cleaned. The pasture by the Anemometer has also been refenced with 15½ chains of fence. The mule pen has been repaired. The old wooden fence along the St. Helen's Gap road has been removed and replaced by a new post and wire fence, 23 chains in length. On the line abutting on the Mount Hybla property a new post and wire fence has been erected to take the place of the old wooden fence which was quite rotten, this fence is 8 chains long. In all 82¾ chains of new fencing have been erected All the pastures near the homestead have been twice billed and are now clean.

The road from the public road to the Clerk's Bungalow has been cleaned thrice and the drains put into working order, the road has also been properly sloped to prevent water lying on the surface.

Forest Trees Plantation.—All the plantations of forest trees have been cleaned with the exception of the one near Egnor Gap in which the trees are now large enough to take care of themselves. All the trees are doing well. The plantation of Oaks has been twice cleaned. The conifers below the Superintendent's Quarters and on each side of the tea piece, have all been cleaned and are growing luxuriantly ; 75 plants of *Thuja Lobbii* have been planted out.

The tea piece near the Homestead has been kept in good order, a large quantity of tea has been picked and cured ; the tea piece at Latimer, and that at Harvey's Field have also been billed out.

Roads.—The Clydesdale Road has been cleaned and the drains put in order twice during the year. The Newhaven Road has twice been billed out, and as this is the main plantation road it has been carefully put in order, special attention being paid to drainage. The narrow places have been widened, given an inward slope, and at some of the sharp turns fences have been erected. All the other roads through the Cinchona Plantation have been billed, and are all in fair, and some in very good order, all slips, etc., being made good. During the months of May, June and July only 3.63 inches of rain fell at Cinchona, and during nearly the whole of this time water had to be carried from the Clydesdale stream which involved great expense.

Cinchona Plantation.—No cultivation of Cinchona has been carried on. Trees, however, which are seen to be dying, are barked, and the bark is sent to the storeroom in Kingston, first being cured at Cinchona.

The storeroom for Cinchona bark at the Parade is full, and I am only waiting for a rise in the market to ship to London. I have ascertained from the agents for the Royal Mail S.S. Co., the Clyde Line, and Messrs. Davidson and Colthirst, what charges would be made for the carriage of bark to London, and I am authorised to say that the same freight would be charged to private planters. I am glad to say that a considerable reduction has been made.

The following are the rates ;—

Royal Mail, £3 and 5 per cent. primage per ton measurement of 40 cubic feet.
Davidson and Colthirst, 17s. 6d. per ton measurement with 5 per cent. primage.
Clyde Line, (E. A. Haggart) ¾d. per lb. packed in bags.

The following are the amounts of barks harvested.

Hybrid (standard)	1,138 lbs.
Officinalis	5,453 "
Succirubra	1,717 "
Hybrid (mixed)	1,574 "
Total harvested	9,882 "

Of this 65 bags have been sent to the store house at Parade, and 64 bags remain at Cinchona.

The following seeds of Cinchona have been sent during the year to Kew, and the plants are said to be doing well :—

Cinchona Josephiana, C. succirubra, C. micrantha, C. Calisaya, C. Pondiana, C. officinalis, C. hybrida, C. Ledgeriana ; and one packet *Cinchona succirubra* to Mr. Sibley, Shooter's Hill P.O. Twenty lbs. of bark have been sold to Messrs. Kinkead.

Sale of Plants.—The total number of ornamental plants sold at Cinchona was 673 ; the total number of cuttings sold, 400.

Vegetables.—Fifty two varieties of Canadian potatoes were received from M. Dupuis, and planted in the vegetable garden. Peas have been presented from time to time by Messrs. Carter and Co. High Holborn, London. Careful observations are being made on the relative values.

Forest and Ornamental Trees. Planted 1883. In 1883, several *Pinus insignis, Cupressus macrocarpa,* and *Grevillea robusta* were planted on the slopes of the homestead. Of these *Pinus insignis* has reached a height of from 30 to 45 feet, with a girth, four feet from the ground, of about 2 feet to 2 feet 6 inches. Some of them are very handsome specimens. For timber it is not valuable, but its quick growth renders it a very useful tree for making shelter belts for coffee, &c.

Grevillea robusta.—The Silky Oak, has attained a height of about 30 feet. This height would have been greater but for the high winds so often experienced here. The trees, nevertheless, are very handsome, the wind topping them and preventing them running up too quickly. It resists drought, flourishing in the Liguanea plains, and as it is both ornamental and useful, I can recommend it for planting in any part of the island It is a native of the sub-tropical part of east Australia. Von Müller says that "the wood is elastic and durable, valued particularly for staves of casks, also for furniture."

Cupressus macrocarpa has grown exceedingly well, having in some instances reached a height of 25 feet. This is good growth, as it is not a tree inclined to grow straight up, being more addicted to throwing out strong side branches and increasing its girth at the bottom. Like *Pinus insignis* it will grow on poor soil, and is well adapted for shelter belts.

Juniperus bermudiana, the Juniper Cedar, planted at the same time in the same position has not grown so fast, being somewhat crowded by the more freely growing trees mentioned above. This is a most valuable tree flourishing in the plains as well as the hills even in the poorest soil. It is one of the best trees for resisting wind, as the roots penetrate very deep—a most admirable shelter tree. Posts made from it last longer than most others. Timber, valuable for furniture, building &c.

Pinus Massoniana in the lower corner of the Nursery reached a height of nearly 40 feet.

Carya olivæformis, peccan nut, so highly esteemed in the United States has been anything but a success, the tallest plant is not ten feet in height and has not yet flowered.

Podocarpus elongatus, the Cape Yacca, has far outstripped its Jamaica relative *Podocarpus coriaceus* in speed of growth. The two species planted at the same time in the same soil and situation are now, the "Cape Yacca" about 30 feet in height, "Jamaica Yacca" 3 feet in height. There were magnificent logs of timber of the Cape Yacca at the Colonial and Indian Exhibition.

Cupressus sempervirens planted at the Bellevue piece in the clayey spots where Cinchona refused to grow, has now reached a height of 25 feet with a girth 4 feet from the ground of 2 feet 6 inches. The timber is exceedingly durable, and the tree itself attains a great age.

Stillingia sebifera, the Tallow Tree of China, planted in the Nursery Garden and near the Mt. Hybla gate has not grown fast, being now only about 10 feet in height.

Pinus Massoniana and *P. insignis*, planted at Upper Buzza in spots where the Cinchona refused to grow, have also thriven well, having reached the height of 25 feet..

Planted 1884. The plantation of forest trees between the Superintendent's house and the Bungalow, about 2 acres in extent, consists of *Pinus insignis, P. Massoniana, Cupressus sempervirens, C. macrocarpa, C. Lawsoniana, Podocarpus elongatus, P. coriaceus, Juniperus bermudiana, Frenela australis*, and Eucalypti. These trees have all flourished. Some of the Juniper Cedars, growing where there were no pines, have attained a height of from 15 to 25 feet; but the majority of the Juniper Cedars, and also the Yaccas are not more than 5 feet high, being crowded by the quicker growing Pinus and Cupressus and so deprived of light and air. The Eucalypti in the same position are, in spite of being topped and blown about by the wind, over 40 feet in height.

Dammara australis, the Kauri Pine of New Zealand, a very handsome and peculiar conifer, planted on the slopes of the Homestead, has grown well. The position being very sheltered, it has not been damaged by wind, and has reached a height of 15 feet.

Hakea gibbosa, the Snail Tree, so called from the shape of the fruits, has succeeded fairly in the same situation, being from 6 to 8 feet in height, and fruiting regularly.

Casuarina torulosa, is a very handsome as well as curious tree; it does not grow to the height of the Casuarina of the plains, *C. stricta*, but it is more compact, 20 feet in height with a girth of branches of more than 40 feet. Casuarina trees make good shingles, and furniture, and afford excellent fuel.

Araucaria excelsa, in spite of having been blown over in the winter of 1887, is now a very handsome tree, 20 feet in height.

The *Eucalyptus Globulus* trees in a row by the side of the public road are nearly 60 feet high. Some young trees have grown 10 feet in 3 months. They require to be constantly topped.

Podocarpus elongatus, "Cape Yacca," planted in the Homestead grounds, have now reached a height of over 20 feet, and since the removal of a number of Cupressus and Juniperus, are growing at a very fast rate.

The Juniper Cedars in Upper Buzza have reached a height of 15 feet. *Cupressus macrocarpa* has reached a height of 20 feet. *Podocarpus elongatus* a height of 15 feet, the Eucalypti 30 feet. This plantation has an area of about 3 acres.

At Bellevue piece in a plantation of about 2 acres in extent, the Juniper Cedars have reached a height of 15 to 18 feet; the Eucalypti from 20 to 35 feet; Acacias about 20, Podocarpus 15 feet.

Planted 1885. The piece of land below the Bungalows about 1 acre in extent was planted in 1885 with various forest trees and ornamental shrubs, consisting of Juniper Cedar, *Pittosporum, Cupressus macrocarpa, Podocarpi, Berberis*, and *Pinus insignis*.

These are much too crowded to thrive, and it is proposed to thin out these trees during the current year, to allow the more valuable ones to grow.

A nursery for *Cedrela odorata* was established during the year, 1885, at Resource some distance below Cinchona, but nearly the whole of the plants were stolen.

Several conifers were planted near the Homestead tea piece on land about 2 acres in extent. These are chiefly Juniper Cedars which have now reached an average height of about 10 feet. This plantation in a few years should be very valuable.

Pinus insignis in the same piece of ground has reached a height of 15 feet, while the rapidly growing Eucalypti have reached a height of nearer 50 feet. Some plants of *Casuarina* are growing exceedingly well. The plantation contains *Cupressus, Thuja*, etc., which need no special remark.

Many other plants were put out during this year but no fresh plantations were made, the plants being used simply for supplying vacant places.

1886—Newhaven Gap. At Newhaven Gap a small plantation chiefly of Junipers has grown exceedingly well, showing that these trees are adapted for planting in exposed and windy places. Scarcely a more windy place exists in Jamaica than Newhaven Gap, yet these plants are growing evenly and in perfect shape

Month.	Temperature.		Barometer.		Inches of Rain.
	Max.	Min.	7 a.m.	3 p.m.	
			25	25	
October, 1889	73.4	58.6	.317	.312	8.24
November "	77.2	58.7	.359	.355	4.00
December "	67.4	56.2	.343	.295	19.39
January, 1890	67.8	58.6	.355	.243	9.16
February "	67.3	57.7	.350	.336	11.21
March "	66.1	57.7	.293	.294	7.41
April "	67.4	56.6	.350	.298	6.52
May "	70.2	59.1	.306	.281	1.75
June "	70.7	55.7	.324	.315	0.56
July "	74.7	59.5	.245	.232	1.32
August "	73.0	59.4	.222	.200	6.31
September "	72.0	60.2	.315	.232	6.16
October "	71.2	58.5	.201	.192	2.67
November "	74.2	54.9	...	...	6.50
December "	66.7	55.5	...	...	3.00
January, 1891	66.7	58.7	.295	.234	2.47
February "	68.4	59.0	...	...	2.03
March "	67.3	56.1	...	...	0.94
Averages	70.0	57.8	25.3005	25.2525	Total 100.04
Means	63.9		25.2765		

Hope Gardens.

Mr. William Harris, Superintendent at Hope Gardens, has been a constant victim of malarial fever, produced in great measure by the refuse removed from the Reservoirs of the Kingston and Liguanea Water Works. It has not only been a serious matter for himself and his family, but the frequently recurring interruptions in the performance of his duties have been detrimental to the public service, and have hindered the progress of the work in the Gardens. From his report I take the following:—

The work at these Gardens has consisted to a great degree in hoeing and billing grass and bush, and endeavouring by every available means to eradicate the noxious weeds which infest the grounds. To aid in this work, and to assist in some measure in lessening the great expense attendant thereon, portions of the grounds have been planted with Guinea corn and maize, but owing to the exceedingly dry weather which has prevailed for such an extended period, the crops yielded have been very much smaller than they otherwise would have been, indeed one crop of maize was almost a total failure. The intention is to plant a few more crops, however, and if the seasons are more favourable, better results may be looked for. Undoubtedly the corn has assisted to a great extent in keeping down weeds and the grounds are gradually being thoroughly cleaned.

Drives.—The drive running through the Teak plantation crosses a small gully which is dry except after heavy rains. Instead of filling it up and thus directing the water which occasionally accumulates into another channel it was thought better to bridge the gully; a culvert has therefore been built of sufficient dimensions to carry off a large volume of water and prevent injury to the drive. Large cement drain pipes have been laid at two other places where an open drain to carry off the waste water from the Water Works reservoirs crossed the drives.

Ponds.—A pond for growing aquatic plants has been excavated and some lilies have been placed in it; the water weed, *Chara,* is however very troublesome.

Sisal Hemp.—23,000 suckers of Sisal Hemp (*Agave rigida* var. *Sisalana*) were imported from Turks Island. A plantation of about 30 acres of this plant has been established and the plants are doing well. Many of the suckers obtained from Turks Island were small and weak, and a nursery was formed of these and they have thriven remarkably well, being now as large, almost, as those in the plantation, or field. Our field was at first overrun by stray stock, but by putting the fences then existing in good order, and running a new fence we have been able to keep the stock out.

The Sisal Hemp is admirably suited for growing on the hot, dry plains of the Liguanea, it requires little cultivation and seems to thrive in any poor, rocky soil.

Onions.—In the latter end of November last, half-an-acre of ground was carefully prepared for Onion seed imported from the Canary Islands. The seeds germinated freely and the plants have done well, many of them forming good, large sized bulbs.

Nursery.—As usual, special attention has been given to Nursery work, and many thousands of plants have been propagated and distributed. The Nursery at the present time is well stocked with a varied collection of plants, useful and ornamental. Regular supplies of plants most in demand are received from Castleton Gardens.

Pinery.—The plants in the pinery are in a robrst state of health, and are particularly large and fine. The suckers were put in a fresh piece of ground which had been thoroughly cleaned and trenched, but no manure of any kind was given and the results are excellent.

Plants put out.—A large number of plants have been put out in permanent positions, and with few exceptions are doing well. During the excessive drought, planting operations have had to be suspended, but with the return of seasonable weather will be resumed. In a new place like this there is much to be done which is likely to escape the notice of those unacquainted with such work, for instance, uprooting trees, levelling ground, collecting and removing stones and rubbish of all kinds, trenching, forking and manuring, making walks and grass verges, &c. There is also the usual routine work of a garden, such as pruning, watering, potting, hoeing and cleaning, cutting grass.

Plants received.—The following plants have been received from Castleton Gardens during the 18 months under review :—

Palms	...	...	1,210
Crotons	...	...	272
Roses	...	...	3,052
Various Plants	...	...	4,502
			9,036

Valuable consignments of plants have been received from the Royal Gardens, Kew ;—during the fifteen months 5 cases containing 222 plants, and one small tin of bulbs of *Freesia* have been received. The plants were such as *Piper ornatum*, various *Nepenthes*, *Garcinia Kola*, *Alpinia Galanga*, *Webera corymbosa*, *Ficus religiosa*, *Uncaria Gambier*, &c., &c. Of the Gambier plants 34 were received in good order, 8 in fair order, but 38 were very weak and have since died. Another case also received from Kew contained 37 Begonias, &c., &c., for Cinchona, and the plants were transferred there. From the Parade Garden, Kingston, 14 suckers of Sisal Hemp, and 21 *Ficus lucida* plants. From the Hill Garden, Cinchona, 285 various plants, 13 bundles of Geranium cuttings, 9 *Schomburgkia Lyonsii.*

From Mr. R. K. Tomlinson, Lacovia—191 various Jamaica Orchids, and roots of *Nelumbium luteum.*

From Mr. Thos. Kemp, Caymanas—7 young Coconut Palms, and 57 various Orchids.

From Mr. G. P. Dewar, Trelawny—1 barrel of Kangaroo grass roots.

From Rev. E. Bassett Key, St. Mary's College, Balaclava—*Forsteronia floribunda*, *Aristolochia sp.* and 3 ferns.

From Mr. A. C. Bancroft, Oracabessa—1 plant, *Apocynacea.*

From Mr. E. L. Frank, through the Hon. W. B. Espeut—4 Olives, (2 "Mission" and 2 "polymorpha"), 4 Pears, 4 German Prunes, and 4 Apricots. These have been transferred to the Hill Garden at Cinchona. Also 6 Peccan Nut plants.

From Mr. Wynne, Mandeville—5 Banana suckers, choice kinds.

From Botanic Gardens, Demerara—24 bulbs of *Hippeastrum solandriflorum*, 22 various Orchids.

From Mr. J. R. Bovell, Barbados—6 *Adiantum Farleyense.*

From the Director of the Botanic Gardens, Singapore—A Wardian case containing 15 various plants, 8 of which were dead when they arrived.

From Wm. Paul & Son, England, (purchased)—166 Roses, and 50 roots of Spiræa, &c., also 827 various bulbs, 131 of which were kept at Hope and 697 sent to the Hill Garden at Cinchona.

From Rear-Admiral Ammen, U. S. Navy—10 plants of Durian *(Durio Zibethinus).*

From Mr. W. P. James, Bermuda—102 Lily bulbs, and 36 Gladiolus. The majority of these were transferred to the Hill Garden.

From Mr. W. MacCullum, Bermuda—144 Lily bulbs, transferred to the Hill Garden.

From Messrs. Sutton & Sons, Reading, England—1,086 various bulbs, &c., (purchased for Exhibition Grounds).

From Messrs. J. Veitch & Son, London, (purchased)—35 various Orchids.

From E. H. Krelage & Son, Haarlem, Holland—6,000 Gladiolus and Ixias (purchased for Exhibition Grounds) and 162 Hyacinths, Tulips, &c., presented.

From Mr. Keey, Port Royal—Sucker of Fig Banana.

Plants distributed in Exchange.

To the Royal Gardens, Kew—A case containing 29 plants of *Spathelia simplex*, Ferns, &c.
To Mr. T. Kemp, Caymanas—24 *Eucalyptus spp.*
To Mr. Keey, Port Royal—6 various ornamental plants.
To H. E. Sir W. Hely Hutchinson, Grenada—72 various Jamaica Orchids (per Mr. Morris).
To H. E. the Governor of the Leeward Isles, for Anguilla—12,000 bulbils of *Furcræa gigantea* (per Mr. Morris).
To J. R. Beach, Florida—126 cuttings of Crotons, Mangoes, Cashew and Dracœnas.
To T. A. T. Vaughan, Jamaica Exhibition—1 Jamaica Orchid *(Oncidium tetrapetalum)*.
To Mr. Lindsay Smith, Turks' Island—4 ferns.
Dr. Strachan, Kingston—1 Amherstia.
Total number of Plants distributed in exchange, 12,263.

Plants distributed free.

Mr. A. C. Sinclair, for the Grounds of the Victoria Institute—120 various.
Right Rev. Bishop Gordon, for the Roman Catholic Cemetery, Kingston—32 Palms, 54 shrubs, 64 shade trees.
His Honour The Commissioner, Turks Islands—16 Crotons, 15 shrubs and 24 Roses.
Mr. R. S. Spalding, May Pen—85 Crotons, Palms, Fruit Trees, Roses, &c.
Lepers' Home, Spanish Town—84 Roses, Palms, Crotons and Hibiscus.
To Dr Ogilvie, Kingston—1 dozen Roses in exchange for plants presented for Exhibition Grounds.
To Commodore Lloyd, Port Royal—50 Casuarinas.
To the Right Rev. Bishop Gordon, for Alpha Cottage Industrial School, Kingston—762 Economic and ornamental plants.
Mr. G. J. DeCordova, Kingston—30 shrubs in exchange for plants presented for Exhibition Grounds.
To the Parade Garden, Kingston—102 ornamental plants.
To Castleton Gardens—250 Nutmeg plants, and several bundles of Rose cuttings for propagating purposes.
To King's House Gardens—3,118 various ornamental plants.
To the Exhibition Grounds—10,977 plants of a useful and ornamental character.
Total number of plants distributed free, 15,898.

Plants sold.

Nutmegs	...	2,140	
Cinnamon	...	71	
Mangoes	...	608	
Oranges	...	1,701	
Liberian Coffee	...	25	
Cocoa	...	480	
Kola Nut	...	407	
Sugar Cane	...	4,234	
Miscellaneous Fruit and Economic Plants		1,609	
			11,275
Palms	...	2,218	
Ferns	...	373	
Orchids	...	301	
Roses	...	3,068	
Crotons	...	2,318	
Miscellaneous trees and shrubs		5,073	
			13,351
Distributed free	...	...	15,888
Distributed in exchange	...	...	12,263
Total number distributed		...	52,787

The Receipts on sales amounted to £387 9s. 11d.

Seeds distributed.—Seeds of the Golden Wattle *(Acacia pycnantha)* were forwarded to the following:—

Mr. Carl Hinderman, Southfield.
Mr. Muirhead, Amity Hall.
Mr. Thos. Kemp, Ewings Caymanas.
Mr. S. Scharschmidt, Mandeville.
Mr. R. Collymore, St. James' Parochial Board.

Mr. L. F. Mackinnon, Kingston
Mr. Thorp, Mocha.
Mr. A. H. Groves, Bath.
Mr. E. F. Forrest, Black River.
Mr. A. C. Austin, Cross Keys.
Mr. Jas. Allwood, Kingston.
Mr. R. Sidgwick, Chester Vale.
Mr. J. J. Deslandes, Chapelton.
Mr. Silvester.
Mr. R. H. B. Hotchkin, Halfway Tree.
Mr. J. Stephens, Radnor.
Mr. F. Roper, Moneague.
Mrs. Nash, Watson's Hill.
Rev. J. Seiler, Newport.
Hill Garden, Cinchona.
Castleton Gardens.
Hon. Lt Col. C. J. Ward, Kingston.
Mr. Dahl, Kingston.
Seed of Havanna tobacco sent to Mr. J. W. Welsh, May Pen.
To the Royal Gardens, Kew—7 pkts. various seeds.
To Mr. W. E. Sant, Kingston—Seeds of castor oil plant, large variety.
To Dr. Trimen, Botanic Gardens, Ceylon—200 Kola nuts.
To Messrs. Reasoner Bros., Florida—200 Mango seeds.
To J. R. Beach, Florida—5 pkts. various seeds.

Seeds Received.—From the Royal Gardens, Kew—57 pkts. of various seeds.
From Messrs. Reasoner Bros., Florida—14 pkts. seeds,
From the Botanic Gardens, Trinidad—5 pkts. seeds.
From the Botanic Gardens, Demerara—14 pkts. seeds, 120 seeds of *Attalea speciosa*, and 220 seeds of *Maximiliana sp.*
From the Botanic Gardens, Hong Kong—2 pkts. Chinese Cabbage seed.
From the Botanic Gardens Melbourne—131 pkts. of *Eucalyptus* and other seeds.
From the Botanic Gardens Calcutta—2 pkts. Bamboo seeds.
From the Saharunpur Gardens—13 pkts. seeds.
From Madras—20 packets various seeds.
From the Botanic Gardens, Adelaide, South Australia—10 pkts seeds.
From Grenada—3,000 Nutmeg seeds (purchased) and *Luffa.*
Seeds of *Stephanotis* from Dr. Plaxton, Kingston.
Citron seeds from Mrs. Henderson—Pleasant Hill.
Citron seeds from Mrs. Marescaux—Cherry Garden.
From Castleton Gardens—71 parcels of palms and other seeds.
From Parade Garden—9 pkts. Cocoa and Palm seeds.
From Hill Garden, Cinchona—68 pkts. various seeds.
Mr. R. K. Tomlinson, Lacovia—20 pkts. of various seeds.
Mr. Richmond, Spanish Town—Papaw seeds.
From Mr. John Parry, Kingston—Seeds of *Ipomœa Horsfalliæ.*
From Mr. L. F. Mackinnon, Kingston—Seeds of Alfalfa *(Medicago sativa).*
Mr. H. B. Malliett, Kingston—Seeds of Bergamot Orange.
From Mr. Henry Sewell, Australia, through Director—14 packets of various seeds.
From Assistant Bishop Douet—Seeds of Cinnamon.
From A. C. Mais, Kingston—Seeds of senna.
From Mr. Arambarry, Constant Spring—Soap berry seeds.
From F. A. Jenoure, Port Antonio—2 pkts. Tomato seeds.
From Major Knollys, Kingston—Seeds of *Jacaranda sp.* (Queensland).
From Mr. P. C. Cork, Barbican—Seeds of Sunflower, imported, and native grown.
From R. Stewart, Newport—Seeds of *Eriobotrya japonica.*
From Mr. A. Jaeger, Honolulu—3 pkts. of seed, various.
From Mr. J. Stephens, Radnor—1 pkt. White Queen Onion seeds.
From Mr. A. Leon, Temple Hall—Havanna tobacco seeds.

Purchased from Messrs Sutton & Sons, Reading, England, and from Messrs. Jas. Carter & Co., London—Seeds of *Ipomœa*, *Convolvulus*, Mignonette, *Godetia* and various other flower seeds, also collections of vegetable seeds.
Purchased seeds of Tomatoes from the following:—
Messrs Johnson & Stokes, Philadelphia.
Messrs W. Atlee Burpee & Co., Philadelphia, U. S. A.
Messrs D. Landreth & Son, Philadelphia, U. S. A.
Messrs Peter Henderson & Co., New York, U. S. A.
Messrs. Carter, Page & Co., London Wall, E. C.
Messrs Sutton & Sons, Reading.
From Mr. G. P. Dewar—Seeds of "Greenheart."
From Mr. Frank, Jamaica Railway Co., 181 Peccan nuts.

Rainfall for eighteen months from 1st October, 1889, to the 31st March, 1891.

Month.			Rainfall.	No. of Days on which Rain fell.
October	1889	...	7.05	14
November	"	...	0.84	5
December	"	...	0.88	4
January	1890	...	1.53	9
February	"	...	1.57	9
March	"	...	3.58	9
April	"	...	2.10	5
May	"	...	2.28	7
June	"	...	0.90	2
July	"	...	0.89	2
August	"	...	5.80	7
September	"	...	6.87	15
October	"	...	4.20	10
November	"	...	5.18	10
December	"	...	0.83	5
January	1891	...	2.10	6
February	"	...	1.14	4
March	"	...	0.00	0
			47.74	123

Castleton Garden.

Mr. E. Campbell was temporarily transferred from King's House Garden to take charge of Castleton in place of Mr. Thompson. He has carried on the work of the Garden to my satisfaction.

The usual routine of garden work has been proceeded with, and some improvements have been effected.

The garden has attracted a large number of visitors. During 18 months 896 names have been entered in the Visitor's Book, or on an average 50 a month. Those who come from abroad, and more especially those from temperate regions, are very much struck with the beauty of the garden, and the interesting character of the plants growing in it. Mr. Morris, who was here in February, said that he had not seen as pretty a garden since he left Jamaica. Mr. Wm. Saunders, Superintendent of Gardens, Agricultural Department, Washington, when he heard that it had been in contemplation a few years ago to give up the garden, remarked that to do so would be like burning down a picture gallery. But those also who live in Jamaica, and are accustomed to tropical vegetation, appreciate the pleasure and profit to be derived from a visit. The drive from Kingston, though a long one, is full of interest, first through the Liguanea plains, then up Stony Hill, past settlers' groves of cocoa, coffee, and bananas with a sprinkling of oranges, akees, sugar cane, annatto and yams; down into the Wag Water with broad alluvial stretches covered with tobacco, cultivated by Cubans; along the winding river fringed with clumps of graceful bamboo plumes, and its banks hidden by masses of creepers; past the rocks by the roadside covered with ferns and mosses, the scarlet "dazzle" and the blue "forget-me-not" of Jamaica; until Castleton is reached where art shows nature at its best by world wide selection and harmonious combination.

One of the most superbly beautiful of trees, the *Amherstia nobilis,* was in magnificent flower this year; and was worth crosssing the globe to see. Though covered with its long pendent bunches of vermillion and yellow flowers, it only yielded a few seeds. It is a native of the Malay Peninsula, and naturally prefers a moist climate. One of the Iron Woods of India, *Mesua ferrea,* also attracts attention from the red colour of the young drooping foliage, and the large fragrant white flowers. It has not yet ripened seed. The Mangosteen, *Garcinia Mangostana,* the fruit of which in its native country is said to be the most delicious in the world, yielded a small crop for the first time this year. It requires a damp and hot atmosphere and probably the eastern end of the island would be the most suitable situation in which to cultivate it. The Traveller's Tree of Madagascar (*Ravenala madagascariensis)* is the noblest form of that essentially tropical family—the Banana order (*Musaceæ*). The leaf-stalks contain water, a merciful provision for the thirsty traveller. The leaves are perhaps the largest known. The Souari or Butter Nut (*Caryocar nuciferum*) produced fruit; as also the Norfolk Island Pine (*Araucaria excelsa*) and *Samadera indica.* The two large Araucarias in the garden, *A. excelsa* from Norfolk Island, and *A. Cunninghamii* from Australia are very fine and well grown specimens about 80 feet high. *Araucaria Bidwilli,* the Bunya-bunya Pine of Australia, and *A. imbricata,* the Monkey Puzzle, from Southern Chili, are still small. The genus Araucaria which occurs only in S. America and Australia, is an example of a geographical distribution of certain plants which is interesting as indicating a former connection between lands in the Southern hemisphere. It is probable that the Australian expedition to the South Polar regions may throw some light on this question. *Samadera* is noteworthy inasmuch as the oil, expressed from the kernel of the fruit, is used in the East for rheumatism; the wood is a good tonic, and the bark has febrifugal properties.

The collection of Palms is always much admired for the great variety of their graceful forms. Labels of an indestructible nature have been substituted for the old wooden labels; they are made by Druery of London, and are composed of enamelled iron. Several of the Palms have fruited, some for the first time, as *Oreodoxa regia, Hyophorbe amaricaulis, Areca triandra, Areca Aliciæ, Dypsis madagascariensis, Stevensonia grandifolia, Hydriastele Wendlandiana.*

The Water Lily Tank is wonderfully beautiful with its surroundings of Palms, Bamboos, and grassy slopes and the placid surface of bright water on which float the symmetrical leaves of white and pink lilies. In the centre is the *Victoria regia*, sadly dwarfed by its narrow confines.

From the brightness of the still Lily pool it is a grateful contrast to visit the shady Ferneries with the quick stream dancing over the stones, or to study at leisure the named collection in the Fern house.

Among economic plants that are examined attentively, may be mentioned the Nutmeg Tree, with its yellow fruit splitting and displaying the "mace" a network of scarlet covering and half concealing the brown nut underneath; the elegant Cinnamon Tree with 3-veined leaves and aromatic bark; the spicy Cloves of commerce, the unopened flower-buds of *Caryophyllus aromaticus*; the white flowered Vanilla, clinging to some moss-grown tree trunk, or hanging in festoons, an appropriate framing to a group of ferns; the grove of Liberian coffee shrubs, with dark-green leaves, white flowers, and large red berries; the cocoa, with the small pretty flowers growing out of the trunk, and followed by the large, yellow or purple pods; its rival, the Cola or Bissy Nut Tree; the African Rubbers, (Landolphia) climbers, and so contrasting with the Honduras Rubber Tree (*Castilloa elastica*), and similar to the native Rubber Withe—(*Forsteronia floribunda*).

It has been proposed to lease a certain portion of the Castleton grounds, not under cultivation, at a nominal rent to the Boston Fruit Company for the purpose of maintaining Rest Houses for the accommodation of visitors. This will be of great benefit, as it will enable visitors to spend a night at Castleton with more time for careful examination, and with less fatigue for those who are in delicate health.

As the centre for distribution of plants has been changed to Hope Gardens, most of those propagated at Castleton have been sent there. Many were also sent to the Exhibition grounds, and for the Avenue borders at King's House. The following are the actual numbers:—

Plants sent to Hope Gardens and Exhibition Grounds.

Roses	6,318
Palms	1,504
Ferns (Tree Ferns included)	3,000
Crotons	850
Various Shrubs and Trees	3,980
Fruit and other Economic Plants	1,015
Begonias	14
Pine Suckers	36
Lilies	21
Total	16,738

Seeds sent to Hope Gardens:—

98 Packets various Seeds.

Plants sent direct to Exhibition grounds:—

Palms	1,645
Shrubs, various	1,889
Climbers	410
Crotons	190
Ferns	1,645
Total	5,779

Plants sent to King's House:—

Crotons	130
Palms	70
Ferns	16
Roses	106
Various Shrubs	1,634
Total	1,956

Plants sold at the Gardens :—

Roses	816
Palms	363
Miscellaneous Trees and Shrubs ...	2,307
Do. Fruit and Economic Plants	656
Crotons	247
Nutmegs	438
Oranges	500
Total ...	5,327

Seeds sold :—

Nutmegs	100
Cacao Pods	56

The receipts on sale of plants and seeds amounted to £46 3s. 1d.

A collection of specimens was prepared for the Exhibition :—22 kinds of woods, and varieties of fibre, 12 kinds of seeds, several products of Bamboo, also Ginger, Sarsaparilla, Gamboge, Nutmegs, Liberian Coffee, &c.

Plants in great variety have been contributed to the Flower Shows held in Kingston, and cut flowers, ferns, leaves, &c., have been sent to King's House for balls, &c.

A new border, 2¼ chains long, 15 feet wide, has been made on one side of the walk leading to the Bower by the river. The borders generally have been weeded, and manured, and some hundreds of new plants put out. The trees in the borders and the arboretum have been pruned, and some over-crowded duplicate trees have been removed. None of the trees have made remarkable growth, except *Ficus* (*Urostigma*) *rhododendrifolia.*

The Nursery stock is in a constant state of transition to Hope Gardens, while propagating is continually being kept up at Castleton.

The Water Lily Tank, and the dam, have been thoroughly cleaned out.

The Fern House was repaired to some small extent. The collection of ferns was renewed and it is in excellent condition. Several tree-ferns (*Cyathea*) have been collected from the woods, and planted in various spots in the Garden. Two new fern rockeries have been established. The shed that stood near the Superintendent's house has been removed to the Nursery, and ferns and other pot plants placed in it.

All the walks have been regravelled, and several drains made across them to prevent the wash of gravel during rain.

The wire fence enclosing the Gardens, has been re-strained, and several new posts have been supplied. Climbing plants have been placed along the fence by the Arboretum. A new gate has been put up near the cart shed. The three entrance gates have been painted. The benches have been repaired and painted.

Some repairs to the Superintendent's house and to the out-offices have been carried out by the Public Works Department.

A mule was purchased to replace one that died ; and a new cart has been provided.

Rainfall for eighteen months from 1st October, 1889, to the 31st March, 1891.

Month.	Rainfall, Inches.
1889.	
October	18.40
November	9.95
December	23.47
1890.	
January	26.39
February	8.60
March	6.64
April	5.11
May	9.57
June	4.68
July	8.85
August	11.28
September	25.82
October	8.56
November	15.72
December	12.22
1891	
January	8.70
February	0.41
March	1.70

Parade Garden.

This Garden, more than 7 acres in extent, is maintained as a Public Pleasure Garden in the capital of the Island. The amount of money available is not large enough to do all I could wish in order to increase the value of the Garden, and also to make it a more popular place of resort.

The gates which I recommended for the east and west sides, have not been erected. I see no objection whatever to a thoroughfare through a public garden. On the contrary I should like to increase the thoroughfares from one to several. People who would not otherwise think of entering the garden, will do so, if it is a short cut; and I know from my experience of the London Parks what a relief and a delight it is, to have a walk of even a few yards through grassy lawns and by brightly coloured borders, and how those who are thus led unconsciously to appreciate some of the beauties of nature, will return in their spare time, and get rest of mind and refreshment of soul.

To maintain the garden, however, as one of the most frequented and popular places of resort in the Island, and worthy of its position in the chief port and capital, it is absolutely necessary that it should receive the most constant and unremitting care from a properly trained and energetic gardener, and that he should have a fair complement of skilled labourers, and an adequate supply of garden tools. Superintendents at 20s. or 30s. a week for the different gardens,—was the recommendation made in the Report of the Special Committee in 1886, adopted by the Legislative Council; but I say without hesitation and after experience, that even if the Director spent the whole of his time in going from garden to garden, and doing a Superintendent's work, the results with men that could be obtained for such low wages would be utter failure. It might be possible for a short time to get a suitable man at this rate, but he would naturally use the post only as a stepping stone to some appointment where his services would be better appreciated and adequately remunerated. It is extremely difficult to keep even labourers after they have received a minimum amount of training, and learnt to distinguish the weeds from cultivated plants, or to use a lawn mower. It is reasonable that they should expect better pay when they have gained some experience, and only natural in the event of their not receiving more than unskilled men, that they should either relapse into careless mechanical work, or leave the service for even less wages, and greater freedom. But not only is it necessary that the Kingston Garden should have a trained Gardener as Superintendent, it is essential also for the business of the Department that he should be an efficient agent in receiving and despatching plants by steamer or railway, and in transacting such other work as may be necessary in the chief town.

Regravelling of the pathways has been carried out, but great loss is experienced by the storm waters flowing down from Upper King St., and washing the central walk.

One of the finest Ficus was struck by lightning; thus one of the best shade trees in the garden has been lost.

The garden has been provided with the electric light through the exertions of one of the Members of the City Council, and it is now kept open until nine o'clock at night. This is a great boon to the public, and is much appreciated.

Visitors are gradually becoming more numerous, and as a rule there is scarcely any infringement of the Regulations.

PARADE GARDEN.—ELEVATION 60 FEET.

Meteorological Results for eighteen months, from 1st October, 1889, to 31st March, 1891.

Month.	Pressure.		Temperature.					Dew Point.		Vapour.		Humidity.		Rainfall.
	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.	Inches.
1889														
October ...	29.959	29.904	76.2	84.5	89.7	71.2	18.5	70.6	73.1	0.749	0.815	83	69	4.20
November ...	29.998	29.929	73.8	85.3	89.9	69.7	20.2	68.3	70.9	0.692	0.756	83	62	0.19
December ...	30.023	29.954	68.6	85.6	89.1	65.0	24.1	64.4	66.9	0.605	0.659	87	54	0.01
1890														
January ...	30.056	29.993	67.5	85.0	88.9	64.5	24.4	63.1	68.5	0.578	0.697	86	58	0.34
February ...	30.053	29.992	67.4	83.2	86.9	64.2	22.7	62.9	68.9	0.574	0.706	86	62	0.37
March ...	30.042	29.981	70.1	81.1	85.5	66.8	18.7	64.5	68.0	0.607	0.684	83	66	3.27
April ...	30.073	30.015	71.2	83.1	86.3	67.9	18.4	65.3	68.4	0.624	0.694	81	63	0.26
May ...	30.025	29 971	75.4	83.4	87.2	71.0	16.2	67.8	71.6	0.680	0.774	77	68	1.22
June ...	30.054	30.003	76.6	86.6	89.1	73.0	16.1	67.8	71.7	0.680	0.777	74	62	0.44
July ...	30.045	29.997	76.8	86.5	89.5	72.3	17.2	68.0	72.7	0.684	0.804	74	64	0.34
August ...	30.001	29.957	75.9	85.7	89.1	72.6	16.5	68.7	71.2	0.701	0.764	78	62	5.23
September ...	29.986	29.929	75.8	84.0	89.0	72.4	16.6	69.2	72.6	0.713	0.801	80	69	3.04
October ...	29.969	29.902	75.8	84.6	88.3	72.5	15.8	68.3	72.9	0.692	0.810	78	68	2.41
November ...	29.955	29.896	73.7	83.5	88.1	71.4	16.7	67.5	70.8	0.673	0.754	81	66	2.73
December ...	30.035	29.965	70.6	83.2	86.6	68.5	18.1	64.6	67.9	0.609	0.682	81	60	0.31
1891														
January ...	30.050	29.992	68.4	83.6	86.6	66.5	20.3	63.3	68.1	0.582	0.687	84	60	0.41
February ...	30.052	29.975	69.8	83.9	86.7	66.9	19.8	62.7	66.1	0.570	0.641	79	55	0.27
March ...	30.024	29.954	70.4	82.9	85.8	67.4	18.4	63.6	67.2	0.588	0.666	80	59	0.04

King's House Gardens and Grounds.

Mr. Thompson, Superintendent of Castleton Garden, was transferred to King's House to be available for supervision of work at the Exhibition grounds. He has been indefatigable in carrying out my plans for the improvement of King's House grounds, and the formation of the Exhibition grounds. The work in one place alone would have taxed the efforts of most men, but Mr. Thompson has worked early and late with the greatest enthusiasm, and with a thoroughness deserving of the highest praise.

The following details are taken mainly from his Report.

The extent of the Grounds, including Garden, Pastures, and Guinea Grass, amounts to 177 acres.

A Fern House was erected by the Public Works Department in 1889, to replace the one destroyed by the last hurricane For want of a structure of the kind, the stock of Ferns necessary for house decoration, &c., could not be maintained. This Fernery is 80 feet long, open in front. The roof is supported on rough wooden pillars, it slopes upwards towards the back, and is thatched with palmetto. In consequence of the dense shade of the ginep tree in front, this roof proved too dark, four large windows were put in the roof, but even yet there is not sufficient light. The back of the house is formed below of a stone wall, and above there are moveable windows and jalousies. The ferns are planted in a series of rockeries formed against the wall,—the rockeries alternating with wooden stages to support ferns in earthenware pots. Several tree ferns have been brought from Castleton; some were potted in large tubs, and others were planted out in the borders. The latter have not done well, but those in tubs have succeeded. Probably the failure of those planted out was due to the want of a sufficient amount of stones below the roots to ensure perfect drainage. Moss is wired round the stems, and if this is kept moist, by syringing, it is unnecessary to give much water at the roots.

A new Rose Garden has been made near the Fernery, but although 130 loads of good soil have been carted to it; it is still much too sandy. The walks were planted with Bahama grass.

The trees in the avenue, the Willow Fig (*Ficus benjamina*) and the Royal Palm (*Oreodoxa regia*), planted in 1881-82, with a few exceptions, had not grown with any vigour, in fact many died. This was owing to the want of water. Water pipes were laid along the road in 1890 and the trees are shooting out with a rapidity that gives great hopes for the future. A border of shrubs has been formed between the road and the trees, covering a space 100 chains long by 18 feet wide, a breadth of 2 feet next the road being a verge of Bahama grass. Most of the plants have come from Hope and Castleton. When the shrubs grow to their full size, it is hoped that the border will not be more difficult to keep in order than the grass bank. The avenue road has been greatly improved; it has been relaid, and drains, culverts, and concrete bridges have been made by the Public Works Department.

Wire fencing, 80 chains long, has been put up to keep stock off the drive, and six gates have been fixed in the fence.

Seventeen chains of iron fencing along the roads, near the house, had to be moved back to give proper width for the new border.

At the main entrance 5 chains of wire fencing have been repaired, and a dildo fence *(Cereus Swartzii)* formed against it to keep stock out. The fence round the East Lodge has been taken away, and the grounds dug, and planted with shrubs and Bahama grass.

A trench leading towards the west gate, 6 chains long, and 2½ feet deep, has been made to carry water off the beds, when heavy rain falls.

Four square chains have been dug, and planted with Bahama grass to form a Cricket Ground and enclosed with 15 chains of wire fencing.

Several large palms have been removed from various parts of the garden, where there were growing too thickly and planted in the space intended for a Palmetum; the ground for which, 6 square chains in extent, was dug up, and planted in Bahama grass *(Cynodon Dactylon.)*

Wire grass *(Paspalum Swartzianum)* on quarter of an acre has been replaced with Bahama grass.

All the lawns and verges have been carefully weeded, and vacant spots replanted.

A hedge of foliage plants has been planted on one side of the house.

The narrow walk that ran along the north side of the house has been done away with, and a broader walk made a few feet to the north. The main walk in the garden has been widened; the soil has been taken out of some part of it, and replaced by broken bricks and stones to prevent accumulation of water. All the walks have been regravelled, they require constant weeding, the avenue road is hoed once a fortnight. All the grass verges have been widened from 4 to 20 inches.

The two beds in front of the dining room have been entirely replanted. The Croton bed on the north side has also been replanted. All the borders have been forked, and manured several times.

Several acres of the pastures have been billed, and the Guinea grass pieces kept in order.

The Pinery has been cleaned several times during the year, and the pines have borne well.

The drought necessitated a great deal of extra labour in watering trees, shrubs, and flowers, and I am glad to say there has only been a loss of a few small plants.

Most of the Orchids have been repotted. The stock of pot plants has been considerably increased.

After the completion of the Ball Room, a great deal of work had to be done in the way of removing soil from one place to another in order to make the ground level, and a grass terrace and a gravel walk, each 6 feet wide were formed.

The usual work of attending to the decorative plants in the house, carrying them to and fro, watering, cutting flowers, decorating Ball Room, &c., was considerably increased during the Exhibition season.

Rainfall for eighteen months from 1st October, 1889, to the 31st March, 1891.

Month.			Rainfall, Inches.
1899			
October	...	...	5.09
November	...	..	1.42
December	...	...	1.26
1890			
January	...	...	1.18
February	...	...	0.46
March	...	...	
April	...	...	
May	...	...	
June	...	...	
July	...	..	
August	...	...	
September	...	...	
October	...	...	
November	...	...	
December	...	...	0.00
1891			
January	...	...	0.60
February	...	...	0.00
March	...	...	0.00

Bath Garden.

The Bath Garden was formerly the Botanic Garden of the island It was founded in 1774 by Sir Basil Keith, just 10 years after the first Botanic Garden was founded in the West Indies at St. Vincent. As however the St. Vincent Garden was given up about the year 1815, the Bath Garden is the oldest Garden in the West Indies that has been continuously kept up. Dr. Thomas Clarke, came out to take charge of it, when it was first planted. It was later superintended by Dr. Dancer author of "Medical Assistant," Dr. Stewart West, Dr. James MacFayden, author of "Flora of Jamaica," and Mr. Nathaniel Wilson.

During Mr. Wilson's tenure of office, a new Botanic Garden was begun at Castleton, and in the years 1862-68. such plants as could be easily removed, were taken to Castleton with the consent of the Directors of the Bath. Trees, palms and large shrubs were all left behind, together with representatives of all that were removed, so that there is no doubt but that the Garden might have been maintained in all its former glory if the Directors of the Bath, had had the means at their disposal. The area however has been gradually reduced to about half an acre, and the magnificient palms, trees, and other plants outside the present limits have been ruthlessly cleared away Plants were sent to the Garden by Mr. Morris. while Director, but with only £20 per annum for maintenance, it is not possible to do more than just keep the fence in order, and remove fallen leaves. As the Medicinal Bath is beginning to attract some attention again, and is likely to become a place of resort, it would make the place more attractive to give a somewhat larger grant towards the Garden, and so allow of its being kept in better order. It would be a misfortune to let it go to ruin, containing as it does trees of the Durian, one of the Upas trees, Napoleona, and others, which are only represented in the other Gardens by small specimens.

I have recommended already, and beg to repeat my recommendation, that a small grant of £5 be made for the purchase of labels for the trees, so that visitors to the Garden may be able to learn the names of the various trees of interest.

Mr. A. H. Groves is at present acting as Overseer of the Garden, and I have to thank him for the interest he takes in it.

Education in Gardening.

Apprentices.—The Government of Lagos has sent out two apprentices to be trained in practical work at the Botanical Gardens in Jamaica, with the view of hereafter appointing them as "working Superintendents of the district branches or outstations" in their own country. They were about 19 years of age when they arrived, and had received a fair education. A room is granted to them at Hope Gardens, and their Government allows them each a provision of £50 per annum.

I have from the commencement of the negotiations on the subject, made it clear that it was not possible with the present staff to undertake any tuition, but that if the apprentices had received a good education, they would be able to read and understand such books as were given them, treating of the fundamental principles of gardening and agriculture.

The plan has been carried out, and so far has proved satisfactory. The apprentices have worked in the Hope Gardens, as gardeners work in the Kew Gardens. They are learning the elementary practice of gardening, and the use of tools, and are as far advanced as can be expected after less than a year's work. I am satisfied with their industry in this respect, and expect that after another two years they will be fairly proficient.

With regard to books, I have lent them some from the Departmental Library—These are

The alphabet of the Principles of Agriculture. By Professor Tanner, F.C S.

Further steps in the Principles of Agriculture. By Professor Tanner, F.C.S.

In both of these books, each chapter ends with a number of questions on the subject matter, and the answers to these questions have been satisfactorily written out by the apprentices, have been looked over by me, and are filed in this office.

Text Book of Indian Botany. By D. Oliver, late keeper of the Kew Herbarium, and Professor of Botany in University College, London.

From written descriptions of the structure of flowers which they wrote for me, they appear to be able to understand and apply the teaching given.

Plant Life By Dr. M. Masters, Editor of the "Gardeners Chronicle," and Examiner in Botany for the University of London.

This work, on the physiology of plants, is more difficult and requires reading over and over again, with constant reference to it during their stay in Jamaica. I feel sure they are slowly assimilating the instruction.

Industrial School.—An Industrial School has been established in the grounds of the Hope Gardens, and a certain number of the boys are engaged in daily labour in the Gardens. The staff in the Gardens is not sufficient to allow of any direct instruction to be given to them, but I hope that arrangements may soon be made to afford them special instruction in curing and pruning Cocoa, in the special cultures of Sisal Hemp, Onions, &c., and in the proper cultivation of the ordinary products of the Island. If this practical work is combined with school work in Dr. Nicholls "Tropical Agriculture," and elementary text books, and is continued for a number of years, it may be expected that the best of them will be capable of acting as instructors in other parts of the Island, and that all will be able to exert an influence, wherever they may be living, in the improvement of the methods of agriculture at present employed.

Bulletins.

Seven Bulletins have been published containing 25 separate articles, giving information on new and important agricultural industries, as well as notes on other cultures, lists of plants growing in the Gardens and descriptions of native plants. Finally there is an Index to numbers 1 to 21.

Fibre.—Fibre cultivation and preparation is perhaps the most important of the new industries recommended. A list of all the chief fibres, with notes and latest quotations in the London market, was prepared to illustrate a very fine collection, sent to the Department from Kew Gardens for the Exhibition. This exhibit attracted a good deal of attention, and has been presented to the Jamaica Institute for display in the Museum.

An excellent report by Mr. C. F.Cross on the fibres shown at the Colonial and Indian Exhibition was reprinted, as it teems with information and is not readily accessible.

Sisal Hemp is the most promising of all fibres for this Colony, and notes on its cultivation were published in October, 1889.

Fruit.—The Orange trade should be very much larger than it is. The number exported during the year ended 31st March, 1891, was 40,725,085 valued at £57,015 2s. 4d This is less than the exports in 1887 and 1888, and it is unsatisfactory that such a promising industry should be crippled through want of care in packing. Notes on curing and packing, as practised in California, appear in Bulletin 21.

With the total destruction of the Orange groves in the Azores by disease, noticed in No. 16, it might be expected that there would be a good market for this fruit in Great Britain, and as a matter of fact small consignments to London Fruiterers have paid handsomely, and regular consignments are now made to Scotland. Fruit properly cured and packed, will stand the journey well, and will last days afterwards in excellent condition.

In No 21, there is also a description of a mode of making genuine Orange Wine, which has been successfully used in Jamaica and has produced a wine said to be equal to good sherry. With so much local knowledge of the art of making first class Rum, there ought to be no difficulty in producing Jamaica Wine from the Orange as well as from the Grape. All the Oranges in the Island could be utilised in this way, and it would no doubt pay very much better than to export the fruit.

The method used in Sicily for obtaining the essence from the lemon, and described in No. 16, could be also employed with the lime which grows so abundantly in the Island. There is also the process known as *à l'écuelle*, which is perhaps somewhat simpler, though a special machine is necessary. This, however, is small and inexpensive, and no doubt could be made in Jamaica. One of these, I believe, has been imported for an estate in St. Ann's.

The export of limejuice is gradually diminishing, the amount for the past 12 months being 53,884 gallons of the value of £2,245 3s. 4d. or less than half what it was in 1886. If the extraction of the essence were taken up, the juice could still be obtained, and it would doubtless lead to a large increase in the export.

Vegetables.—The cultivation of Onions has been treated of in No. 18. Experiments have been made in the different Gardens and in various localities throughout the Island with satisfactory results. It was said that Onions would not bulb in the Island, but it has been proved that this is a mistake, if suitable localities with a fair amount of rain, are chosen for the culture.

Experiments in the growth of English Peas and Cabbage, suitable cultivations for the cooler parts of the Island, are detailed in No. 20. These experiments are being continued in the Hill Garden at Cinchona, so as to determine the special varieties suited for our climate, and the best months in the year for planting. It is not supposed that an export trade, at any rate of any extent, could be maintained, in "English" vegetables; but it is important to consider what can be grown for home use, as well as for export.

Cocoa.—A note on the cultivation of Cocoa is given in No. 20, supplementary to a previous article. The amount of Cocoa exported in the 12 months, ended 31st March, 1891, was 6,417cwts. 2qrs. 24lbs., valued at £14,439 17s. 2d., which is nearly twice the amount exported 4 or 5 years ago. While the amount of the exports is increasing, the value per cwt. indicates that the curing of the bean is still very faulty. Except on large estates, the beans are generally only washed and partially dried. Individual growers cannot be blamed for this, as buyers pay rather for bulk than quality, and accordingly they get unfermented, wettish beans, which weigh heavier, and fill more bags, than the well-fermented, dry shrunken beans. If merchants would instruct their buyers in country districts to pay a little more for properly cured beans, which they could keep separate, the growers would soon see that it is to their individual advantage to take some trouble about curing, and the country generally would be richer. His Excellency the Governor has arranged to provide instructors to go amongst the people, and show them how to prune their cocoa trees, and cure the beans. There will be, therefore, no excuse for ignorance. Another method by which the immense loss to the country might be saved would be for buyers to purchase pods, and cure the beans themselves.

Rice.—The amount of Rice imported during the 12 months was 6,985,940lbs. of the value of £41,915 12s. 9d. There is no reason why this food supply should not be supplied by our own soil, and the £40,000 kept in this Island for the benefit of our own people. An article on the cultivation appeared in No. 19.

Dr. Calder, of Meylersfield Estate, has grown Rice on a large scale in Westmoreland to the advantage both of himself and his work people; and he delivered an interesting Lecture on the whole subject at the instance of the Jamaica Institute before a large audience at the Exhibition. The publication of his lecture is looked forward to with interest.

Tanning Materials.—Strangers to Jamaica are always struck with the immense areas lying absolutely waste, even in fertile parts of the Island. This state of things will, I hope, be improved from year to year, until even our barren wastes are made to produce something of value.

One product, suited for soil where scarcely even grass will grow, and where as little rain as 20 inches falls in the year, is the Golden Wattle of Australia, yielding the richest tan-bark in the world. Attention has been called to this tree in No. 19, and large extracts given from a pamphlet on the subject by Mr. J. H. Maiden, the Curator of the Technological Museum in Sydney. A large quantity of seed was contributed from the Kew Gardens, and Mr. Maiden, at my request, has most kindly obtained and supplied me with another large supply. The clear profit arising from the cultivation of 100 acres for 7 or 8 years, as Mr. Maiden shows, was stated before a Government Commission to be from £1,000 to £3,000.

Another tanning material of quite a different type is Gambier, described in No. 20. This plant will only grow in deep moist soil. The authorities at Kew after considerable trouble and with great difficulty, obtained a supply of seedlings from Singapore for the West Indies. The consignment arrived in such poor condition that it was doubtful at the time whether any would survive.

At the Exhibition a block of concentrated juice of Mangrove was shown. A sample was sent to Kew, and submitted there to experts. The result was so favourable that a request was sent out that a ton of it might be prepared for experiment on a commercial scale.

India Rubber.—A further Report on the Native India Rubber, in addition to the one in No. 10, appears in No. 21. The London manufacturers stated the value to be 3s. 2d. per pound.

Cinchona Bark.—Reports from time to time have been published on the state of the Cinchona Market. See Nos. 15 and 21. As far as can be judged from these Reports, the immediate future for Cinchona is not reassuring. I have, however, been asked by a London Firm to supply seeds of *Cinchona succirubra* to the value of £50 for growing on estates in Ceylon.

Coca.—Articles on this plant which yields the well-know cocaine, are published in No. 15 and 16. The coca shrub grows well in Jamaica, but unless grown on a large scale, it probably would scarcely pay.

Sugar Cane.—A report on a disease in Sugar Canes was published in No. 15, and articles on seedlings appeared in Nos. 15 and 19.

The demand for tops has been greater than the supply available at the Gardens. Planters are experimenting with the varieties grown—about 40—to ascertain whether any are better suited to the soil and other conditions of their estates, than their present stock of plants. Mr. Joseph Shearer of Vale Royal, writes: "The Vulu-vulu, Grand Savanne, Poa-ole, Seete, and Otaheite are certainly worth preserving, and I am doing all I can to increase my planting of them. . . . . Salangore and Elephant are not suited for our soil and climate here," i.e., Trelawny. This is a practical method of increasing the output of sugar. It would be advantageous also to follow the cutters in the field and note any variations from the usual type of cane. Many varieties giving a larger yield per acre could be picked out in this way and propagated. The larger the estate the greater the chance of finding such bud-variations. With a small mill as shown by Messrs. Duncan Stewart of Glasgow, or the Chatanooga Co. at the Exhibition, the juice of a single cane could be extracted, and then tested with the proper instruments to ascertain the quality of the juice. Manures will enable the planter to grow a greater weight of cane per acre, but they do not cause any increase in the richness of the juice. This very desirable end has to be attained by selection of individual canes. Much is hoped for from the demonstration by Messrs. Harrison and Bovell at Barbados, that seedlings can be raised. But it is doubtful whether as much can be done in this way as by selection from bud-varieties. There are very few seeds to a large quantity of arrow, and the seedlings are so extremely delicate that they require constant attention in a seedling shed. The percentage of varieties richer than the original stock is not likely to be greater than that obtainable from bud-variation in the fields. To attain any great success in this direction would require the devotion of the owner of a large estate for several years to this single object. There is no reason why the richness of the cane in sugar should not be increased as it has been in beet, but it demands, in this case also, the expenditure not only of years of labour, but of a considerable amount of money.

The total acreage in canes is about the same as last year.

Two mills were shown at the Exhibition suitable for small settlers. Both are driven by mule-power, and are a great improvement on the old "John Crow" mill in efficiency and ease of working. One of these mills manufactured by the Chatanooga Plow Co., grinds, on an average, about 30 gallons per hour, yielding from 55 to 63 per cent. of juice: the cost is £10 10s. The other by Messrs. Duncan Stewart, is a most admirable small mill, costing about £30.

Various other Economic Plants.

Tobacco.—The area cultivated is steadily increasing, but it is not as great yet as it was in 1881-82. Seed from good Havanna tobacco growing in Jamaica, kindly supplied by Mr. Quesada of Kingston and by Mr. Antonio Leon of Temple Hall, has been distributed amongst settlers with the hope that it will yield a superior leaf. Sir J. D. Hooker, writing lately with reference to Jamaica cigars, says, "they are a very great improvement on even the best that I have previously had. They have an excellent flavour and burn well. I do hope that by selection even finer qualities will be raised in Jamaica. It only wants judicious measures for a few years on the part of some grower who will give his *whole mind* to it: choosing different sites, soils and seeds." That Jamaica tobacco is of a superior quality is testified by the fact that Jamaica divided the prize for the best tobacco grown in British Colonies, given by the London Chamber of Commerce. But it must not only be carefully cultivated, it must also be properly cured. Information on the whole subject will be found in Bulletin No. 13 in Mr. Espin's Treatise. If a settler will earnestly devote himself to the culture and cure of tobacco he will find that it is very remunerative. For instance, there are some 20 acres cultivated by an intelligent Cuban at an annual cost of £300. The yield is 10,000lbs., which sells if of good quality, at £7 per 100lbs.; that is, he nets £20 per acre.

Coffee.—The area under cultivation is increasing, being higher than in any year since 1882. The high price given for coffee has induced planters in other West Indian Islands to recommence the cultivation, and our Blue Mountain Coffee has obtained such a name that applications for seed have been received not only from the West Indies but from Fiji, West and South Africa and the East Indies.

Nutmegs.—The demand for plants is increasing and I anticipate that at least 20,000 seedlings will be required during next year Arrangements have been made to grow plants in the Gardens from the very finest seed procurable from the best estates in the West Indies. The plants will be sold at cost price.

Banana.—During the first half year of this period, there were 1,554,904 bunches exported, of the value of £142,532 17 4. During the succeeding 12 months, there were 4,847,659 bunches exported valued at £444,368 14 10 which is nearly three times the amount exported 5 years ago. The cultivation is increasing rapidly. Careful attention is given on large estates to ploughing, draining, &c., and small settlers are beginning to perceive the advantage to be derived from keeping their lands clean. In many cases, cocoa and nutmegs are planted under the shade of the bananas with the anticipation that, even if bananas fail in a few years' time to be a paying crop, there will be a permanent crop ready to take its place. This wise forethought should be more widely followed.

Herbarium.

The Herbarium has been increased by collections made in the Island, and by contributions made by the Director of Kew Gardens of duplicate ferns and other plants, collected in Cuba by Baron Eggers; in St. Vincent, Dominica and St. Lucia, by the collectors for the Royal Society's Committee for the investigation of the fauna and flora of the lesser West India Islands; in Porto Rico by Sintenis, and in loupe by Mazé; in Demerara by Mr. Jenman.

All the plants sent from Kew were named there, and are therefore authoritative, and will be of the greatest service in working out the flora of Jamaica and comparing it with the floras of the other West Indian Islands. These specimens have all been mounted on sheets of paper and put in their proper places in the Cabinets. The Cabinets are quite full, and it is necessary to provide another set.

I regret very much that I have had almost no time at all for work in the Herbarium. To carry on the work to the greatest advantage, it is important that the help of some one who has made some progress in botanical science should be obtained. I would like to have the opportunity of issuing in the "Bulletin" from time to time descriptions of Jamaica plants for the benefit of those who are interested in collecting and who wish to learn their names. Grisebach's "Flora of the West Indies" is expensive, and out of the reach of many. It is moreover not altogether suited for those whom I most wish to help,—those who are only commencing the study of systematic botany, or who have not made any very great progress. I am pleased to say that there are many with whom I am in correspondence who take a lively interest in the plants, and express their gratitude for any help which may be given. For my part I am very grateful to my correspondents in all parts of the island for sending specimens and for the very great trouble which they take in getting plants for me which I may be particularly anxious to have. To give an instance by way of illustration, there were no specimens of flowers or fruit of Cogwood in any of the Herbaria in Europe, and it was known only from the leaves, from which it was not possible to come to any decision. though it was conjectured that it belonged to the same order as the Timber Sweet Wood, *(Laurineæ)*. I wrote to numerous persons in different localities, asking them to look out for flowers and fruit. Many were perfect strangers but all did their best to help. The tree is large, and both flowers and fruit inconspicuous, so that it was some time before any success was obtained. At length Mr. George Douet and Dr. Dewar were able to send specimens, one of the flowers only, the other of the fruit only, It was then examined by Professor Oliver of Kew, and pronounced to be an undescribed species of Zizyphus, *(Z. Chloroxylon)*, a genus, hitherto, not known to exist in the West Indies, and belonging to a different order from the Sweet wood. It is of course, important to get all the information possible about the native timbers, and I am greatly indebted to all those whether successful or not, who helped me on this and on other occasions.

In connection with these remarks, I may add that I shall be thankful to any who will point out corrections to be made in my "Index to Economic Plants,' issued at the time of the Exhibition and who will give further information on soils, elevation, uses, &c., which may be considered in preparing another edition for the Imperial Institute, and the Chicago Exhibition.

As illustrations to the "Index," I had a set of Herbarium specimens prepared, and placed together with a collection of ferns in revolving frames, in the Jamaice Institute Court in the Exhibition. This collection, supplemented by further collections in cabinets, was much appreciated by those who took any interest in the subject, and was carefully studied by many.

Library.

The Library has received considerable additions, and several books have been placed in it which could be lent under certain restrictions to those interested in special branches. Loans have been made with satisfactory results.

A number of books and pamphlets have been presented by the Director of the Royal Gardens, Kew, to whom my grateful thanks are due, as also to those who have freely contributed Reports, Bulletins, Journals, Newspapers, &c.

A catalogue of books is appended.

W. Fawcett,
Director of Public Gardens and Plantations.

APPENDIX.

Catalogue of Books added to the Library. (The names of Donors are printed in italics in square brackets.)

Balfour, (Prof. I. B. and others). Annals of Botany. London and Oxford.). 1889-91. 8vo.

Beccari, (O.). Le Palme incluse nel genere Cocos, Linn. (Extract from *Malpighia I. viii.*) Messina. 1888. 4to. [*Kew.*]

Bentham, (G.). Plantæ Hartwegianæ. London. 1839-57. 8vo. [*Kew.*]

Bentham, (G.) and Oersted, (A. S.). Leguminosæ Centro-americanæ. (Extract from *Vidensk. Medd.*) Copenhagen. 1853. 8vo. [*Kew.*]

Burbidge, (F. W.). Cultivated Plants; their propagation and improvement. Edinburgh and London. 1877. 8vo.

Campbell, (Dr. D. H.). Structural and Systematic Botany. Boston, U. S. A. 1890. 8vo.

Detmer, (Dr. W.). Physiologie Végétale. Translated by Dr. H. Michels. Paris. 1890. 8vo.

Duthie, (J. F.). Field and Garden Crops of North Western India. Parts 1 and 2. Roorkee. 1882-83. Fol. [*Kew*].

Duthie, (J. F.). Illustrations of Indigenous Fodder Grasses. Part 2. Roorkee. 1887. Fol. [*Kew.*]

Edmonds, (H.). Elementary Botany . . . London. 1889. 8vo. [*Publishers, through Messrs. Dulau.*]

Eichler, (A. W.). Uber den Blüthenbau der Zingiberaceen. (Extract from *Sitz der K. Akad. d. W.*) 1884. 8vo.

Fish, (D. T. and others). Cassell's Popular Gardening. 4 Vols. London, &c. 8vo.

Fream, (W.). Soils and their properties. London. 1890. 8vo.

Gamble, (J. S.). Manual of Indian Timbers ...Calcutta. 1881. 8vo.

Grisebach, (A.). Plantae Wrightianae, e Cuba orientali. Cantab. U. S. 1860. 4to.

Hackel, (E.) The True Grasses. Translated by F. Lanson Scribner and E. A. Southworth. New York. 1890. 8vo.

Holmes, (E. M.) Botanical Note Book...... London. 1878. 8vo. [*Dulau.*]

Journal of the Royal Agricultural Society. Vol. 25. 2nd Series. London. 1889. 8vo.

Kew, Royal Gardens. Bulletin of Miscellaneous Information. London. Oct., 1889, to March, 1891. 8vo. [*Kew.*]

Knight, (Chas.). Cyclopædia of Industry... London. 1851. 8vo. [*Kew.*]

Kny, (L.) Botanische Wandtafeln. viii. Berlin. 1874. Fol. Text 8vo.

Lardner, (H. H.). Cultivation and preparation for Export...of Products...in Sierra Leone. London. 1890. 8vo. [*Kew.*]

Liddell, (Dr., and Dr. Scott.) Greek–English Lexicon. London. 1889. 8vo.

Lloyd, (J. N., & C. G. Lloyd.) Drugs and Medicines of North America. Nos. 1–4. Cincinnati. 1884. [*Kew.*]

Lock, (C. J. W.). Spons' Encyclopædia of the Industrial Arts, Manufactures, and Raw Commercial Products. Edited by C. J. W. L. 2 Vols. London. 1882. 8vo.

Lindau, (Dr. G.). Monographia generis Coccolobae. (Extract from *Engler's Botanischen Jahrbüchern*). Leipzig. 1890. 8vo. [*Kew.*]

Lockyer, (Norman and others). Nature. May 1890 to March 1891. London. 8vo.

Masters, (Dr. M. T.). Plant Life. 2nd Ed. London. 8vo.

Masters, (Dr. M. T.). Botany for Beginners......London. 1872. 8vo.

Maiden, (J. H.). Wattles and Wattle-Barks ......Sydney. 1890. 8vo.

McNab, (Prof. W. R., M. D.) Botany : Morphology and Physiology. London, 1888. 16mo. [*Publishers, through Messrs Dulau.*]

McNab, (Prof W. R., M. D.). Botany : Outlines of Classification of Plants. London. 1889. 16mo. [*Publishers, through Messrs. Dulau.*]

Morton, (J. C. & others). The Crops. 4th Ed. London. 8vo.

Mueller, (Dr. J.). Lichenes Portoricenses. (Extract "*Flora,*" *No.* 32.) Regensburg. 1888. 8vo.

Oersted, (A. S.). Palmae Centro-americanae. (Extract from *Vidensk. Medd.*) Copenhagen. 1858. 8vo. [*Kew.*]

Oersted, (A. S.). Plantae Novae Centro-americane. (Extract from *Vidensk. Medd.*) Copenhagen. 1858. 8vo. [*Kew.*]

Oliver, (Prof. D.). First Book of Indian Botany. London, 1869. 8vo.

Presl, (J. S.). Reliquiae Haenkeanae...... Prague. 1830. Fol. [*Kew.*]

Plumier, (C.). Description des Plantes de l'Amèrique. Paris. 1693. Fol [*Kew.*]

Radlkofer, (von L.)......Henoonia. (Extract from *Sitz. d. k. b. Akad. d. W.*) Munich. 1888. 8vo. [*Kew.*]

Radlkofer, (von L.)......Ueber die Gliederung der Familie der Sapindaceen. (Extract from *Sitz. d. k. b. Akad. d. W.*) Munich. 1888. 8vo. [*Kew.*]

Sachs, (J. von.) History of Botany. 1530 to 1860. Translated by H. E. F. Garnsey & I. B. Balfour. Oxford 1890. 8vo.

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

Sargent, (C. S.). Catalogue of Forest Trees of N. America. Washington. 1880. 8vo.

Schlich, (W.). Manual of Forestry. Vols. I and II. London. 1889. 8vo.

Shortt, (Dr. J.)...Indigo...Madras. 1862. 8vo.

Smith, (J.)...Filices of Panama. (Reprint from Seemann's Botany of the Voyage of H. M. S. "Herald.") [*Kew.*]

Smith, (Dr. Wm.). Smaller Latin—English Dictionary. London. 1889. 8vo.

Tanner, (Prof. H.). The Alphabet of the Principles of Agriculture. London. 8vo.
- Further steps in the Principles of Agriculture. London. 8vo.
- Elementary School Readings on the Principles of Agriculture. London. 8vo.
- First Principles of Agriculture. London. 1890. 18mo.
- Elementary Lessons in the Science of Agricultural Practice. London. 1887. Fcap. 8vo.

Thome, (O. W.). Text Book of Structural and Physiological Botany. Translated by Prof. A. W. Bennett. London. 1887. 8vo. [*Publishers, through Messrs. Dulau.*]

Trinius, (C. B.). Bambuseæ. Paniceæ. Phalarideæ. Supplementum. Agrostideæ. 1835-1841. 4to. [*Kew.*]

Veitch, (Jas.) A Manual of Orchidaceous Plants...Parts 5, 6, 7. London. 8vo.

Vuillemin, (P.). Biologie Végétale. Paris. 1888. 8vo.

Ward, (Prof. H. M.). Timber and some of its Diseases. London. 1888. 8vo.

Watt, (Dr Geo. and others). Dictionary of the Economic Products of India. Vols I and II. A—C. Calcutta. 1889. 8vo.

Watts, (Dr. W. M.). School Flora...London. 1887. 8vo. (*Publishers, through Messrs. Dulau*).

Wendland, (H.). Index Palmarum...quae in hortis europaeis coluntur....Hanover. 1854. 8vo.

Wood, (H. Trueman). Reports on the Colonial Sections of the Exhibition. London. 1887. 8vo. [*Kew.*]

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BULLETIN

OF THE

BOTANICAL DEPARTMENT,

JAMAICA.

CONTENTS:

PRICE—Two-pence.

JAMAICA:
GOVERNMENT PRINTING OFFICE, 79 DUKE STREET, KINGSTON.
1892.

STRAWBERRY CULTIVATION.

Propagation is effected by taking off runners, or by sowing seed.

Alpine Strawberries (red and white) are always best raised from seed, and the plants are not kept longer than two years.

Select largest fruit, quite ripe; crush, and dry on paper. Before sowing, put the seeds in water, and only sow those which sink.

Sow in boxes, keep under shade, just sheltering from direct rays of sun, and plant out when the leaves are well developed.

Well rooted runners may be obtained for transplanting by loosening soil round the largest and healthiest runners to allow roots to develop.

Only those required for propagation should be allowed to remain, unless the plants are going too much to leaf.

Soil.—Any garden soil is suitable; for cultivation on a large scale, a loamy soil in a moist situation should be chosen. If the soil is rather clayey, dig in plenty of rotten leaves; and in any case the ground should be well manured.

Planting.—The best time for planting is during showery weather. The soil should be made quite firm about the roots. The seedlings or runners should be put 1½ feet asunder in rows,—the rows being 2 ft. to 2½ ft. apart. But Alpines and other varieties with small fruit may be planted closer.

Cultivation.—Weeding must be done by hand, as the roots are very numerous and close to the surface.

Forking between the plants is advantageous, if carefully done, so as not to injure the roots.

As the fruit is much superior on young plants, the strawberry beds should be partially renewed every year, and the plants not left longer than 3 or 4 years.

Just before the flowers open, short, rotten manure should be spread over the ground; and above this, when the fruit begins to change colour, a layer of clean straw, or dry grass should be strewn.

If there is dry weather, or if the soil is very light, when the fruits are swelling, the ground should be watered heavily.

If it is desired to get very large and choice fruit, only 4 of the flower-scapes should be allowed to remain, the rest being removed with the leaves at their base. And, as the lowest blossoms on the scape produce the finest fruit, all the flowers above these, appearing later, are clipped off.

If the strawberries are attacked by slugs or snails, lay down fresh lettuce or cabbage leaves through the plants, and search these every morning. A line of wood-ashes, soot, or quick lime, surrounding the bed, will prevent incursions from other parts of the garden.

LIQUORICE (Glycyrrhiza glabra, Linn.)

The quantities of Liquorice in different countries vary greatly. It is said that the juice from Turkey and Greece is bitter, of Sicily and Spain sweet and rich, but that of Italy the richest, though less is exported thence. Liquorice in these countries is a vigorous and abundant wild plant, almost too much so in many places In Spain it grows finest in the rich bottom lands of the great rivers, and the crop depends much on the mildness or severity of the winters. It is of such vigorous growth that other weeds cannot encroach on it and crowd it out, and no parasite or insect pest is known to infest it. It is so tenacious of life that if only a small portion of the root is left in the ground after the collecting season it shoots up again. There are two kinds of liquorice, one sending down a tap root from 3 to 6 feet deep, and the other runs underground from 6 inches to 2 or 3 feet deep. The latter is the most highly prized, from the facility with which it is dug up. Only the roots are used, the tops being burned for fuel. It varies in quantity and quality according to soil in different provinces, changes its colour to red, yellow or brown, and the proportions of saccharine and starch vary also. The climate best suited to the growth of liquorice is that where oranges and all the *citrus* family thrive, as it cannot endure severe ground frost nor cold high altitudes. In Sicily it grows most luxuriantly in low lands adjacent to streams of water. The valley of the river Simeto is so rich that, with the rudest tools and culture, the peasants have no difficulty in growing cereals and other plants for food. Their principal trouble is keeping down the weeds that spring up so abundantly in the cultivated lands, and the liquorice from its pertinacity is most dreaded. A crop can be gathered every three or four years from the same ground, and the digging commences after the autumn rains have set in. Liquorice requires the hot sun to perfect its juice, but at the same time it bakes the ground so hard, the task of collecting the deep-set roots would be too laborious and expensive till the earth is well saturated. There are seven manufactories in Catania alone, and they produce from 700,000 to 800,000 lbs. annually, and others in various cities of the island. Very little of the root is exported either from Sicily or Italy, only the rolls or sticks made from the inspissated juice. Asia Minor exports largely to the United States. So long ago as 1885 steam presses were in use there, and from Alexandreth, in Smyrna, 6,000 tons were exported at a value of about $192,000. *(Chemist and Druggist, Aug. '91.)*

CASSAVA. Manihot utilissima, Pohl.

Cassava is a native probably of Brazil. It is a half-shrubby perennial, with very large yellowish roots filled with a milky juice, generally poisonous; leaves large, very deeply divided into 3 to 7 segments; fruit with six narrow, thick wings. (*Euphorbiaceæ.*)

There are a number of varieties, according to colour of stem and division of leaves. There is also one with a non-poisonous juice in the root. But the plant generally known as "Sweet Cassava," is without wings on the fruit, and has a reddish root. (*Manihot Aipi*, Pohl.)

Bitter Cassava Root abounds in a milky poisonous juice, and does not become soft by boiling or roasting.

Sweet Cassava Root has a non-poisonous juice, has tough portions in the centre, but becomes quite soft by boiling, and is eaten like potatoes.

Cassava Meal is prepared from both kinds. The root is grated, by which the cells, containing the juice and starch-grains, are broken up. The grated material is placed under pressure, sometimes with water pouring through it The pressure squeezes out all the juice; while a certain proportion of the starch-grains passes over with the liquor. The substance left under pressure consists chiefly of the cell-walls broken up, but also of some starch-grains. This is Cassava Meal which is dried on hot plates, and made into Cassava cakes. The liquor which passes away under pressure, being the pure juice only, or the juice mixed with water, is allowed to stand for some time, when the starch settles to the bottom, and the liquor is poured off. The starch-grains, as seen under the microscope, are mullar-shaped. This is Cassava starch proper, as distinguished from Cassava meal.

Tapioca is prepared by heating moistened cassava starch on hot plates This process alters the grains, which swell up, many bursting, and then they agglomerate in small irregular masses.

Cassareep is the juice of the bitter cassava root, concentrated by heat, which also dissipates the volatile poisonous principle. The same is further flavoured with aromatics. Boiled with peppers and fish or meat, it forms the West Indian "pepper-pot."

The following notes on making Cassava Cakes, Tapioca and Cassareep are kindly contributed by a correspondent :—

Cassareep. Grate the Cassava and squeeze out the juice, which is to be put aside for about 3 days. Add one pint of fine salt to every twelve quarts, and then boil down until it becomes like syrup. If it is intended for long keeping, it must be boiled thick. Put aside in jars, till required for bottling.

Tapioca. Grate the Cassava. Wash it by putting in a cloth and pouring clean water on it till all the starch is washed out. The water containing the starch must be set down till all the starch has settled, and the water at the top is quite clear. Decant the water, leaving the starch at the bottom. Wash again with clean water, allow it to settle, and pour off the water. Take up the starch in lumps, and put it to quail a little in the sun. Then mash it up fine. and sieve it. Put a large baking iron on the fire, and bake it in cakes not too thick The iron should not be too hot, as the cakes must not be baked brown. Then dry well in the sun, and beat in a mortar, coarse or fine, as required. If sieved, it will give two qualities, fine and coarse.

Cassava Cakes. Grate and squeeze well, but do not wash. After squeezing, let the lumps dry very slightly in the sun. Beat in a mortar and sieve. Bake on the iron thin or thick, according as Bammies or thick cakes are wanted.

VEGETABLES.

With reference to the articles on cultivation of vegetables, a correspondent writes as follows :—"I have found that the first rains in January and July, if they are more than short showers are the two best months for foreign seeds: if no rains in January and July, February and August become the months. It is remarkable how soon seeds lose their vitality in Jamaica, if at all exposed. My plan was to pack in brown paper, then place in a glass bottle with a screw top until full, and then wrap and place in a dry dark place. It was some trouble, but then I could keep seeds in vitality for the rains as they come. This was in the Clarendon mountains."

This note on the best months for sowing in the Clarendon mountains is just the information that it is important to obtain for every district in Jamaica, and I venture to hope others will assist me in the same way.

With regard to putting by seeds, the caution might be added that the paper should be thoroughly dried in the sun or an oven before being used for wrapping the seeds.

The same correspondent continues :—"In St. Andrew I used to collect in the higher mountains wild parsnip seed and wild carrot seed, and sow them in well prepared and rich, manured soils, and I reaped first rate crops. I also did much with rape. This tillers well, and the sprouts would readily grow. I also collected cabbage seed at a high altitude, and the sowing gave curious results. All kinds and sorts came up. For ready growth however the tiller cabbage, called greengage, is the best. It only grows from the sprouts. All the cabbage supply here (in St. Ann) is from the red mountain soil, say 1,400 to 2,000 feet above sea-level, and is the said greengage. I used also to have a varied culture of beans and peas, black eye and others. The yellow dwarf and an angular pea from South America are very prolific and very hardy. All these require to be kept carefully in darkness and quite dry, and not always then could the stock for seed be kept fresh and vigorous."

These experiments on the seeds of wild plants are very interesting as experiments, but for the purpose of growing vegetables for use, it is much better to purchase imported seeds of the best kind. It is said that plants deteriorate in Jamaica, if grown from seed produced here. One reason for this may be that the seeds are not kept sufficiently long after being collected. W. F.

BAY RUM.

The correspondent in Dominica, Mr. H. F. Green, who sent me information about the manufacture of Bay Rum published in Bulletin No. 26, adds a further note :—

"The dried leaves of *Pimenta acris* are shipped in large quantities from here to New York. They are generally sent away in large bales, weighing some 200 lbs. each."

GINGER.

Cultivation and Curing in Jamaica.

A grower of ginger near Christiana gives some interesting details on this subject, for which I am indebted to Mr. Geo. Douet :—

"With regard to yield per acre, it depends entirely on the nature of the soil, whether it is suited for ginger or not, and how it is planted and cured, and whether the seasons are favourable. The average for one acre would be from 10 to 15 hundred pounds, that is, when it is dried, perfectly cured and fit for market. A good crop may yield as much as 20 hundred pounds.

As long as the ginger, when dug up is kept from the sun, it need not be peeled for 2 or 3 days.

After peeling for the day, put them to soak in plenty of water over night In the morning, wash, clean, and weigh. Put on mats, turn over carefully each piece at midday for six or eight days until cured. As sun goes down, take them in. Do not let them get wet or they will mildew.

The trouble of curing is not much, for each peeler washes her own share, and helps to lay them out. One person can easily attend to 7 or 8 peelers, and do odd jobs besides.

It takes 3 lbs. of green ginger to make 1 lb. of dry."

A Correction.—In Bulletin No. 26, in article on Ginger, page 6, fourth last line, omit word "water."

FERNS : SYNOPTICAL LIST.—VIII.

Synoptical List, with descriptions, of the Ferns and Fern-Allies of Jamaica by G. S. Jenman, Superintendent, Botanical Gardens, Demerara (continued).

8. *Cyathea Tussacii*, Desv.—Stem very stout, attaining 20-25 ft. high, prickly and rough with ragged scars ; stipites stout ; densely armed with strong curved sharp spines, 1½-3½ ft. l. greyish-scurfy clothed above with long attenuated very narrow rather fibrillose scales ; fronds large, tripinnate, about 8. ft. l. and 4 ft. w. very coriaceous and rigid, dark dull green above, rather glaucous beneath, rachis stout, freely asperous prickly beneath, and with the costæ, which are also asperous, grey fibrillose and scurfy : pinnæ opposite or nearly so, 1½-2 ft. l. 6-8 in. w. usually not quite sessile, pinnulæ close, sessile, serrate-acuminate, about 4 in. l. and ⅝ in. w. fully pinnate at the base, almost as deeply pinnatifid above, shortly acuminate ; segments close, curved or subfalcate, acute or bluntish, about 5 li. l, 1-1½ li. w., the margins even and incurved when dry ; veins once forked near the base ; sori at the forking of the one to three lower veins, close against the costules ; involucres cupshaped, very thin and sometimes shrivelling.

Var. *magnifolia.*—Fronds much larger, chartaceous, vestiture much less, pinnæ 2½ ft. l. 10 in. w. pinnulæ 5 in. l. 1 in. w. rather more tapering, deeply serrated at the apex ; segments flatter, broader, subcrenulate in the outer part, pale grey beneath ; veins once or twice forked ; sori smaller, sparser, greyish.

Very abundant in forests from 4,000–6,000 ft. alt., chiefly in damp gloomy ravines. A large, very robust species, perhaps the most robust of all, of grisly aspect, the large flatly spreading head of a dark dull colour. The coating of grey scurf gives the vascular parts the aspect of being powdered, over which are the grey scales, which vary in form in the different parts. This vestiture readily distinguishes it.* In some instances, as mentioned under *concinna*, late in the resting season, about May or June, the fronds all drop away, leaving the bare trunk. When vegetation begins again, a whorl is thrown up together.

9. *C. insignis*, Eat.—Stem stout, reaching 20 ft. or more high, densely clothed at the top with matted pale brown very narrow scales ; stipites spreading, stout, asperous but quite devoid of prickles, similarly clothed to the trunk ; fronds forming a rather flat head, ample, tripinate, 7-8 ft. l. 3½–4 ft. w. subcoriaceous, dark green above, glaucous beneath ; rachis strong, somewhat scurfy scaly, dark greyish brown, castæ slightly rusty tomentose above, deciduously scurfy beneath, costulæ and ribs beneath with minute stellated scales, surfaces otherwise naked ; pinnæ approximate, 1½–2½ ft. l. 6–8 in. w. nearly sessile, drooping at the ends ; pinulæ close, very numerous, sessile, acuminate, the point rather long and subentire or serrate, fully pinnate at the base, above this very deeply pinatifid, 3–4 in. l. ½–¾ in. w. ; segments curved or subfalcate, acute or obtuse, 4–6 li. l. 1–1½ li. w. even or crenulate edged, the basal pair, which are usually enlarged, often lobed or pinnatifid, and overlapping the costæ : veins once or twice forked below the middle, pellucid : sori copious inserted near the forking, reacking from the base to the top of the segment and filling up the space between the midrib and recurved edges : involucres thin glaucous, hemispherical, bursting irregularly from the top, —*C. princeps*, J. Smith.

Plentiful in situations at 4,000–5,000 ft. alt. but not generally diffused, gathered on the slopes of Catherine's Peak and of Blue Mountain Peak and at several intervening places, where it is common and as a rule gregarious, growing both in shade and out. A particularly fine plant, the stem 6 in.

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* *C. Imrayana*, Hook., of Dominica, mistakingly referred by the Author later to this species, has hemispherical involucres, quite correctly shown in Sp. Fil. Vol. I., t. 9. B.

thick, and well distinguished by the dense subulate vestiture, entire absence of prickles, thin hemispherical pruinose coloured involucres. Like the two preceding, it makes its growth periodically, throwing out a tier of fronds at once and then resting for an interval.

10. *C. gracilis*, Griseb.—Stem erect or decumbent, 2½-3 in. thick occasionally reaching 10 ft. high, clothed with the appressed persistent bases of past stipites; stipites erect, spreading 2·2½ ft. l. dark bright chestnut, slightly warty at the base, but quite unarmed, and densely clothed with rather large ovate-acuminate scales of like chestnut colour; fronds relatively large, but slender and lax, 4-7 ft. l. 3-3½ ft. w. tripinnate, chartaceous, dark green, naked; rachis and costæ dark bright brown, the latter and the costulæ rusty pubescent above, all otherwise naked; pinnæ lax, 1¼-2 ft. l. 5-10 in. w. truncate and petioled at the base, the petioles 1-2 in l. apex serrate-accuminate; pinnulæ distant, truncate and petioled below, the point serrate-accuminate, 3-5½ in. l. 1-2 in w. pinnate or only pinnatifid the costæ very slender; segments flat, oblong, incised throughout, or (in the pinnate pinnulæ) lobed half way to the midrib, blunt or rounded, ½ 1¼ in. l 2 4 li. w.; veins once to thrice forked; sori rather large, situated at the forking; involucres delicately thin, hemispherical, split to the base eventually into 3 5 sepal-like pieces, exposing the sporangia and the setiferous receptacle.

Very plentiful in sheltered situations in forest at 5,000-6000 ft. alt. in the region of the Govt. Cinchona Plantation, where it is gregarious in slight valleys or depressions of the ground, growing in leaf mould. The stem is rather soft and fibrous outside from the decaying stipites and coating of aerial rootlets, the woody portion being only about 1½ inches in diameter. It is usually short, but reaches in occasional instances 10-12 ft. The root hold in the peaty soil is not very firm, so that the stems frequently fall and lie procumbent, though this does not much affect the growth. The pinnæ drop with age, the dead stick-like rachises of past, remaining with the present, fronds. The species is remarkable for its very lax habit, the parts being relatively broader, distant and conspicuously peticled.

11. *C. dissoluta*, Baker.—Stem 6-10 ft. high, 2½-3 in thick, clothed above with chestnut scales; stipites spreading, castaneous, prickly and asperous, the spines short straight and bluntish, densely paleaceous at the base like the stem; fronds tripinnate, 3-4½ ft. l. 1½-2 ft. or over w. chartaceous, dark green, rachis, costæ and costulæ castaneous, the two latter puberulous beneath and rusty pubescent above, the last having small chestnut rather bullate scales mixed with a few fibrils beneath which extend to the ribs and veins, other parts glabrous; pinnæ approximate, ¾-1¼ ft. l. 4-6 in w. shortly petioled; pinnulæ near, 2 3 in l. ½-¾ in. w. sessile or the lower barely stipitate, serrate-acuminate, fully pinnate at the base, almost as deeply pinnatifid above that; segments oblong, flat, somewhat curved, close, 4-5 li. l. 1½ li. w. blunt, serrulate throughout; veins generally once forked; sori at or just below the forking, near the rib, extending ½ or ⅔ up the segments; involucres chestnut brown, thin, hemispherical, breaking down irregularly to the base into spreading calyciform or not, lobes, exposing the setiferous receptacle.

Infrequent in forests, sometimes associated with *furfuracea* and *gracilis*, at 5,000-6,000 ft. alt. gathered a short way below Morce's Gap, at Portland Gap, and other situations of about the same elevation. I have said under that species that in cutting and form this and *Alsophila parvula* have a very close resemblance. In addition to the generic character, they contrast however in the colour of their vascular parts and vestiture, *A. parvula* too having a much taller more slender stem, and occupying a much lower range of altitude. The sori appear to be larger in the smaller specimens. When freshly gathered the substance is pellucid, with crowded minute grey dots on the underside.

12. *C. Schanschin*, Mart.—Stem reaching several feet high, about 3 in. thick, clothed with very dark castaneous scales at the top; stipites rather slender, castaneous or blackish, glossy, 1-1½ ft. l. freely armed with short straight spines and clothed at the base with scales like those of the stem; fronds spreading, tripinnatifid, 3½-5 ft. l. 2-2½ ft. w. chartaceous, dark green above, subglauceous beneath, rachis costæ and costulæ rusty pubescent especially above, with similar minute scales scattered generally over both surfaces of the segments; pinnæ 1-1½ ft. l. 4-6 in. w. generally shortly petiolate; pinnulæ 2-3¼ in. l. ½ in. w. approximate or with half their own with between, shortly stipitate, deeply pinnatifid, or casually fully pinnate at the base, the point serrulate-acuminate; segments 3-4 li. l. 1½ li. w. oblong blunt, hardly curved, finely serrulate, or subentire, a little expanded at the base, the lowest one being on the inferior side of the pinnulæ; veins pellucid, once forked above the middle, or simple; sori small, situated at or below the forking ascending ½ ⅔ up the segment; involucres very thin, breaking down calyciform, revealing the small ciliate receptacles.

Common on the highest slopes and peaks of the Blue Mountains, attaining the highest elevation in the country, higher than any other species of tree fern. On the slopes just under the Blue Mountain Peak it is common, but ascends though somewhat reduced in size, to the summit. The slightly pedicellate pinnulæ, rather zigzag costæ glaucous underside and ciliate surfaces well mark the species from those near it. The stipites and trunk are peculiarly dark, and look almost black in the forest. At first the sporangia show clearly through the delicately thin involucres.

13. *C. furfuracea*, Baker.—Stem reaching several ft. high, 2½-3 in. thick, even surfaced, the scars small and close, freely clothed at the top with ferruginous scales; stipites 1·1½ ft. l. erect spreading, dark bright brown, the base densely clothed with scales like those of the stem, and freely armed with short bluntish spines, fronds drooping at the ends, 3½-4½ ft. l.2 ft. w. or over chartaceous, dull green above, pale beneath, rachis asperous, brown rather rusty pubescent above, costæ slender, greyish pubescent above slightly muricate beneath, with a few deciduous scattered linear lanceolate dark brown scales, which, reduced in size, extend to the costulæ and ribs, the two latter parts densely coated beneath with meal coloured, more or less bullate, and acuminate scales, the other surface on both sides, but chiefly the under, bearing small scattered greyish fibrils; pinnæ 1-1¼ ft. l. 3½-4 in. w. approximate, nearly sessile or shortly pedicillate, shortly acuminate; pinnulæ close, or with a slight space be-

tween, sessile, very deeply pinnatifid or the lower ones fully pinnate at their base, the apices shortly acuminate and serrulate, 3-3½ in. l. 6-7 li. w. segments flat, close, barely curved, the point rounded and serrulate, 3-4 li. l. 1½ li. w.; veins once forked from the middle, or simple : sori at or below the forking ascending ½-⅔ up the the segments; involucres fragile, hemispherical, breaking down irregularly calyciform.

Very common in forests and on wayside banks from 4,000-6,000 ft. alt. The trunk is comparatively slender, but attains occasionally a height of 40 or more ft. and is sometimes, though but rarely, branched, bearing two or three heads. Its much taller trunk, copious meal-coloured vestiture of the costules and ribs, few pale fibrils scattered over the dull surfaces, and brighter ferruginous scales of the crown distinguish it at sight from its allies. The belt at 5,000 alt. seems to be its chief habitat though it extends equally, in diminishing quantity, both above and below that line.

14. *C. monstrabella*, Jenm.—Stem 2-3 in. thick, reaching 4 or more feet high, freely clothed at the top with castaneous scales; stipites 1-1¾ ft. l. chestnut brown at the base but straw coloured higher densely armed throughout with short straight bluntish spines, and at the base with linear-acuminate scales like those of the caudex; fronds spreading, 3-4 ft. l. 1¼-1¾ ft. w. bitripinnate, chartaceous dark green above, sub-pruinose beneath, rachis prickly or asperous at the base, bright stramineous, pale pubescent down the face as are the costæ and costulæ, the costæ furnished beneath with small narrow scattered brownish scales, the costulæ with minute bullate like-coloured ones; pinnæ subdistant, nearly or the upper, quite sessile, ¾-1 ft. l. 4-5 in. w. the apex lobate; pinnulæ with their own width between or subdistant, sessile, rounded and subentire at the base, 1½-2½ in. l. 4-5 li. w. cut almost to the costulæ into close blunt rounded slightly crenate lobes, which are 2. li. w. and d., veins flabellate or pinnate, the venules once or twice forked; sori situated at the forking, involucres hemispherical, very fragile, breaking down calyciform, exposing the setiferous receptacles.

Infrequent near Portland Gap, 5,000-6,000 alt. in forest, gathered twice by Nock, who describes it as having at a short distance the appearance of a *Marattia*. I hesitate equally to let it stand or remove it; it appears evidently to be an abnormal state, but whether of a known or otherwise unknown species I am unable to decide. Difference in colour and vestiture makes me hesitate in referring it to either *Schanschin* or *furfuracea*, to which species it is most closely allied. There is a tendency to tasseling in the fronds, for the upper pinnæ are forked from the base, the divisions being of equal length, a tendency that is also exhibited on the superior side by some of the lowest pinnulæ. These are often fully pinnate, and the segments oblong, characteristics no doubt of the normal state.

15. *C. conquisita*, Jenm.—Stem reaching several ft. high, stout, paleaceous above; fronds erect spreading, 5-6 ft. l. dark dull green above, beneath greyish, coriaceous, naked generally but with a few minute scales scattered on the ribs of the underside, both rachises and costæ castaneous and clothed above with a richly tinted chestnut pubescence; pinnæ approximate, 6-8 in. l. 1-1¼ in.. w. quite sessile, acuminate, fully pinnate at the base; segments linear-oblong, rounded at the apex and finely serrulate ¾ in. l. 2 li. w. spreading horizontally (not curved) in the lower half of the pinnæ where they are constricted at the base and open, with half their own width between, those above slightly dilated and connected with a sharp sinus between; veins once forked, the line of sori on each side rather nearer the midrib than margin; involucres thin and fragile, breaking down irregularly calyciform.——Wilson, n. 134, in J. Smith's ferns, Herb. Brit. Museum. Wilson's label says :—"A large growing tree fern, fronds nearly upright, and five or six feet long, stem large, quite a tree. Very different from n. 16." Number 16 is the following species here given, with which this has near affinity, but is distinguished by the open space that occurs between the segments at their base, whereby the inferior ones are isolated. The segments are also flatter, and the lines of sori and the veins show distinctly on the upperside.

16. *C. pendula*, Jenm.—Stem reaching several feet high, rather slender, scaly at the top; fronds pendent—spreading, coriaceous, dull dark green above, beneath glaucous, rachis channelled, and with the costæ clothed above with a bright castaneous pubescence, glabrous or slightly puberulous beneath, surfaces elsewhere naked; pinnæ sessile, 6-9 in. l. 1-1¼ in. w. deeply pinnatifid or at the base fully pinnate; segments 6—8 li. l. 1½—2 li. w, rounded and serrulate at the apex, slightly dilated at the connected base, the sinus between being narrow and sharp, veins once forked; sori situated at the forking, forming a line near the midrib; involucres thin and fragile, castaneous, breaking down calyciform. Wilson n. 16, J. Smith's ferns, Brit. Mus. Herb. No locality is given on the label, which says; "A tree fern, 8-10 ft. high, stem about the size of a man's wrist or smaller, fronds at the top only, which hang all round, hence its creole name, "Parasol Fern." Very different from 134. This and the preceding are only known from Wilson's specimens in the British Museum, which are insufficient to show whether they are simply bipinnate or tripinnate species, the former of which is inferred in the foregoing descriptions from the fact of the rachises being channelled. They require to be compared with *Hemitelia Sherringii*, with which, speaking from memory of the specimens, their alliance seems to be.

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THE SUGAR-CANE BORER.

(*Diatræa saccharalis*, Fabr.)

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

History.

Sir Hans Sloane, in his book on Jamaica (1.*) refers to the worm eating the sugar-canes, which he describes as not over one-third of an inch long, not so thick as a hen's quill, and of a reddish brown colour. In all probability, he observes, it is some sort of butterfly, moth, beetle, or weevill, which thrusts in the egg, from which the borer hatches, and feeds on the cane until it be ready to turn into an aurelia, when it comes out, and leaves a greyish skin, which he often found in the spoiled canes. The canes so eaten are not fit to make sugar, and therefore are ground to make rum, or given to the hogs to feed on.

The perfect insect was not seen by the author, and thus we are left in doubt as to the species, the more so, because the larva is said to be reddish-brown, which is not the case with the insect now to be considered; nevertheless it is highly probable that part at least of the damage complained of by Sir Hans Sloane was due to our insect.

In 1793, Fabricius (2.) described a moth from South America as *Phalæna saccharalis*, which is doubtless the same species as our Sugar-cane Borer; although Zeller, according to Comstock, (10.) was of opinion that the description given would apply to any one of several allied species. Turton (3.) gives a translation of the Fabrician description, as follows :—

"Wings striate cinereous, the hind margin dotted with black. Inhabits South America, in the sugar-cane, which it dries up and destroys; is very destructive to plantations. Body small cinereous immaculate; upper wings sometimes immaculate; lower wings white immaculate. Larva 6-footed, pale hyaline with a reddish-brown head and 8 dots each side; pupa naked long, chestnut-brown with numerous short raised spines before."

The statement "larva 6-footed," must be taken as applying only to the thoracic or true legs; the total number of legs is 16. Howard (21.) conjectures that the original specimens may have come from Dutch Guiana, which is the more likely, because the description of the larva was drawn up from a figure by Myhlenfels.

About 35 years later, the Rev. Lansdown Guilding (4.) wrote a memoir on the insects infesting the sugar-cane in the island of St. Vincent, an extract from which is given by Gosse (5.) in his "Naturalist's Sojourn in Jamaica." Mr. Guilding described the borer as a new genus and species, *Diatræa sacchari*, and wrote of it as follows :—

"By far the most destructive and common enemy is the smaller grub of the Borer-moth. . . . The sugar-cane is never exempt from this dreaded pest. In the seasonable island of St. Vincent, from improved cultivation, the animal is not very formidable; but in some other of our colonies, which, from the absence of mountains, or other causes, are subject to dry seasons, it has been known to blast the hopes of the year, to destroy whole acres of canes, and to ruin the unfortunate planter."

In 1856, Westwood (6.) wrote an article on the Sugar-cane Borer, and pointed out that it was apparently first described by Fabricius as *Phalæna saccharalis*. This identification has been generally accepted, and while some have referred the insect to the genus *Chilo* Zinck., most writers on the subject have recognised Guilding's genus as valid, calling the species *Diatræa saccharalis* (Fab.)

Two other specific names have been given to the insect, namely *obliteratellus*, Zeller (8.) and *crambidoides*, Grote.

Descriptive.

Egg.

The egg, as described by Comstock (10.) is flat and circular, one twenty-fifth of an inch in diameter, milk white with a faint greenish tinge when first deposited, turning orange-yellow when about to hatch. Seen with a microscope the whole surface is coarsely facetted.

Larva.

The newly-hatched borer, (again quoting Comstock) is "about 2 millim. long, broad at the head and tapering towards the end. The colour is orange-yellow, but each segment bears a row of reddish warts which give the whole larva a reddish appearance. The head is black, polished and very flat, and is of a very convenient shape for an entering wedge in forcing its way between leaf and stalk." This description was made from specimens infesting maize in the United States, but there seems to be little doubt that the species is identical with ours.

Mr. L. O. Howard (21.) comments on the considerable difference between the several published descriptions of the adult larva. These differences are such that one might well suppose that several species had been confounded under one, but experience has shown that the larva is extremely variable, as well as the moth. Prof. Riley examined a long series of the moths, reared from both corn and sugar-cane, and came to the conclusion that they must all be referred to a single species. Gosse (5.) writes :—"The caterpillar is of a yellowish colour, spotted with faint black dots, and in a slight degree hairy." The larvæ from British Guiana described by Miss Ormerod (9.) were also spotted, but she gives no detailed description.

* The numbers following authors' names refer to the Bibliography given at the end.

Comstock (10.) describes the specimens from maize as follows :—

"When full grown it [the larva] measures nearly, if not quite, an inch in length. It is nearly cylindrical, tapering slightly towards either end, and is furnished upon its back with many brown or blackish spots, six upon each segment, arranged in two transverse rows, four in the front row and two in the hind, the hind two slightly wider apart than the middle two of the front row. Each segment has also a spot on each side (lateral) and two below (subventral). In the late fall brood—the hibernating larvæ—these spots become obsolete, and they resemble very perfectly the borers found in sugar-cane."

Of the sugar-cane borers he says :—

"The full-grown borer is about an inch long, rather slender, nearly cylindrical, and cream-white in colour, with a yellow head and black mouth-parts."

Howard, (20.) remarking on these facts, observes :—

"All the larvæ which we had seen from sugar-cane up to the present year were entirely white, with yellow head and thoracic shield, but these were all full-grown individuals ready for hibernation, or which had hibernated. In Prof. Comstock's article (10.) it is shown that all hibernating larvæ found in corn by his correspondent, Dr. Anderson of Abeville County, S.C., were pure white without a trace of brown spots. Therefore the brown spots on the midsummer individuals in corn in South Carolina and Virginia afford no argument for the non-identity of the sugar-cane and corn borers. Moreover specimens from sugar-cane from Florida collected in October of the present year show the brown spots and variation in the colour of head and prothoracic shield noticed in corn specimens and are in fact indistinguishable from these. In addition to this, from my observations in Westmoreland County, Va., the past August, it seems probable that the loss of the spots is characteristic of the perfectly full-grown larva, as at this date the few delayed individuals of the first brood are all white."

Howard further describes and figures the larva, and writes concerning the variation in the spots, &c. :—" There is considerable variation in the size of these spots, and in some individuals they are comparatively small, while in others (alcoholic) they are so large as to give the whole larva a brownish effect. There are frequently in the alcholic specimens two subdorsal purplish longitudinal lines, and the head and prothoracic plate vary from bright honey-yellow to brown."

The larva in spirit which I received from Mr. Van Putten, of Roaring River Estate, is 7 millim. long (evidently immature), yellowish-white without spots, head brown.

Pupa.

Comstock (10.) says :—" The pupa is rather slender, three quarters of an inch long, dark brown in colour, and very rough upon the back when viewed with a lens." Howard (21.) gives an enlarged figure of the pupa.

Moth.

The Fabrician description, quoted above, evidently refers to the male Gosse (5.), on the other hand, describes the female, writing :—The *Diatræa sacchari* is a small-sized straw-coloured moth, with upper wings of a tint best described as an ochry-drab, varied with darkened lines and margined dots. The under wings are pale yellow."

Comstock (10.) says :—" The moth is of an ashy gray colour and has a wing expanse of about an inch and a quarter. With the female, the hind wings are nearly of the same colour as the fore, while with the male the former are silvery white."

Prof. Riley (see Howard, 21.) examined over fifty specimens, and found that "there is great variation both as to the distinctness of the transverse lines and of the terminal series of dots, and as to the general ground colour. It is also noticeable that the later-bred specimens from the South are, on the whole, darker. The males are generally much darker than the females." The moth is figured by Comstock (10.) and by Howard (21.)

HABITS.

Mr. Howard (21.) sums up the life-history thus :—" In early spring the parent moth lays her eggs upon the leaves of the young cane near the axils and the young borer penetrates the stalk at or near the joint and commences to tunnel, usually upwards, through the soft pith. The larval growth is rapid and the borer is active, and frequently leaves the stalk at one place and enters at another, making several holes in the course of its growth. When ready to transform, it burrows to the surface, making a hole for the exit of the future moth, and transforms to the pupa state. There are several generations in the course of a season and the insects hibernates in the larval state within the stalks."

Most of the above is taken from Comstock (10.), who gives the larval period as 30 days* when reared in confinement at Washington, but "in midsummer in the South the growth will probably be much more rapid." The duration of the pupa state in summer, he says, " is probably not more than six day or eight days." Eggs laid by a moth at Washington hatched in a week. Thus the whole period, from egg to moth, may be taken roughly at six weeks.

The larval period in the Lesser Antilles is given by Mr. G. W. Smith (24.) as about 30 days, but as his account of the habits appears to be derived from that of Comstock (10.), it seems probable that this statement is not founded on direct observation.

NATURAL ENEMIES.

Very little is known of the natural enemies of the Sugar-cane Borer. Mr. Smith (24.) write that " in some places it has been found that there are ants in the ground which prey upon the bores and help to keep it in check." Prof. Morgan (22.) found the larva of a beetle (*Chauliognathus pennsylvanicus*) in the burrows feeding on the boring larvæ in Louisiana.

* On p. 241 he says 30 days, but on p. 244, 37 days is given as the period. Probably one or other of these figure is a misprint.

Geographical Distribution.

Diatræa saccharalis appears to be a native of South America and the West Indies, or it may have originally occupied a limited area on the continent, and spread since the cultivation of the sugar-cane became general.

As related above, it has long been known from Jamaica. Guilding (4.) recorded it from St. Vincent in 1828. Comstock (10.) refers to its ravages in the Windward Islands, and particularly in Guadaloupe, in 1785 and 1786. Mr. Smith (24.) refers to its occurrence in the Lesser Antilles, mentioning St. Vincent and Grenada. Miss Ormerod (9.) records it from British Guiana. Mr. E A. Schwarz found it in the Bahamas. In the United States it has been found to attack maize and sorghum, as well as sugar-cane. Avequin (7.) recorded it from Louisiana as early as 1857, it having been apparently first noticed in 1855. Comstock (10.) refers to its occurrence in Louisiana, South Carolina, and Georgia. Ashmead (14) reports it from Florida. Howard (21.) gives details of its injury to corn in Virginia, and relates that Mr. Pergande found the larvæ in *Tripsacum* at the southern end of the Long Bridge crossing the Potomac River at Washington. Townsend (23.) found it in New Mexico, and it is reported by Weed from Mississippi. In Kit Carson Co., Colorado, a Corn-stalk Borer appeared in 1889, which the present writer (18.) suggested might be *Diatræa.*

It is a remarkable circumstance that in the United States it appears to be spreading northwards. At the 1891 meeting of the Association of Economic Entomolgists, Mr. Howard said "that this species is spreading northward rapidly through the Southern States and has reached the southern border of Maryland, but that it is not a pest to be feared with the methods of careful cultivation in vogue at the north."

It has also been reported from the Sandwich Islands (11.) In the Oriental Region, Cotes (17.) reports it as injuring sugar-cane in India. Westwood (6.) in 1856 wrote an article on the Cane-borer of Mauritius, which had been called *Proceras sacchariphagus*, and considered it probably identical with that described by Guilding. However, he gives a description of the Mauritius larva (see Howard, 21.) which is evidently different from ours. In Java, Dr. Kruger (20.) records four different borers, one of which, *Diatræa striatalis*, Snellen, occurs also in Borneo, Sumatra, and Singapore, and according to Howard (21.), almost exactly resembles the West Indian insect. In Queensland, Mr. H. Ling Roth (12.) found a species, which he believed identical with *D. saccharalis.*

Injuries.

The loss occasioned by the borer, in Jamaica as elsewhere, is very considerable.

Mr. D. A. Van Putten writes from Roaring River Estate under date 25th March, 1892 :—

"I now send you two pieces of cane, and a small phial with one of the worms in rum. The whole cane becomes rapidly dry, and the leaves perfectly dry, so that the stock will not feed on them, and the short top is useless for planting.

"The crop will fall off very much. We had estimated for 140 tons, but will not make more than 115 tons of sugar. Our neighbours I see are also affected with it."

The worm sent is immature, but evidently the larva of *D. saccharalis.* The canes have a very dried-up appearance, with tunnels in the centre of the pith. They are also attacked by two or three species of fungi, which probably follow the decay due to the borer.

It is scarcely necessary to enumerate the various accounts published concerning the damage done by the borer. Extracts bearing on this point are given above from Guilding and others. According to Comstock, Dr. J. B. Wilkinson states that in 1857 the borers were very abundant along the Lower Mississippi, the crop upon one plantation being utterly destroyed, as the canes broke to pieces without cutting.

Westwood (6.) was informed that the borer was very destructive in Jamaica about 1845.

Food-plants other than Sugar-cane.

In the United States, *D. saccharalis* has been found to severely attack maize (*Zea mays*); and Thompson (19.) writing from Louisiana, reported that sorghum (*Sorghum vulgare*) appeared to be far more viciously attacked than tropical cane. Another food-plant is *Tripsacum dactyloides*, or gama grass, in which the larvæ were found by Mr. Pergande at Washington. The occurrence of the borer in a wild grass may be of considerable practical importance, as it would be almost useless to kill the borers in the canes if they were breeding abundantly in an adjoining grass-patch. Grass growing near cane-fields should therefore be examined, and if found infested, burned at suitable intervals.

Remedies.

In Gosse's (5.) work, there is a quotation from a letter of Mr. Stephen Hannaford of St. Dorothy, to Mr. Hill, as follows :—

"The system of trashing and of keeping the canes clean is the best and surest method, as well to prevent the depredations of the borer, as to improve the juices. In seasonable districts, where this system can be fully carried out, the mischievous effects of the borer seem to betray a want of proper attention on the part of the manager to his field. But in districts subjected to long spells of drought, the utmost caution is necessary. It is generally observed that the borer commits the greatest injury to the cane after a rapid growth, which is followed by a spell of dry weather, whilst vegetation seems not only suspended, but the plant itself struggling for life. In this dilemma the planter chooses the least of two evils. To trash his canes under such circumstances would prove almost, if not entirely, destructive to his field ; he is, therefore, compelled to suffer the borer to proceed unmolested, until rain has fallen, and the plant has again started into life. Then the removal of all the loose trash from the the cane will check the progress of this insect, and by following up this operation as often as the canes require to be freed from superfluous trash the borer ceases to effect further perceptible injury."

Westwood (6.) wrote that he had been informed by an intelligent Jamaica cane-grower that the ravages of the borer "had been greatly checked by allowing the refuse to accumulate on the ground and then firing the whole plantation, the old roots subsequently throwing up more vigorous shoots."

Comstock (10.) gives rather full suggestions for remedies, as follows :—

"According to our present information, the cane-borers hibernate almost exclusively in the larva or "worm" state [in the United States]. During the winter they are to be found most abundantly, of course, in the seed canes, but also in the discarded tops, and also to a slighter extent in the stubble. We cannot hope, of course, to exterminate the insect, owing to the extreme difficulty of fighting it in the stubble, but the number of larvæ which hibernate in this place is so small that, supposing the others killed off, the borer can be well kept in subjection. It is the custom upon most plantations to plough the tops under for fertilizers, but if the plan of burning them during the winter were universally adopted, many of the borers would doubtless be killed which otherwise would help to start the next summer's brood. The question of dealing with by far the larger number, which are to be found in the cane stored away for seed, now remains. In such cane as is planted in the fall it is reasonable to suppose that the borer will not be able to develop, or if it should develop that the moth will not be able to force its way through the wet heavy soil above it, especially where the system of rolling after planting is followed. Why should not the same reasoning apply to such seed cane as is laid down in furrows at the time of harvesting ? It would depend, of course, upon the amount of earth with which it could be covered without danger from mildew and decay. After a bad worm year all seed cane should be laid down in this way, and not left openly in flat "mat," which allows of a safe hibernation and an easy natural escape of the moth. The cane should be covered as deeply as is safe in order to more effectually stop the egress of the moth, and in planting the ensuing spring only so much should be uncovered at a time as is necessary for immediate use. In harvesting in the fall also such canes as are worst infested should be thrown aside with the tops, to be burned during the winter. Moreover, inasmuch as certain parts of a plantation are always damaged more severely than others, the seed to be kept through the winter should be selected from other localities and from amongst the very best and least damaged cane. We cannot insist too strongly upon the necessity of following this latter course. If these suggestions are acted upon, we think that the damage from the borer will be very greatly lessened."

Howard (21.) referring to the damage done by the borer to maize, remarks :—"Where, however, the old stalks are systematically removed from the field and burned after harvest or during winter, or where a constant rotation of crops is practised, the corn stalk-borer will never become a serious pest, and the Virginia and South Carolina farmers have it in their hands to check it at any time by pursuing these methods."

Riley and Howard (19.) suggest as an experiment spraying the plants with Paris green at the time that the eggs are laid, but it seems very doubtful whether this method would succeed, if at all, sufficiently to be worth trying on a large scale. The trouble and expense would be considerable, and very thorough spraying would be needed to have any satisfactory results. It does not indeed appear that this method is advised for general use, but the recommendations are as follows :—"We know, however, that there are several generations in the course of the summer, probably at least half-a-dozen; and, as in the case of all many-brooded insects, there will be a constant overlapping of broods, so that the moths will be flying most of the summer. This means an almost continuous egg-laying, and your only absolute protection, where the moths are abundant and breeding, will be to spray with Paris green at frequent intervals. In an experiment of this kind you will not mind taking considerable trouble, and I would therefore advise you to purchase a "Little Climax" pump with outfit from Nixon Nozzle and Machine Company, of Dayton, Ohio, and to spray with Paris green in the proportion of one-quarter of a pound to 40 gallons of water. I would spray at intervals of from two to three weeks, and oftener when heavy rains intervene."

Mr. G. W. Smith (24.) in his excellent article, writes :—"As a remedy I would suggest the advisability of cutting the ripe canes as quickly as possible. Take up every piece of rotten cane, carry them out of the field and pass them through the mill; this will destroy any grubs that may chance to be in them. Burn all the megass, for a couple of seasons at least, as the method of stacking megass for future use may assist in keeping up the disease ; on no account leave pieces of rotten cane lying around the estate, these only form breeding ground for fresh hordes of insect-pests. The thrash and stumps should then be collected, carted away from the field, and burnt. The reason of this is, that in some places it has been found that there are ants in the ground which prey on the borer and help to keep it in check. Burning on the field itself would thus destroy them also.

Plants should then be selected from the strongest unaffected canes procurable, and not at random, as is often the case ; these be may immersed in water at a temperature of 130 degrees for 48 hours, to which may be added as an additional precaution, a one per cent. solution of Carbolic Acid or Sulphate of Ammonia. The kerosine emulsion may also be useful. It is just possible that at some stage or other these insects may exist in the soil, and it is clear that if we could reach them with a fertilizer, which is at the same time an insecticide, we may do a good deal towards eradicating them. In Queensland there is a German fertilizer used in canefields infected with an insect pest that emerges from the ground and cuts off the stalks of the plants. This fertilizer is called "Kainit," and farmers there who have used it, say they enjoy an immunity from the pest. The cost is about £3 per ton, and it is reckoned that about 300lbs. is enough for an acre. This may be ploughed in as a fertilizer and at any rate seems worth a trial.

In conclusion, I may remark that one feature of the disease deserves careful attention. It is this. In no case have I observed plants of the Transparent, Ribbon, or Caledonia Queen canes affected by the insect, either moth or beetle, and that, too, even when growing side by side with badly diseased Bourbon canes. This would seem to point to the fact that the Bourbon variety is either a weak one, or has become degenerate from long cultivation in the West Indies, in the same localities. . . . .

The question is a very serious one to all concerned in sugar planting, and whatever steps are taken, either for eradicating the borer, or keeping it in check, it must be remembered that success can only be expected from a unity of action among the planting community, and that however careful one individual may be to do all that may be directed, his efforts will be unavailing if he has a neighbour more carelessly disposed, who prefers to allow things to run on in the old groove."

With regard to the "Kainit" fertilizer, it is hardly applicable to the present case, as the life history of *D saccharalis* is well-known, and there is no reason to suppose that at any stage it lives in the soil.

I have given rather full accounts of various remedies proposed, so that planters may choose whichever seem most suitable to their case. There seems to be no doubt, that if energetic means were adopted throughout the infested districts, the pest could be kept well within bounds. It is for the planters to consider what measures may best be taken to secure that co operation, without which individual efforts will be more or less futile; but no one can doubt that in these days of severe competition, when sugar is by no means so profitable as formerly, a comparatively small gain or loss, much less than that mentioned by Mr. Van Putten, may make all the difference between success and failure.

Species Allied to the Sugar-Cane Borer.

The genus *Diatræa* seems to be more especially neotropical, although a species (*D. striatalis*, Snell.), very similar to ours, but supposed to be distinct, occurs in the Malay Archipelago. There are also two species, in addition to *D. saccharalis*, recognised in the United States, and named by Prof. Fernald *D. alleni* and *D. differentialis*. According to Prof. Fernald, as quoted by Comstock (10.) Zeller described several South American species under *Diatræa* about the year 1880, but I have not seen the paper in question, and do not find any mention of the species in the "Zoological Record." In 1882 Zeller described *Diatræa pinosa* from Colombia. *Chilo*, the closely-allied genus to which our insect has frequently been referred, is of very wide distribution, and occurs in both hemispheres. In the United States four species (*C. plejadellus*, Zinck., *C. densellus*, Zell., *C. squamulellus*, Zell. and *C. comptulatalis*, Hulst,) are known, and in 1878 Zeller described several from South America

Diatræa belongs to the family *Crambidæ*, which consists of moths, usually of plain colours and small size, remarkable for their long palpi, which give them the appearance of having an elongated snout. Several of the species are known to be destructive to plants of the grass family. Two species of the typical genus, *Crambus*, are known to occur in Jamaica, namely *C. curtellus*, Walker, and *C. ligonellus*, Zeller.

Other Sugar-Cane Pests.

It is not proposed to here enumerate the numerous other insects which have been reported to attack the sugar-cane, but as there has been some confusion between the lepidopterous and coleopterous borers, and between the true borers and other insects, a few remarks seem necessary.

There is a little beetle of the genus *Xyleborus*, brown in colour, cylindrical in shape, and less than an eighth of an inch long, which has caused great alarm in Barbados recently, and has been the subject of various telegrams and newspaper notices.*

Mr. G. W. Smith (24.) writes on this subject:—

"The 'Destructive Borer' and the ravages done by that insect to the crop of 1892, is engrossing the attention of every one connected with sugar-planting in these islands. . . . . I have read with interest the several letters from the pen of Miss Ormerod published in the *Herald* newspaper, and have been favoured with a copy of Prof D'Albuquerque's Report. . . . .

Three years ago the planters at St. Vincent observed that an insect pest was devastating their canefields, and so severe were its attacks, that it was estimated that one-third of the crop was destroyed by them. I had an opportunity of examining numerous samples of diseased canes, and I also spent several days in the field, studying the habits of the insect. At first sight, judging from the numbers of the small beetles (*Xyleborus perforans*) found in diseased canes, I was led to think that they were the real depredators. On close examination, however, it became clear to me, and numerous subsequent investigations have justified the conclusion; namely, that the beetle is not the destroyer of the cane, but only a successor to a far more formidable pest—the larva of a well-known pest, *Diatræa saccharalis*, and that the beetle very rarely, if ever, attacks a cane that has not previously been ravaged by the moth-borer. This may easily be seen by close inspection, and to note how far this theory held good, I have repeatedly taken specimens at random from various parts of an affected field, and have always found that in the majority of withered and diseased-looking canes, there were the large tracks of the moth-borer, without a trace of the beetle; in a great many instances, there were the tracks of both moth-borer and beetle in the same cane, but never an instance of the beetle alone. Mr. Grant, the Manager of Woodland's Estate in this island, has been with me at several of these investigations, and after examining numbers of specimens, we are pretty well convinced, so far as it affects Grenada—that not only does the moth-borer first attack the cane, but that the beetle never commences its work until the cane has become thoroughly soured."

There is no reason to doubt that Mr. Smith's opinion, that the *Xyleborus* is not responsible for the damage, is a perfectly correct one, and the only amendment needed to his account is that it may, as will appear below, follow the attacks of the weevil as well as the moth.

The genus *Xyleborus* includes some species, as *X. dispar* in Europe and North America, and *X. cœlatus* in North America, which are injurious to trees; but there are also numerous species which appear to exist only in rotten vegetable matter, or under dead bark. Thus for example, in *Insect Life*, 1890, p. 167, we read of *X pubescens*, which lives in orange and other trees:—

"The mature beetles burrow in trees of all sorts but have never been known to infest healthy living orange trees, but when found in the orange always occur in the dead or diseased wood. It cannot, therefore, be considered injurious to the orange. The freeze of last winter, which you say killed many of the orange trees, accounts for the presence of numbers of this insect."

* See also "The Sugar Cane," April 1892, p. 212.

Numerous species of *Xyleborus* are known from the West Indies. Eichhoff, in 1867-68, described *X. capucinus*, from Guadaloupe, *X. affinis*, from Cuba, *X. alternans*, from St. Domingo, *X. inermis*, from Cuba, *X. torquatus*, from Cuba and Porto Rico, and *X. amplicollis*, from Porto Rico.

Through the kindness of Dr. Plaxton, I have received three pieces of injured cane from Barbados, together with numerous specimens of the *Xyleborus* in a bottle. The specimens of cane are fairly stout, juicy and well formed, and do not present the dried-up appearance of those attacked by the *Diatræa*. Within, however, they are sour and rotten, and in many places, especially about the joints, the little burrows of the *Xyleborus*, hardly $\frac{1}{25}$th inch in diameter, are to be seen. But in addition to these, are large burrows, some half-an-inch wide, filled with cane splinters, and terminating externally in holes of considerable size. In one of these burrows I was so fortunate as to find a pupa, from which the adult beetle had been nearly ready to emerge. Although not in good condition for examination, this is doubtless the well-known Borer-Weevil, *Sphenophorus sacchari* (Guilding), which has been known in the West Indies as injuring sugar-cane since the latter part of the last century. It is extremely similar to, and perhaps identical with *Sphenophorus sericeus* (Fabr.)*, which is common in Jamaica, and has been observed by Mr. Bowrey breeding in plantain and banana. A good account of *S. sacchari*, as occurring in Jamaica, was written by Mr. Samuel Kell King in 1845, and is quoted by Gosse in his "Naturalist's Sojourn in Jamaica," p 451.

In the Sandwich Islands the sugar-cane is attacked in a similar way by an allied species, *S. obscurus* (Bdv.), of which a good account, with figures, is given in "Insect Life," 1888, pp. 185-189. This insect is also found in Tahiti and New Ireland, and is supposed to have been introduced into the Sandwich Is. It feeds on the banana as well as the sugar-cane.

Mr. King in 1845 suggested that the Jamaican insect was not indigenous, "but that it was imported into Jamaica from Tahiti; for it suddenly appeared in 1797, the year after the Tahitian varieties of the cane were introduced into the island." In the face of this suggestion, and the fact of the Pacific Islands species breeding both in sugar-cane and banana, one might readily suppose that the West Indian *S. sacchari* and *sericeus*, and the Pacific *obscurus* were all one and the same species, which originated in Tahiti, and should, according to priority, be known by the name *sericeus*. This, however, is rendered quite doubtful because the figure given of the Sandwich Is. beetle in "Insect Life," and Mr. Schwarz's elaborate description, do not agree with Jamaican specimens of *sericeus*. Yet *sericeus*, as shown by the short series in the Museum of the Jamaica Institute, is quite variable, and as the specimen described by Schwarz was probably immature, it is possible that the apparent differences may prove not to have specific importance.

Thus it appears that the sugar-cane pest now causing injury in Barbados is not the *Xyleborus*, and not even the *Diatræa*, but the *Sphenophorus*, or weevil.† This is, of course, so far as one can tell from the specimens received; but it is likely enough that the Borer-moth also occurs in Barbados, and is responsible for a part of the damage. It is clear, however, that the *Xyleborus* follows the depredations of the weevil, as well as those of those of the moth.

In Jamaica, on the other hand, we are suffering from the Borer-moth, a decidedly more serious pest than the weevil, which will require continuous attention if it is to be controlled.

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(24.) 1892. *Geo. W. Smith*, Barbados Agricultural Reporter, March 29.

* Identified by Mr. C. O. Waterhouse, and recorded in Trans. Ent. Soc. Lond. 1878, p. 303. The species is there referred to Fabricius, but on the label of a specimen, named at the British Museum, to Latreille.

† It should be mentioned that damage to sugar-cane has also been caused in Barbados by a mite, *Tarsonymus bancrofti*, Michael, according to a report published in "Kew Bulletin," April, 1890, p. 83. Another mite, of the genus *Damæus*, was also considered to be injurious. However, the injuries inflicted by mites do not resemble those of the borers, and could not be confounded with them. The remedy used for the mites is immersion of the canes in warm water and carbolic acid (1 lb. of acid to 50 gallons of water) for 24 hours, previous to planting. Lime has also been found useful.

GARDENING IN JAMAICA.

To the Editor of the "BULLETIN."

SIR,

I think it would be helpful to those among us interested in gardening if you would allow us to make use of the "Bulletin" to record our gardening experiences, our successes and failures. We amateurs might perhaps in this way help each other more than experts can help us, for the latter are apt to take for granted knowledge which we do not possess, and have painfully to acquire through failures and disappointments. It is easy of course to get books on gardening, but almost all these (*all* I have come across) are suited to other conditions than ours. Take for example an admirable book entirely devoted to rose culture, (a book I happen to possess among several other gardening manuals) which is most simply and practically written. Now roses will grow and thrive from one end of Jamaica to the other, at any elevation—or absence of elevation,—nevertheless out of the whole book I got but one hint which was of any use to me for Jamaican rose-culture. This was a method by which you could produce a neat compact bush, well ventilated in the centre, and bearing its flowers all over the outside of the bush. It was simply this, prune always to an eye pointing in the direction in which a branch is desirable, and avoid inside eyes as much as possible No doubt this is very unnecessary information as far as gardeners are concerned, but I am an amateur, appealing to amateurs for help and information, and anxious to impart any which I myself have found of use. Following this rule in Hanover, at an elevation of between 800 and 900 ft. above sea level, had quite a magical effect on my rose trees, of various kinds, numbering at that time between 300 and 400. Instead of the usual long straggling whip-like branches with a rose or two at their extreme ends, I succeeded in getting neat compact bushes clothed with verdure and bloom almost to the ground, and free from mildew or moss in the centre. But *when* to prune is another matter, all directions on this point were useless. I had to discover for myself that in that moist climate, at so low an elevation, pruning should never cease, each branch, as its load of roses begins to fall, should be pruned back, always mindful of the rule with regard to the direction of the eye. This sounds laborious, but an hour every morning is quite sufficient for the number of rose trees I have mentioned, as of course they do not all come in together; and I can fancy no easier, pleasanter, more healthful work for a lady, rising, say at 6 o'clock, during the wet season, when the air is cool and fresh and the morning mists are not yet dispersed, for in those hills they seldom disperse till after 7 a.m.

With regard to bulbs and annuals, my experience (not a very wide one) is, that no imported bulbs and very few annuals can be induced to flourish at the above-mentioned elevation. Of annuals, Petunias, balsams, coreopsis, marigolds of various kinds, campanulas, and sunflowers are all I can name which have been entirely successful, not of course counting the tropical annuals. But the list increases in proportion to the rise in elevation, and here in the Blue Mountains, at 4,380ft. above sea level, it becomes a long one. Our garden soil is of the most unpromising order; in one part heavy yellow clay, in another whitish and dry; everywhere so stony that the proportion of earth to stones is comparatively small Our nearest approach to a gardener is a "coffee hand" whose sole idea is to drag a hoe over the surface of the garden beds, laying low both friend and foe impartially; but so bountiful is nature here that in spite of all disadvantages of soil, in spite of all incursions of devastating weeders, flowers of all sorts and descriptions flourish and abound. Phlox once sown broadcast, continues to increase and multiply and vary itself indefinitely, and the same may be said of the blue corncockles of our native land; mignionette, marigold, candy tuft and numbers of other English flowers; they need only to be thinned out and kept within bounds. Finding that a majority of the flowers belonging to the temperate zone made themselves so much at home in these mountains, I have lately been experimenting on import bulbs from Carter's, and the Army and Navy "Auxiliary." Carter's bulbs came out by post in brown paper bags filled with charcoal; every bulb was firm and in perfect order when received. The consisted of snowdrops, crocus—I mention these first because they were my only failures, the crocus all came up but did not thrive or flower, the snowdrops made no sign,—hyacinths, tulips, daffodils, freesia, sparaxis, blue bells and jonquils. Hyacinths, I was assured, had been tried again and again in various parts of Jamaica, but had never flowered, *all* Carter's flowered and are now throwing out numbers of offsets. One pale lavender was particularly fine and bore the largest flowers I have seen anywhere. The hyacinths from the Auxiliary arrived (I am sorry to say) in a state of rottenness. All Carter's daffodils bloomed, some of the freesia and sparaxis are now in bloom, others in bud, the jonquils and blue bells look well and flourishing, but have not yet bloomed.

About a year ago Cannel & Sons, Swanly, Kent, sent me out some small plants of chrysanthemums by post. They were all new and valuable, and the English season being so short, they begged me to try whether I could succeed in getting seed from these for them, offering to send me a collection of choice chrysanthemums in repayment of my trouble should I be successful. Out of the 6 plants one died, killed by a grub, the rest turned out magnificent, blowing with a profusion such as I have seldom seen before—they were perfect umbrellas of bloom—but alas! the flowers died off without seeding; the plants then threw out a perfect little forest of offsets, and I find that any cuttings broken off from the old plants will root easily. Can any one tell me why when the climate and locality suit them so admirably, they give no seed? Can any one suggest a method by which they could be induced to do so? Such as nipping off the largest portion of the buds, pruning the roots, confining the plant in a small pot—have any of these devices been tried? I ask this as I am told that no chrysanthemums even of the commonest kind ever seed in Jamaica, however scantily they may blossom. Any information on this subject will be thankfully received.

SELINA HEAVEN.

No. 31.

May, 1892.

BULLETIN

OF THE

BOTANICAL DEPARTMENT,

JAMAICA.

CONTENTS:

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JAMAICA:
GOVERNMENT PRINTING OFFICE, 79 DUKE STREET, KINGSTON.
1892.

DISEASED BANANA PLANTS.

The Secretary of the Agricultural and Industrial Association of Fiji communicated with the Department of Agriculture of N. S. Wales, under date June 16th last, notifying the despatch of a case of diseased banana plants, and asking the Department to interest itself in having the disease thoroughly investigated. From this letter it appears that the disease has defied eradication by the banana planters of Fiji. The evidence seems to show that it affects the young plants, that after they are set and begin to grow the outer leaves begin to turn brown, droop and die, and that the succeeding leaves do the same as they reach from four to six inches in length. The plant continues growing in this way for several years without much increase in size, instead of growing as it should to a height of from six to twelve feet, and producing fruit. The disease is said to be very serious, although sufficient information has not yet been furnished to indicate the exact extent of loss.

In connection with this matter it may be mentioned that the Department also received from Clarence River some six months ago a specimen of diseased banana, but as this specimen consisted of a grown plant after it had been cut down, it was not possible to make out very much. It is possible however, that this disease from Fiji is the same as sent from Clarence, and inasmuch as investigation has shown a number of causes for the diseased condition of the Fiji plants, reason exists for making them known, as that information may be of assistance to the banana-growers in the northern part of this Colony.

The Fiji plants were found to be in some parts covered with aphides or plant lice, and these on some of the plants were so numerous that they might have done considerable damage. Still, it could not be proved from examination that they had done much damage, although they had existed in very large numbers—as many as several hundred cast-off skins being often seen in the axil of one leaf.

The Government entomologist, who has made an examination of these aphides, believes them to be a new species; drawings of them have been made by the departmental artist, and they will probably be described in a coming number of the *Agricultural Gazette*. In the root-stock of the Fiji plants a fungus was found. What the exact nature of the fungus is has not yet been ascertained, because no spores could be found. The exact systematic position of the fungus therefore remains unknown. But the fact that it does a good deal of damage has been established. Its presence may be known by a brown discolouration of the interior of the root-stock and roots. The tissues instead of being white, as they are when healthy, take on, where the fungus is thickest, a dark-brown tint, and where it is just penetrating and has not yet caused a serious destruction of tissues, a light-brown colour.

It is rather remarkable that in the soil about the roots of these plants nearly thirty species of [illegible] Two of these species have shown to be injurious to the plants, one of them attacking the roots, and being found living parasitically on certain brown rotten cavities, and the other being found between the sheaths of the leaves of the plant, and in some cases even at the very core where the tissues appeared to be quite sound and white. It will therefore be seen that there are four separate causes for the diseased condition of these plants, viz.: aphides or plant lice, a fungus causing rot in the root-stock, and two different species of nematodes.

The remedies that are suggested in the present state of our knowledge, which of course is incomplete, are these:—

1. That where the bananas are cultivated a system of rotation should be adopted; that no attempt should be made to grow banana plants on the same ground continuously for a long series of years, and this for two reasons:—In the first place the soil naturally becomes exhausted of the elements necessary for the growth of the banana plants and therefore after a series of years the plants become weakly and do not thrive as at first. Furthermore, and this is quite as important as the first reason, if the banana plant or any other plant for that matter is grown continuously on the same land for a long series of years, the diseases of the plant are bound to accumulate on that piece of land. The disease which first appears in a mild form and only here and there, will in each succeeding year, attack more and more plants and usually in a more virulent manner. Unless special precautions are taken to prevent disease, a continuous and successful growth of any one plant on the same land is next to an impossibility. At the same time the Department thoroughly realises the difficulty of getting agriculturists in a new country to adopt a system of rotation. What farmers usually do is to find out the crop that will pay them best, to learn the methods of cultivating it and to obtain the necessary machinery for that crop, and then of course to keep on in that simple line as long as possible. No one can blame them for doing this, but a time always comes when this keeping to one crop can no longer be done, and the tendency is always to wait too long before beginning a system of rotation.

2. Judging from the specimens sent, the soil about banana plants is infested to an extraordinary degree with nematodes, therefore it is best in cultivating, to plough deeply or to occasionally subsoil the land. These nematodes attack the roots of plants and exist largely within eight inches of the surface. As they become rarer as the depth of the soil increases, it follows that if the land be ploughed deep and thoroughly so as to turn the soil exactly bottom side up, a soil comparatively free from nematodes will be brought to the surface and at the same time the nematodes which were near the surface are buried so deep that they can do much less damage than they could if at the surface.

3. From what has been thus far seen, the main difficulty with these plants is thought to be due to the attacks of the fungus mentioned above, and here the best remedy to recommend is great care in setting the new suckers, i. e., in making new plantations. As pointed out, the presence of fungus

is indicated by discolouration in the root stock. Now when suckers are cut off from the old plant with a spade they should be inspected and all brown and rotten portions should be carefully removed, and all suckers from which these brown and discoloured portions cannot be removed without destroying the chances of growing should be discarded. Of course, if the sucker is set out with some of this diseased tissue attached to it, when it grows the diseased tissue keeps pace with the growth and it will not be long before the plant is seriously hindered and perhaps altogether destroyed by this rot at the root.

Agricultural Gazette of New South Wales.

COCO-NUT DISEASE AT MONTEGO BAY.

In Bulletin No. 23 for September, 1891, a Report was published on this Disease. The following correspondence shows that the simple remedy of burning the leaves in the early stages, has proved successful.

Montego Bay, 4th May, 1892.

W. Fawcett, Esq., Gordon Town P.O.

Dear Sir,

Your letter of date 28th ultimo I duly received, the subject of which I communicated to Mr. Doull and attach the correspondence for your information. I entirely agree with Mr. Doull that the disease is spreading, and no one, so far as I am able to ascertain has tried the other remedies you suggested.

The disease is steadily thinning the coco-nut trees in and around the town and its progress appears more rapid in the dry weather than in the rainy seasons.

I have, &c.,

J. W. Gruber.

Montego Bay, 30th April, 1892.

Dear Sir.

Mr. Fawcett would be glad to know whether you tried the remedies suggested to check the coco-nut disease, and if so with what result.

Are the trees recovering naturally and without the application of a remedy, or is the disease spreading?

Yours, &c.,

J. W. Gruber.

Alex. Doull, Esq., Catherine Hall Estate, Montego Bay.

Reply.

I have not as yet tried the Sulphate of Iron remedy. I have continued the application of Salt and have kept to the firing of the Trees and as far as I can judge at present I consider the last named remedy good—if the Trees are not too far gone when fired. A good number that were fired last year are now bearing fruit. The trees do not recover naturally and the disease is certainly spreading.

A.D.

Catherine Hall Estate, 2.5.92.

PARCHMENT COFFEE.

In Bulletin No. 8 for October, 1888, attention was called to the system of sending coffee in parchment to England to be cleaned there.

Messrs Lewis & Peat in a communication to Kew Gardens, says, " most satisfactory results have been attained. We have recently sold large parcels from America which were 'milled' here; and against 70s. per cwt. obtained last year for the same coffee cleaned on the plantation we obtained 86s. 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 invariably been in favour of cleaning here. The process is quite simple, and the cost is 2s. 6d. 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 must be perfectly dried and kept from moisture afterwards,—insufficient drying is most damaging to after results—and must have the greatest care."

In Bulletins 12 and 14, there are further notes on the subject.

While coffee planters in Jamaica, who have the full complement of machinery and water power, may consider it not worth while to enter upon the new system, there appears to be no doubt that under other circumstances, it is decidedly advantageous to ship the coffee in parchment; and it is understood that planters in Costa Rica are even abandoning new machinery, finding that the new system effects such a saving.

In calling attention again to this subject, the following information is added, contributed by Mr. W. A. Sabonadiere of Arntully, who received the replies to his questions from a well known English broker.

Questions. — *Answers.*

Re Parchment Coffee shipped to London to be cured.

1. Name and address of Firm who cure the Coffee.

1. The Proprietors of the Metropolitan Wharf where your Coffee is always warehoused.

2. Is the Coffee conveyed direct to the Mills and what is the arrangement about Duty. The Mills must be a Bonded Warehouse?

2. The Wharfingers have the Coffee sent to them exactly in the same manner as if it were not in husk.

3. On arrival, is the Coffee at once taken in hand or kept in a very dry place?

3. Cleaned with every despatch unless it is damp when it has to be dried for which an extra charge is made.

4. How is the Coffee prepared? Does the sizer take out Nos. 1, 2, 3, and Triage qualities? Is it polished after winnowing? and is it garbled (i. e., the deformed and bad beans taken out by hand as is done here and in Ceylon) or is the sizing alone deemed sufficient?

4. The Coffee is sized but not garbled as hand-picking is far too costly here.

5. Is not the wet, damp, foggy weather of England, calculated to injure the colour and quality of the berry?

5. The colour of London cleaned Coffee is generally very good indeed, but is not so permanent as Colonial preparation.

6. Would it be preferable to send home the Coffee in barrels? or are bags sufficiently safe? and do not they sometimes get sea-damaged?

6. Barrels add so much to the Freight as you have to find room for the beans in parchment, which of course occupy so much more space. There is not often any great damage in the R. M. ships.

7. What is the cost of curing etc., per cwt?

7. 4/ per cwt. including barrels. 2/6 in original bags.

8. The Purchaser pays duty, and takes the Coffee from the Mills, which is sold in Mincing Lane by the Broker as customary?

8. Being cleaned in bond, it is treated just the same as ordinary Coffee.

9. Would the Brokers, if the Coffee is made over to them by the Agent undertake to see the Coffee handed over to the Mills and see to its preparation or must the Person to whom the Coffee is consigned do this?

9. The Coffee is at just the same position as ever, the B/ lading is handed to the Wharfingers who clean the Coffee and send samples to the Brokers.

[illegible] for sale? Would the Coffee be likely to sell better if put into barrels or casks?

10. [illegible] high grown Coffee we should advise the Coffee to be re-packed into barrels and we give the inclusive charge in No. 7.

11. Should the Parchment Coffee be dried as fully as would be done here, fit to go to the Mill, as hard indeed as to be brittle between the teeth?

11. Cannot be too dry.

NUTMEGS.

An erroneous impression has gained ground in Jamaica that Nutmegs will not flourish higher than 1,000 feet above sea-level. This is in consequence of a statement in Dr. Nicholl's "Text Book of Tropical Agriculture," that, "as the nutmeg is essentially a lowland plant, its cultivation is not likely to prove successful at a higher elevation than 1,000 feet above the sea."

Mr. John Davidson writes:—"Mine are all doing splendidly at Bellevue, at an elevation of 1,500 feet."

The Hon. H. R. Pipon Schooles writes from Grenada, "Nutmegs in my experience thrive and bear as well at 1,500 feet as at 1,000 feet;—beyond the former elevation I know nothing from our experience here."

The following letters give similar testimony.

Kingston, April 28, 1892.

My Dear Mr. Fawcett,

In reply to your note of the 26th received to-day, my nutmegs are growing at between 1,800 and 2,000 feet above sea level. When I last saw them 10 weeks ago there was no sign of blight, and I have not heard of any since. Only some 6 or 8 are fruiting, but they are nearly all growing so healthily that I am going on planting them.

One tree I have has an enormous amount of fruit on, the boughs being all bent down under the weight, it is a really fine sight and makes the tree look quite golden.

Yours, &c. W. Eloin Sant.

Dear Mr. Fawcett,

Kingston, May 2, 1892.

In reply to yours of the 30th ultimo, I found the Nutmeg which is now bearing so heavily at Langley, when I bought the place in 1879. But it had been quite neglected along with 2 others and remained so for say 2 years when it was about 18 inches high and probably 4 years old. From that time it has been carefully looked after say for the last 9½ years. Very roughly it is now about 20 feet high, and it has been bearing for 3 years. My other trees just coming into bearing are about 7 to 8 years old, and I have other trees only about 2 years old from the time the seed was planted in the nursery. Not all my 7 to 8 year old trees are bearing, though I think pretty well all the male ones have flowered. We find that the healthiest trees do not bear so early as the medium ones, but go on making wood. Judging very roughly, I should say 60 per cent. are male trees.

I have no objection to your making any use you like of the information, indeed I think we ought to take a little more trouble to let you have information, but the world seems to go along so fast, that there is time for very little outside our work.

Yours, &c., W. ELOIN SANT.

Mt. Stewart, Ramble P.O.
May 2nd, 1892.

Dear Sir,

Yours of 19th April received. I have been away from home for the last two weeks or would have replied earlier.

Dr. Nicholls has certainly made a mistake in saying Nutmegs will not do at a higher elevation than 1,000 ft., for the trees here bear very well, in fact two years ago two of the trees bore so heavily that they suffered and I believe that we are between 1,2 0 and 1,300 ft. The Hon. Evelyn Ellis I am told made the gate at the road turning in,—1,250 ft. by his aneroid that had been set a few days before at sea level. Some years ago Mr. Scharschmidt got a lot of the nuts from me for planting at Hanbury in Manchester. I have not met him for the last two years but when I saw him last he said that 60 out of every 100 nuts were growing well and his place must be much higher than this.

Mr. George Dewar of Harmony Hall, Duncans P. O., has also some growing well in the back lands of Trelawny but at what elevation I can't say.

Yours, &c., R. H. ROBERTSON.

NUTMEGS IN BANDA.

As over 20,000 Nutmeg plants have been sold during the past year for planting in Jamaica, it will doubtless be interesting to those who are cultivating them, to read the following descriptions of Banda, the Nutmeg Island of the East Indies.

"Banda is a lovely little spot, its three islands enclosing a secure harbour from whence no outlet is visible, and with water so transparent, that living corals and even the minutest objects are plainly seen on the volcanic sand at a depth of seven or eight fathoms. The ever smoking volcano rears its bare cone on one side, while the two larger islands are clothed with vegetation to the summit of the hills.

"Going on shore, I walked up a pretty path which leads to the highest point of the island on which the town is situated, where there is a telegraph station and a magni[illegible] little town, with its neat red-tiled [illegible] natives, bounded on one side by the old Portuguese fort. Beyond, about half a mile distant, lies the larger island in the shape of a horseshoe; formed of a range of abrupt hills covered with fine forest and nutmeg gardens; while close opposite the town is the volcano, forming a nearly perfect cone, the lower part only covered with a light green bushy vegetation. On its north side the outline is more uneven, and there is a slight hollow or chasm about one-fifth of the way down, from which constantly issue two columns of smoke, as well as a good deal from the rugged surface around and from some spots nearer the summit. A white efflorescence, probably sulphur, is thickly spread over the upper part of the mountain, marked by the narrow black vertical lines of water gullies. The smoke unites as it rises, and forms a dense cloud, which in calm damp weather spreads out into a wide canopy hiding the top of the mountain. At night and early in the morning it often rises up straight and leaves the whole outline clear. . . . .

"The summit of the small island is composed of a highly crystalline basalt; lower down I found a hard stratified slaty sandstone, while on the beach are huge blocks of lava, and scattered masses of white coralline limestone. The larger island has coral rock to a height of three or four hundred feet while above is lava and basalt. It seems probable therefore, that this little group of four islands is the fragment of a larger district which was perhaps once connected with Ceram, but which was separated and broken up by the same forces which formed the volcanic cone. When I visited the larger island on another occasion, I saw a considerable tract covered with large forest trees, dead, but still standing. This was a record of the last great earthquake only two years ago, when the sea broke in over this part of the island and so flooded it as to destroy the vegetation on all the lowlands. Almost every year there is an earthquake here, and at intervals of a few years very severe ones, which throw down houses and carry ships out of the harbour bodily into the streets.

"Notwithstanding the losses incurred by these terrific visitations, and the small size and isolated position of these little islands, they have been and is still are of considerable value to the Dutch Government as the chief nutmeg-garden in the world. Almost the whole surface is planted with nutmegs, grown under the shade of lofty Kanary trees (Kanarium commune). The light volanic soil, the shade, and the excessive moisture of these islands, where it rains more or less every month in the year, seem exactly to suit the nutmeg-tree, which requires no manure and scarcely any attention. All the year round flowers and ripe fruit are to be found and none of those diseases occur which under a forced and unnatural system of cultivation have ruined the nutmeg planters of Singapore and Penang.

"Few cultivated plants are more beautiful than nutmeg-trees. They are handsomely shaped and glossy-leaved, growing to the height of twenty or thirty feet, and bearing small yellowish flowers. The fruit is the size and colour of a peach, but rather oval. It is of a tough fleshy consistence, but when ripe splits open, and shows the dark-brown nut within, covered with the crimson mace, and is then a most beautiful object. Within the thin hard shell of the nut is the seed, which is the nutmeg of commerce. The nuts are eaten by the large pigeons of Banda, which digest the mace but cast up the nut with its seed uninjured."—*Malay Archipelago.* By *A. R. Wallace.*

EXPERIMENTS IN THE CULTIVTION OF VEGETABLES.—IV.

PEA

The following Tables are a continuon of those in Bulletin No. 25.

Names of Peas grown at Cinchona.	Date of Planting in September, 1891.	First appearance above Ground.	Days from Planting.	First Bloom.	Days from Planting.	Pods of Edible Size.	Days from Planting.	Days during which fit for Table Use.	First Seeds Ripe.	Days from Planting.	Last Seeds 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.	Maximum Temperature.	Minimum Temperature.	Average Maximum.	Average Minimum.	Rainfall.	Number of Days on which Rain fell.	Height in Feet.	Time of Cooking in Minutes.	Quality.
Laxton's Supreme ...	30th	9.10	9	15.11	46	23.12	84	18	2.1.92	94	11.92	108	3.5	4.0	63.9	73.9	53.2	68.3	59.6	49.94	76	5	15	1
Wrinkled Sugar ...	"	9.10	"	7.11	38	Dead.		13.11.91		.	.	44	.	.	65.4	73.9	57.2	68.9	61.9	26.86	35	4	.	.
James' Prolific ...	"	9.10	"	18.11	49	23.12	84	26	28.12.91	89	11.92	110	4.0	3.0	63.9	73.9	53.2	68.3	59.6	49.96	77	5	18	3
Carter's G. F. Wilson ...	"	9.10	"	19.11	50	21 12	82	12	2.1.92	94	Acked by mildew and died.				64.4	73.9	54.2	64.7	60.7	48.18	68	4½	20	3
Dickson's Favourite ...	"	9 10	"	15.11	46	23.12	84	10	2.1.92	94	.	do.	.	do.	64.4	73.9	54.2	64.7	60.7	48 18	68	5	18	3
Carter's Empress ...	"	9.10	"	15.11	46	18.12	79	18	30.12.91	91	21.92	120	2.5	3.0	63.7	73.9	53.2	68.3	59.6	52.66	81	6	20	1
Duke of Albany ...	"	9.10	"	15.11	46	22.12	83	12	28.12.91	89	14.92	108	4.0	7.0	63.9	73.9	53.2	68.3	59.6	49.94	76	6	15	1
Carter's Telephone ...	"	9.10	"	15.11	46	23.12	84	18	28.12.91	89	22.92	114	3.5	5.50	63.9	73 9	53.2	68.3	59.6	49.96	77	6	12	1
Laxton's Prolific ...	"	9.10	"	15.11	46	18.12	79	22	28.12.91	89	Acked by mildew and died				64.4	73.9	54.2	64.7	60.7	45.49	64	5	20	3
Carter's Progress ...	"	9.10	"	19.11	50	Dead.		23.11.91		.	.	54	.	.	66.9	73.9	56.2	68.9	61.9	39.79	43	6	.	.
" Telegraph ...	"	9.10	"	15.11	46	23.12	84	16	2.1.92	94	2.92	126	4.0	5.0	63.9	73.9	53.2	68.3	59.6	53.29	85	6	18	1
Champion of England ...	"	9.10	"	19.11	50	21.12	82	10	Died down.			96	5.0	3.50	64 4	73.9	54.2	64 7	60.7	48.23	69	6	18	1
Marvel ...	"	9.10	"	7.11	38	23.12	84	12	.	do.	.	99	6.0	4.0	64.4	73.9	54.2	64.7	60.7	48.58	71	6	20	1
Tall Sugar ...	"	9 10	"	9.12	70	This Pea produced pods, but they were abortive.									66.9	73.9	56.2	68.9	61.9	42.53	51	8	.	.
British Queen ...	"	9.10	"	18.12	79	Dead.		24.12.91		.	.	85	.	.	64.4	73.9	54.2	64.7	60.7	45.29	61	8	.	.
Ne Plus Ultra ...	"	9.10	"	18.12	79	Dead.		31.12.91. Produced pos same as "Tall Sugar."							64.4	73.9	54.2	64.7	60.7	46.11	66	8	.	.
Emperor of the Marrows ...	"	9.10	"	18 12	79	.	.	do.	.	.	.	do.	.	.	64.4	73.9	54.2	64.7	60.7	46.11	66	8	.	.
Elephant ...	"	9.10	"	18.12	79	.	.	do.	.		.	do.	.	.	64.4	73.9	54.2	64.7	60.7	46.11	66	8	.	.
Blue Peter ...	"	9.10	"	4.11	35	Dead.		10.11.91		.	.	41	.	.	65.4	73 9	57.2	68.9	61.9	26.51	34	½	.	.
Carter's Little Wonder ...	"	9.10	"	Dead.		.	.	.	.	.	.	15	.	.	59.6	73.9	61.2	63.8	55.4	18.05	10	2½	.	.
American Wonder or Emerald	"	9.10	"	7.11	38	Dead.		14.11.91		.	.	45	.	.	65.4	73.9	57.2	68.9	61.9	26.86	35	1	.	.

Bishop's Long Podded ...	"	9.10	"	7.11	38	De	ad.	14 11.	91	.	.	45	.	.	65.4	73.9	57.2	68.9	61.9	26.86	35	2	.	.
Carter's Stratagem ...	"	9.10	"	15.11	46	De	ad.	23.11.	91	.	.	54	.	.	66.9	73.9	56.2	68.9	61.9	39.79	43	4	.	.
Abundance ...	"	9.10	"	15.11	46	23.12	84	10	De	ad.	.	99	8.0	4.0	64.4	73.9	54.2	64.7	60.7	48.58	71	3	20	1
McLean's Little Gem ...	"	9.10	"	7.11	38	De	ad.	11.11.	91	.	.	42	.	.	65.4	73.9	57.2	68 9	61.9	26.86	35	2	.	.
Carter's Pride of the Market	"	9.10	"	De	ad.	.	.	.	.	.	.	15	.	.	59.6	73.9	61.2	63.8	55.4	18.0.	10	.	.	.
Kentish Invicta ...	"	9.10	"	4.11	35	24.11	55	34	10.12.91	71	16.1.92	108	9.0	4.0	63.9	73.9	53.2	68.3	59.6	49.94	76	5	15	3
Advancer ...	"	9.10	"	De	ad.	.	.	.	.	.	.	15	.	.	59.6	73.9	61.2	63.8	55.4	18.05	10	.	.	.
Carter's First Crop ...	"	9.10	"	4.11	35	24.11	55	15	10.12.91	71	6.1.92	108	5.0	4.0	63.9	73.9	53.2	68.3	59 6	49.94	76	3½	18	2
Omega ...	"	9.10	"	De	ad.	.	.	.	.	.	.	15	.	.	59.6	73.9	61.2	63.8	55.4	18.05	10	.	.	.
Carter's Anticipation ...	"	9.10	"	19.11	50	23.12	84	12	30.12.91	91	3.2.92	127	2.0	5.0	63.9	73.9	53.2	68.3	59.6	53.29	85	3½	18	4
" Blue Express ...	"	9.10	"	7.11	38	De	ad.	12.11.	91	(No	pods.)	43	.	.	65.4	73.9	57.2	68.9	61 9	26.86	35	3	.	.
Sharpe's Invincible ...	"	9.10	"	19.11	50	12.12	73	8	De	ad.	24.	12.91	5.0	4.0	64.4	73.9	54.2	64 7	60.7	45.29	61	4	18	3
Sturdy ...	"	9.10	"	19.11	50	De	ad.	24.	11.91	.	.	55	.	.	66.9	73.9	56.2	68.9	61.9	39.79	43	3	.	.
Carter's Balmoral Castle ...	"	9.10	"	15.11	46	22.12	83	18	2.1.92	94	1.2.92	126	7.0	5.0	63.9	73.3	53.2	68.3	59 6	53.29	85	4½	18	4
Laxton's Fillbasket ...	"	9.10	"	19.11	50	De	ad.	26.11.	91	(No	pods.)	57	.	.	66.6	73.9	56.2	68.9	61.9	39.79	43	4½	.	.
Carters' Wonder of the World	"	9.10	"	De	ad.	.	.	.	.	.	.	15	.	.	59.6	73.9	61.2	63.8	55.4	18.05	10	.	.	.
Princess Royal ...	"	9.10	"	15.11	46	28.11	59	28	2.1.92	94	3.1.92	124	12.0	4.0	63.9	73 9	53.2	68.3	59.6	53.26	84	6½	20	3
Laxton's Wm. the 1st ...	"	9.10	"	9.11	40	De	ad.	18.11.	91	(No	pds.)	49	.	.	65.4	73.9	57.2	68.9	61.9	37.59	38	5	.	.
Early Sunrise ...	"	9.10	"	9.11	40	23.11	54	28	2.1.92	94	3.1.92	124	7.0	4.0	63.9	73.9	53.2	68.3	59.6	53.26	84	3	20	3
Laxton's Alpha ...	"	9.10	"	7.11	38	1.11	55	24	28.12	89	2.92	126	12.0	3.50	63.9	73.9	53.2	68.3	59 6	53.29	85	4	20	4
Hundredfold or Cook's Favourite	"	9.10	"	15.11	46	30.11	61	25	28.12	89	2.92	126	5.0	3.50	63.9	73.9	53.2	68.3	59 6	53.29	85	5	18	4

It will be noticed that several of the varieties produced pods, but the peas contained in them seldom attained a larger size than the head of a pin. It is evident that the season of the year is not a favourable one for growing Peas, and indeed three lots planted since, that is between October and February, have yielded little, if any better results.

Carter's "Telegraph" and Carter's "Telephone" were, perhaps, the two best peas when cooked but the plants grow rather tall to be recommended for general cultivation. "Abundance" is an excellent pea, of medium height, and a good bearer. Carter's "Anticipation," "Sharpe's Invincible," "Laxton's Alpha," "Early Sunrise," "Carter's G. F. Wilson," "Carter's First Crop" and Carter's Balmoral Castle" are all good peas, and I have no doubt that in drier seasons the flavor of all would be greatly improved, and as they are varieties of medium height, an advantage where strong winds are of frequent occurrence, they can be recommended for general cultivation.

W. Harris.

MANUFACTURE OF CASTOR OIL.

The following letter shows that Jamaica can compete with India in this manufacture.

"You will remember the sample of Castor oil I showed you in the Exhibition. Only a few weeks ago I sold my first oil to the St. Cruz Hospital at the rate of 7½d per lb. delivered in the Hospital. The Oil kept very well, which only shows that our Castor oil seeds, manufactured in the way you directed me* are as good as the East Indian ones, and much better than those grown in America. My Oil was clearer than the Hospital Oil in Kingston, which Mr. Foster showed me."

CARL HINDERMANN.

LOGWOOD.

The following questions were submitted by a correspondent in the United States, and the answers were very kindly furnished by C. W. Treleaven, Esq., Bogue, who has done so much in the way of regular cultivation of this tree.

LOGWOOD.

Questions.	*Answers.*
1. At what time and age of the tree is the best product obtained?	1. I believe any time after fifteen years.
2. Is there any provision taken for propagating the trees so that they will not be exterminated?	2. Logwood seeds grow very readily and where trees are plentiful no supplies are ever needed, as the ground is generally thickly covered with young seedlings which when a year or two old require to be thinned and trimmed, common bush and trees to be exterminated; provided this rule is followed there will always be plenty of trees to take the place of those cut for export. Even two or three trees will throw seed quite sufficient to cover a large run of land—the seed grows better when scattered on the surface and not covered with earth.
3. The character of the soil upon which logwood, fustic, and red woods grow?	3. Good black earth with clay subsoil at a depth of not less than two feet.
4. Are there any marked differences in the quality of the woods from different parts of the Island?	4. A very marked difference in the same locality, the most plentiful being ordinary red logwood. the less plentiful being of a very deep blue. The latter very soon after being cut and chipped puts on a very rich bronze sheen. There is another sort called by the chippers "white-wood"—this is of a pale mahogany colour and has apparently less dye than either of the others.
5. In Morlet's travels in Central Amerrica there is a description of the Haematoxylon Campechianum which states that the trees send forth young shoots, and as soon as the parent tree is cut down a nursery of young plants springs up and thus prevents the entire extermination of the species. Can you inform me if this is correct?	5. *Ripe* trees when cut do not spring again from the root—the sap of the root gradually rots off, the root is then dug and chipped for export. If a very young tree is cut the root throws up a large quantity of shoots. This Estate ranges from a little above sea-level to an elevation of about two thousand feet—so far as I have observed during a management of fifteen years the best wood is grown below an elevation of one thousand feet.

CASUARINA.

Casuarina equisetifolia, Forst. (C. muricata, Roxb.), is known as the Beefwood tree. It is fast growing and yields excellent timber. It has been successfully established in large plantations in the neighbourhood of Madras, and it thrives in poor sandy soil close to the sea. Colonel Campbell Walker, Conservator of Forests, Madras, estimates the yield of firewood from this tree for locomotives and other purposes, to be four times as great as the return from any tree grown for the same purpose in France. The timber, although somewhat heavy, is valuable also for building purposes. The tree is not attractive in appearance on account of its thread-like jointed branches without leaves, but it withstands strong winds, and it may be usefully employed if planted thickly, to form shelter-belts against sea breezes to mask earth works and batteries, and even to drain somewhat boggy saline lands. In these respects it is much superior to the Blue Gum tree (Eucalyptus Globulus) which is not at all suited to tropical conditions. During the last two years efforts have been made to establish Casuarina trees on the West Coast of Africa. Large supplies of seed have been received through the Indian Office from the Agri-Horticultural Society of Madras, and the seed has been distributed from Kew to all the West African settlements.

Kew Bulletin, March, 1892.

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* Directions in Bulletin, No. 14.

No. 32. June, 1892.

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.
1892.

SISAL HEMP.

An article on Sisal Hemp has appeared in the February number of the *Kew Bulletin*, extracts from which are given below. It will be seen that this article confirms my opinion that planters need to consider carefully both soil and situation before embarking in the cultivation. At the same time those who have decided to undertake this new industry, should lose no time in planting, and they should moreover plant large areas. The larger the area, the smaller will be the working expenses per 100 acres. W. F.

Kew Bulletin on Sisal Hemp.

A remarkable development of the cultivation of Sisal hemp in the Bahamas has taken place during the last three years. The Governor, Sir Ambrose Shea, K.C.M.G., has enlisted such widespread interest, it might be termed enthusiasm, in the subject, that hemp-growing has become, for the moment, one of the most prominent of the new industries of the tropics. Frequent inquiry has been made at Kew, in regard to the plant yielding the best qualities of Sisal hemp, and information has been sought by official and other bodies to enable them to judge of the suitability of the plant for cultivation in other countries. The position taken by Kew in this matter is a very simple one. The various varieties and forms of *Agave rigida*, Mill, the species from which the several sub-species and varieties yielding Sisal hemp are supposed to have sprung, have been carefully studied, and living specimens have been added to the collections in the Royal Gardens. In this respect, the collections at Kew at the present time are probably as complete as any in the world.

Further than this an effort has been made to furnish from time to time in the *Kew Bulletin* such information as could be obtained respecting the methods of cultivation and the incidental conditions of the industry likely to be of general interest * The Bahamas are fortunate in possessing a soil and climate very favourable to the production of excellent fibre. They also have the great advantage of possessing, on the spot, immense quantities of plants of the best variety known to yield Sisal hemp. This variety is of rapid growth, and is easily handled. It has no side teeth to obstruct or retard the process of harvesting, and the people generally appear to have supported the action of the Governor to such an extent that the establishment of the industry is now within measurable distance of being accomplished.

The only drawback, so far, is the want of a machine that will enable the planters to extract the fibre in an effective and economical manner. As a last resort there is the somewhat crude and clumsy machine long used in Yucatan, but it is probable that before any lengthened period has elapsed a machine of a more suitable character will be forthcoming.

In the meantime efforts are being made to establish a fibre industry in Florida, where more than 50 years ago, plants of Sisal hemp were introduced and partially established by Dr. Perrine. A special Report prepared by Mr. Charles Richards Dodge of the Department of Agriculture at Washington [Fibre Investigations, *Report* No. 3, 1891], has lately been issued on the subject. In this Report an account is given of the distribution of Sisal hemp plants in Florida and the adjoining Keys, and it is recommended to utilise these as the starting point of a regular industry. Mr. Dodge says "what can be done in the Bahamas I have reason to believe can be accomplished in this country "[Florida] . . . . We have the soil, the climate, and the plants. The combination of capital "and inventive genius with these conditions must work out the problem, if indeed, the question is not already practically solved." A further account of the efforts made to establish Sisal hemp plantations in Florida is given later.

A small but promising effort is being made to grow fibre at some of the Turks and Caicos Islands, and plants obtained from this source and from Florida have been introduced into most of the West Indian colonies.

A short account has been prepared, mentioning most of the localities where plants of Sisal hemp are now found, and this account will afford useful material for enabling those who may wish to do so to decide as to the wisdom or otherwise of embarking in a fibre industry at the present time. At the close of the article, a statement is given of the average price per ton obtained for Sisal hemp in this country during the last 13 years.

Yucatan.

Information respecting the Sisal hemp industry in Yucatan has already been given in the *Kew Bulletin* for March 1887. Since that time an effort has been made to obtain direct from Yucatan a representative collection of the various Agaves cultivated in that country for fibre purposes.

Through the kind offices of the late Mr. Augustus Baker, Her Majesty's Consul at Vera Cruz, a large plant with a tall stem and flowering panicle was received at Kew in May, 1890. The plant was dead on arrival, but it has since been prepared as a museum specimen, and is now deposited in Museum II. The dimensions of the plant are as follows: length of stem (below the leaves) 4 ft.; circumference of stem 36in.; number of leaves on stem, 50; length of leaves about 4 ft.; breadth of leaves 3½ in.; length of peduncle 14 ft. The branched panicle was received in an incomplete condi-

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* The following articles have appeared in the *Kew Bulletin* on Sisal hemp and allied fibres from species of *Agave*:—
1887, March, p. 3, Sisal hemp (*Agave rigida*, var. *sisalana*). 1887, March, p. 10, Keratto fibre (*Agave Morrisii*). 1887, December, p. 5, Mexican fibre or Istle (*Agave heteracantha*). 1889, March, p. 57, Bahamas hemp (*Agave rigida*, var. *sisalana*) 1889, October, p. 254, Bahamas hemp (*Agave rigida*, var. *sisalana*). 1890, March, p. 50, Bombay aloe fibre (*Agave vivipara*). 1890, July, p. 158, Bahamas hemp (*Agave rigida*, var. *sisalana*). 1890, October, p. 220, Mexican fibre or Istle (*Agave heteracantha*). 1890, December, p. 273, fibre production in the Caicos. 1891, May and June, p. 133, Keratto fibre (*Agave Morrisii*). 1891, July, p. 175, Bahamas hemp (*Agave rigida*, var, *sisalana*).

tion, but the total height of tho plant as now existing is about 24 ft. The weight of the whole plant in a green state was probably not less than 2½ to 3 cwt. The leaves have the characteristic black terminal spine, and they are furnished throughout with small black teeth about 1 inch apart. This plant belongs probably to the variety *elongata* (*Agave rigida* var. *elongata*) It is evident that in Yucatan the plants cultivated for fibre are largely composed of this variety. We learn, for instance, that in harvesting the leaves the Indian who cuts off the leaves is followed by an Indian woman, "who with a knife cuts off the spike or thorn "tipped end and the thorny side of the leaf ready for the machine." In the case of leaves without teeth such as are borne by plants of the variety *sisalana*, it would be only necessary to cut off the torminal spine. Hence, while the latter variety yields fibre of equal if not better quality than the variety *elongata*, its loaves are more easily handled, and they require less treatment during the process of harvesting.

In addition to the large plant received from Yucatan there were received two lots of small plants. The first of these was received on tho 31st May, 1890, and represented apparently about five distinct kinds. The greater part consistod of plants of typical *A. rigida*, and a good number of *A. rigida* var. *sisalana*. The others represented forms not easily determinable in a small state. A set, with the exception of the above, has been retained at Kew, and the plants will be determined later. The others were all distributed to the Botanical Gardens at Singapore, and to the Botanical Stations at Fiji and Antigua. The second lot of small plants from Yucatan arrived at Kew on December 13, 1890. On arriving there were 30 plants dead and 11 alive. The latter were, however, so small and sickly that, weakened by the cold to which they had been exposed, it was impossiblo to save them. This attempt to introduce a representative collection of Agaves from Yucatan, in spite of a considerable sum paid for expenses, was singularly unfortunate. It may be mentioned, however, that Merida, the headquarters of the hemp industry in Yucatan, possesses only an unpaid Vice-Consul, who is but partially under the control of Her Majesty's Consul at Vera Cruz. It is due to the latter to state that he endeavoured to the utmost of his power to assist this establishment; and if he had not been so remotely placed tho result would have been far more satisfactory.

Very little additional information, not hitherto published, has been received respecting the Sisal Hemp (Henequen) industry in Yucatan. The subject has already been very fully treated in the *Kew Bulletin*, and it is only necessary to add a description with wood cut of the method adopted for harvesting the leaves quoted in the *Report* of the Department of Agriculture, p. 25.

"This is done by the Indians, who are almost nude, with a stroke of the knife, or *machete*, at the rate of, for one hand, of 2,000 to 2,500 leaves per day. Following the Indian who cuts off the leaves is an Indian woman, who with a knife, cuts off the spike or thorn-tipped end and the thorny side of the leaf, ready for the machine. One foreman was understood to say that it costs about 50 cents per 1,000 leaves to cut, prepare, and get the leaves to the cleaning machines. On all the large *haciendas* visited were little railways into the fields, upon which on cars, drawn by mules or oxen, the henequen was taken to the mill, and the waste was taken away."

A Sisal hemp plantation should be systematically laid out, and to work it economically it is desirable it should consist of a tolerably large area. It has been insisted in regard to fibre plantations in "Florida that small plantations . . . will not pay. A large tract is necessary for the "economical production of fibre, so that the work of cutting the leaves and shipping the fibre may be "systematically continued for the greater part of the year."

As the weight of the green leaves is so large in proprotion to the yield of fibre, their conveyance from distant parts of the plantation to the factory must involve considerable labour and expense. For instance, if every 100 tons of green leaves will yield only about 2¼ to 3½ tons of dry marketable fibre, it is evident that an immense quantity of useless pulp has to be conveyed to the factory and disposed of as conveniently as the circumstances will admit.

Fibre estates should therefore be established on moderately level ground where light portable railways could be laid, or on moderately sloping ground converging on a single point where wire ropes could be used for sliding the leaves in portable bundles to the factory. The experience gained on sugar estates in cultivating large areas in the tropics and in conveying heavy perishable material to a central point would appear to be generally applicable also to Sisal hemp estates. As in sugar so in Sisal hemp the advantage will ultimately rest with such estates as are able to reduce their working expenses to the lowest point and compete successfully with the produce of countries like Yucatan and the Phillippines.

The *South American Journal* says that "the bulk of the henequen grown in Yucatan is sent to "New York, and that the export has grown enormously. In 1875 the total value of the export from "Yucatan, as shown by the Custom House returns, did not exceed 710,124 dols., since which period "it began to attract greater attention, and in 1878 the figure almost doubled. The following shows "the export of henequen in each year from 1878 to 1889 :—

" 1878, 1,166,504 dols. :	1879, 1,287,375 dols. ;	1880, 1,495,467 dols. ;
" 1881, 2,284,389 dols. ;	1882, 2,672,107 dols. ;	1883, 3,311,663 dols. ;
" 1884, 4,165,020 dols. ;	1885, 3,988,791 dols. ;	1886, 2,929,116 dols. ;
" 1887, 3,901,628 dols. ;	1888, 8,229,460 dols. ;	1889, 6,872,593 dols."

It is mentioned as a curious circumstance that the market price of the fibre in New York increased almost *pari passu* with the increase of exports.

From Messrs. Croker's American Statistics (quotod in Messrs. Ide and Christie's *Monthly Circular*, dated 15th January, 1892) we find that the total importations of Sisal hemp into the United States during the year 1889-1891 were as follows:—1889, 237,736 bales; 1890, 230,800 bales, 1891, 286,700 bales. Of these latter we find 10,006 bales were re-shipped to the United Kingdom. The total importations into the United Kingdom (London and Liverpool), according to Messrs. Ide and

Christie, were 20,296 bales. It is evident from this that the English market in regard to Sisal hemp is comparatively small.

As regards Manila hemp the result is very much the same, although in the first instance the bulk of the shipments are received in the United Kingdom. For instance, during the year 1891 there were received in the United Kingdom a total of 448,000 bales of Manila hemp. Of these there were re-shipped to the United States 175,019 bales, leaving 272,081 bales for consumption on this side. The total receipts of Manila hemp in the United States for 1891 (direct and *viâ* Europe) were 316,697 bales.

Taking the combined consumption of Sisal and Manila hemps (known generally as "white hemps"), we find the relative quantities taken on both sides of the Atlantic to be approximately as follows:—United States, 693,391 bales; United Kingdom, 292,377 bales. . . .

Jamaica.

As might be naturally expected, there has been considerable effort made to introduce plants of Sisal hemp for experimental trial in Jamaica. The present Governor of Jamaica, Sir Henry Blake, K.C.M.G., has taken a deep interest in the matter, and land has been established with fibre plants adjoining the Hope Gardens. The plants numbering over 20,000, have made good progress, and the Director of the Botanical Department is in a position to supply suckers on a large scale to those anxious to start a fibre industry. There are large tracts of level and acccessible lands in the plains of Jamaica suitable for growing Sisal hemp, and if the people had taken note of these circumstances some 8 or 10 years ago, they would have been able to take advantage of the recent high prices for white rope fibres, and have realized some share of the fortunes which have fallen to the people at Yucatan. At the present time the circumstances have greatly altered, and the advice given by Mr. Fawcett in regard to caution being necessary before embarking, at this late hour, upon a Sisal-hemp industry on a large scale is probably correct. In two or three years' time the extensive plantations in the Bahamas will be sending their produce to the market, and this, in conjunction with the expected increased returns from Yucatan, must tend to lower prices, unless something very unexpected occurs to create a greatly increased demand for Sisal hemp.

The steps taken to obtain Sisal hemp plants for Jamaica are detailed in the following extracts from the Annual Report of the Botanical Department for the year 1889:—

"*Sisal Hemp.*—There is considerable demand in the island for plants of Sisal hemp. Three years ago I tried to obtain a supply of plants from Yucatan, but the planters there are so anxious to have a monopoly of a trade which brings them large fortunes that only through a special request from the Colonial Secretary to the British Vice-Consul at Progresso was I enabled to secure one dozen plants of the kind under ordinary cultivation (*Agave rigida*, var. *elongata*).

"Another variety (*Agava rigida*, var. *sisalana*), which is without the teeth on the edges of the leaves, has for some years been growing in the Bahamas, where it was probably introduced from Florida. A specimen of the fibre was shown at the Colonial and Indian Exhibition (1886) by his Excellency Sir Henry Blake, then Governor of the Bahamas. From a test that was made in the railway workshop by Mr. L. Mackinnon on the fibre extracted by Kennedy's machine, it appeared that it is at least as valuable as any fibre previously tested, and moreover, the leaves being without spines on the edges, are cheaper to work up. The Government of the Bahamas had forbidden the export of this plant (called "Pita") for a period of three years, but fortunately it has been found possible to get more than 20,000 plants from Turks Island, and a plantation has been formed at Hope Garden. Mr. Stoddart has superintended the planting. It is expected that it will be found possible to import a considerable number of this variety of the plant, and several applications have been received from planters for supplies of suckers. Considering that the price of Sisal hemp has (recently) fallen from £53. per ton to £27., caution should be exercised in the investment of capital in the enterprise. I should hesitate to recommend its cultivation in any soil which is not suitable to it, and at the same time worthless for other cultivation."

A later account of the Sisal hemp plants at Jamaica is given in the *Bulletin* of the Botanical Department for October 1891, p. 15:—

"In order to encourage the planting of Sisal in Jamaica, the Government has imported lately from Florida 25,000 plants of the same variety as grows in the Bahamas. This is in addition to over 51,000 already supplied to planters, and to over 20,000 planted in the Hope Gardens. . . It is thus possible for any one to obtain a few plants for experiment at a very small expense, or in large quantities for laying the foundation of future fibre farms. . . ."

Fibre Machines.

Until very recently the only machine in use in Yucatan was a clumsy affair stated to be a native invention, called a "raspador." Rude as this piece of mechanism is, it is said that a native will clean 20 leaves a minute with it, though with a considerable per-centage of waste of fibre. While the raspador is said to have been superseded on some plantations, it is more or less generally used at the present time for extracting the immense quantities of Sisal hemp exported. The average work of one machine is claimed to be 7,000 leaves per day with two feeders or operativos.

The following description of the Yucatan Machine is quoted by Mr. Charles Richards Dodge:—

"It is simply a wheel, like a 4-foot pulley, 6-inch face, with pieces of brass an inch square, and 6 inches long, running across the face about a foot apart. This wheel runs in a heavy wooden case. When working well it makes about 110 revolutions a minute. The leaf is put in through a small hole in the case, and being held by a strong clamp, is allowed to whip downward as the wheel moves around. A heavy block, like the brake of a car wheel, is, by lever, brought to bear on the leaf, pressing it against the revolving wheel. In a second the pulp is crushed and thrown into a pit under the wheel, and the fibre is drawn back, one half of the leaf being cleaned quicker than one can follow the motions. The leaf is reversed and the other end cleaned in the same manner."

In the Bulletin of the Botanical Department, Jamaica, July 1891, a report is published of the results of experiments with the Weicher fibre machine at Jamaica. The machine was driven by steam power, and it required four persons to feed it and remove the fibre.

Amongst the leaves cleaned were those of the Sisal hemp plants, *Agave rigida*, var. *elongata*, and *Agave rigida*, var. *sisalana* The results may be briefly summarised at follows: 115 leaves (weighing 185 pounds) were cleaned in 17 minutes These yielded wet fibre weighing 20¾ pounds, and dry fibre weighing 8¼ pounds. The out-turn of dry fibre per day of 10 hours would thus be about 291 pounds.

At the Bahamas an American machine known as the Albee Smith fibre-cleaning machine was lately tried. An account given by the United States Consul at Nassau, dated July 10th, 1891, states that :—

"Considerable difficulty was experienced in getting the machine to run properly, owing to the fact that the steam plant used was defective, and the pulley and belts were not of the proper size, width, &c. But, despite these drawbacks, the operation of the machine was said to be decidedly satisfactory, and nearly all present were of opinion that, under proper conditions, the machine would very easily do all that was claimed for it, and that it was a most valuable improvement over all other machines in use in the colony. The new machine is entirely automatic It grips the leaves continously as fast as the operators can supply them, holds them firmly during the operation of cleaning, and delivers the fibre completely and beautifully cleaned at the further side. No reversing of the leaves or any part of the machinery is required. The operator simply supplies the leaves, and the machine does the rest. It is said to be capable of cleaning 50,000 leaves a day, extracting therefrom 3,000 lbs. of fibre."

It will be noticed that the exact returns are not here given. Those claimed for the machine by the makers are evidently purely conjectural, and having regard to the tested results of other fibre machines, it is impossible to attach any importance to them.

Numerous other fibre machines have been brought before the public during recent years. Some of these are of undoubted merit, but it is evident that the expectations of cultivators of Agave plants have not yet been fully met. The conditions existing in Yucatan, where clumsy and wasteful machines have hitherto been adopted with apparent success, are of a peculiar character. Labour there is so cheap that cultivators can afford to carry on the industry under circumstances entirely unsuited to other parts of the world. Numerous improvements have, however, been lately made in English and American machines, and there are good grounds for believing that the problem will be ultimately solved. The point requiring special attention is to [illegible] the machine, and so save the time and trouble of reversing the leaves before the whole length can be cleaned. The automatic feeding attached to some machines whereby the leaves are presented sideways may accomplish this, but so far such an arrangement has not been tested for a sufficient time to judge of its practicability. The urgent demand which will soon be felt in the Bahamas for a satisfactory means of utilising the extensive fibre plantations established in these islands will call forth strenuous efforts on the part of those interested in the subject. At Mauritius a machine for extracting the fibre of *Furcræa gigantea* has been in use for some years, and it appears to give satisfactory results. This is fully described in the *Kew Bulletin*, May, 1890, p. 98. The labour in Mauritius is chiefly supplied by Indian coolies.

MARKET VALUE OF SISAL HEMP.

In view of the largely increased production of Sisal hemp in Yucatan, and the extensive planting which is taken place in the Bahamas, Turks Islands, Florida, and other places, it may be useful to review the prices which have been realised by Sisal hemp of good quality in this country during the last 10 or 15 years. By the courtesy of Messrs. Ide and Christie, fibre brokers, of 72, Mincing Lane, E.C., we are in a position to place on record the average prices per ton of Sisal hemp in the London and Liverpool markets for every month during the last 13 years from 1879 to 1881, both inclusive. The table attached speaks for itself. It may, however, be useful to point out that the price per ton has been as low as £17 15s. (in January, 1886), and in March, 1889, it rose as high as £56 10s. These are the minimum and maximum prices respectively during a period of 13 years. The average price for each of the 13 years, beginning with 1879, are as follows :—£24 ; £27 ; £28 ; £28 ; £27 ; £21 ; £19 ; £21 ; £33 ; £37 ; £50 ; £30 ; £26. The average price for the whole period is £28 10s. nearly. Prices ruled highest during the year 1889, when the average price was £50 per ton. During the year 1891 the average price was £26 per ton, or nearly one half of what it was two years previously in 1889. The last return issued by Messrs. Ide and Christie, dated the 15th January, 1892, quotes Sisal hemp, spot value, at £23 15s. per ton. The market report is, "Sisal has again fluctuated, but closes at the top, and £2 per ton higher than when we last noticed."* It is evident that the market value of Sisal hemp has shown considerable fluctuation of late years

It has already been shown that the bulk of the Sisal hemp produced in Yucatan is shipped to the United States. The price paid for Sisal hemp in the New York market during the last 13 years is therefore necessary before we can take a complete view of the Sisal hemp industry for that period.

So far, we can only give returns of prices in the United States, published on the 31st December, 1891, for the last three years as follows :—

1889, 8⅝ cents per pound (£40 per ton); 1890, 6 cents to 6¼ cents (nominal) (£28 to £29 per ton) ; 1891, 4¼ cents to 4⅝ cents (£20 to £20 10s. per ton).

In the meantime the complete returns kindly placed at our disposal in regard to Sisal hemp in this country cannot fail to be of service :—

* The Return dated 16th May, 1892, gives spot value at £23. "A good business has been done during the month at about quotations."

Average Price per Ton of fair quality Sisal Hemp in the London and Liverpool Markets for 13 years from 1879 to 1891 (inclusive).

Months.	1879.		1880.		1881.		1882.		1883.		1884.		1885.		1886.		1887.		1888.		1889.		1890.		1891.	
	£	s.	£	s.	£	s.	£	s.	£	s.	£	s.	£	s.	£	s.	£	s.	£	s.	£	s	£	s.	£	s.
January ...	23	0	32	10	28	0	27	10	28	0	22	10	19	0	17	15	27	10	36	0	50	0	40	10	28	10
February ..	23	0	32	10	29	0	27	10	28	0	22	10	18	10	17	15	28	0	36	10	52	0	38	0	27	10
March ...	22	0	29	10	27	0	26	10	28	0	23	10	18	10	18	10	28	10	37	0	56	10	32	0	28	10
April ...	21	0	29	10	29	0	25	0	29	0	23	0	18	10	18	5	31	0	38	0	53	10	28	0	28	0
May ...	21	0	26	10	29	0	27	0	27	0	21	0	19	10	18	10	32	0	35	0	53	0	26	15	28	10
June ...	22	0	23	0	29	0	28	0	26	10	21	0	19	10	18	15	30	0	32	10	49	0	26	0	28	0
July ...	22	0	23	0	27	10	28	0	27	0	20	0	18	10	19	15	30	0	29	0	50	0	25	0	27	0
August ...	24	0	24	0	26	10	27	10	25	10	21	0	18	10	24	10	33	0	32	10	50	0	25	0	23	10
September ...	25	0	25	10	26	10	28	10	25	10	20	0	18	10	25	10	37	0	39	0	50	0	27	0	22	10
October ...	23	0	25	0	27	10	30	0	25	10	19	10	18	10	24	0	40	0	39	0	50	0	26	10	22	0
November ...	29	0	25	0	29	10	29	0	24	5	19	10	18	10	26	0	40	0	40	0	45	0	32	10	21	0
December ...	32	10	25	10	28	10	28	10	24	0	19	10	18	5	26	0	39	0	45	0	45	0	29	10	22	00
Average £	24		27		28		28		27		21		19		21		33		37		50		30		26	

PROFESSOR HUXLEY ON AGRICULTURAL EDUCATION.

In the course of a paper on technical education, before the Easingwold (England) Chamber of Agriculture, on April 10 last, Mr. J. Harrison read the following letter from Professor Huxley, which appears also in the *Agricultural Gazette* of England :—

"I am afraid that my opinion upon the subject of your inquiry is worth very little, my ignorance of practical agriculture being profound. However, there are some general principles which apply to all technical training. The first of these, I think, is that practice is to be learnt only by practice. The farmer must be made by thorough farm work. I believe I might be able to give you a fair account of a bean plant, and of the manner and condition of its growth; but if I were to try and raise a crop of beans, your club would probably laugh consumedly at the result. Nevertheless, I believe that your practical people would be all the better for the scientific knowledge which does not enable me to grow beans. It would keep you from attempting hopeless experiments, and would enable you to take advantage of the inumerable hints which Dame Nature gives to people who live in direct contact with things. And this leads me to the general principle which I think applies to all technical teaching of school boys and school girls, and that is, that they should be led from the observation of the commonest facts to the general scientific truths. If I were called upon to frame a course of elementary instruction preparatory to agriculture, I am not sure that I should attempt chemistry, or botany, or physiology as such. It is a method fraught with danger of spending too much time and attention on abstraction and theories, on words and notions, instead of things. The history of a bean, of a grain of wheat, of a turnip, of a sheep, of a pig, or of a cow, properly treated, with the introduction of the elements of chemistry, physiology, and so on, as they come in, would give all the elementary science which is needed for the comprehension of the processes of agriculture in a form easily assimilated by the youthful mind, which loathes anything in the shape of long words and abstract notions, and small blame to it. I am afraid I shall not have helped you very much, but I believe that my suggestions, rough as they are, are in the right direction.

Yours, &c.,

T. H Huxley.

PRESERVATION OF POTATOES.

The difficulty of keeping Irish Potatoes in edible condition in late spring is well known to housekeepers, farmers and merchants. Professor Schribaux, of the national College of Agriculture of France, has recently divised a very simple, cheap and successful method by which he has been able to preserve Potatoes in edible condition for over a year and a half. This process has been adopted by the French Government for preserving Potatoes for the army. The French Minister of Agriculture publishes the details of the process in the official *Bulletin du Ministère de l'Agriculture* for March, 1891. The following is a translation of the essential part of the scheme. The method of preservation consists in plunging the tubers before storing them away for ten hours into a 2 per cent. solution of commercial sulphuric acid in water, two parts of acid to 100 parts of water. The acid penetrates the eyes to the depth of about one-fortieth of an inch, which serves to destroy their sprouting power; it does not have any appreciable effect upon the skin of the potatos. After remaining in the liquid ten hours the tubers must be thoroughly dried before storing away. The same liquid may be used any number of times with equally good results. A barrel or tank of any kind will do for the treatment. The acid is so dilute that it does not affect the wood. Chemical analysis shows that Potatos treated by this process are as nutritious and healthful after eighteen months as when freshly dug; but they are of course worthless for planting.—*Science.*

YIELD OF POTATOES.

In district of Red Hills, elevation 1,800 feet, "I planted 263 lbs of potatoes between 7th and 12th January, and they were dug between the 31st March and 4th April, yielding 622 lbs. The yield was small, owing to the severe drought. The potatoes are good, though not large."

L. F. Mackinnon.

In England, 8 cwt. of potatoes are allowed for seed per acre, and the yield is from 6 to 7½ tons per acre. W. F.

ONIONS.

Mr. C. L. Walker has been most successful in growing Onions at Ballards Valley, St. Mary, some of the bulbs weighing as much as 1lb.

The seed was "Pale Rod Bermuda," purchased from Mr. Ed. D. Kinkead (Kingston).

Mr. Walker writes :—" I sowed 1s. worth of onion seed the weather being very heavy at the time I suppose one half was washed away. No account was kept of the weight harvested but I estimate that when all have been taken up 3 beds 14x4, 14x3, and 15x12, will yield say 200 lbs. To date a great many are not yet fit, this I think is from being planted too thick and were not thinned onough· Last year the transplanted onions did as well as these.

" I planted tho seed without paying much attention to the cultivation of them, the beds were not highly manured, just a small portion of stable manure being used as the soil is rich."

FERNS: SYNOPTICAL LIST.—IX.

Synoptical List, with description, of the Ferns and Fern-Allies of Jamaica, by G. S. Jenman, Superintendent Botanical Gardens, Demerara, (Continued).

TRIBE V. *Adianteæ.*

Sori marginal; linear, oblong, reniform or roundish, inserted on the innerside of the refloxed cartilaginous margin, which forms the involucre.

The characteristic feature of this tribe is found in the absence of a special involuere, the sori being borne on the innerside of the changed cartilaginous reflexed margin, which is folded back against the underside of the leaflets, thus reversing while folded the general direction of the sporangia in relation to the surface of the fronds. The members too, though varying greatly, possess in common a strong family likeness, and form one of the most natural and best marked tribes in the order.

Genius X. *Adiantum,* Linn Only genus. Characters as in the Tribe.

This genus is well known as comprising the popular and commercially valuable maiden hair ferns, a term applied to all the species of the *Capillus-veneris* type, with which species it first originated. They have usually polished black chestnut stems and rachises, with more or less dimidiate, flabellate or equilateral leaflets, which have no central rib. As in *Lindsaya,* where the leaflets are dimidiate, i. e., apparently half cut away, the fructification is only along the superior, and sometimes the outer margin. The genus occupies both shady and open situations equally, abounding most at low altitudes, ascending from sea level, but gradually decreasing in the higher ranges, up to 3,000 or 3,500 ft. alt., where its appearance terminates.

a. Fronds pinnate or bipinnate, pinnæ equal-sided, sori uninterrupted.

1. *A. deltoideum,* Swartz.
2. *A. lucidum,* Swartz.
3. *A. wilsoni,* Hook.
4. *A. macrophyllum,* Swartz.

aa. Fronds pinnate or bipinnate, leaflets subdimidiate or dimidiate, sori uninterrupted.

5. *A. Kendalii,* Jenm.
6. *A. villosum,* Linn.
7. *A. pulverulentum,* Linn.
   (see also *A. cristatum* and *A. pyramidale.*)

aaa. Fronds pinnate or bipinnate, leaflets unequal-sided or the smaller subdimidiate; sori interrupted, borne on the opposite margins.

8. *A. Kaulfussii,* Kunze.
9. *A. obliquum,* Willd.
10. *A. intermedium,* Swartz.

aaaa. Fronds bipinnate, leaflets dimidiate; sori interrupted, running along the upper margin and generally round the outer.

11. *A. triangulatum,* Hook.
12. *A. hirtum,* Klotzsch.—Rootstock shortly repent, sealy; stipites approximate, erect, ½–1 ft. l. slender, deciduously rusty tomentose; fronds bipinnate, composed of 2-7 pairs of spreading contiguous lateral pinnæ 3 6 in. l. and a similar terminal one, chartaceous, dark-green above rather glaucous beneath, rachis and costæ freely hairy, pinnulæ ciliate or naked, close, 1-2 dozen to a side, the outer linear-oblong, dimidiate, 5-6 li. l. 1½-2 li. br. the lower reduced and cuneate-flabellate, barren evenly serrated; veins forked, radial, sori minute, roundish or reniform, contiguous.—Hook Sp. Fil. vol. 2 l. 82, A.

    Gathered a few years ago by V. P Parkhurst, locality not recorded. A widely spread and quite characteristic species, of which two forms are prevalent in Trinidad the Guianas and Brazil in one of which scattered hairs occur on the disk of the leaflets, while in the other they are absent. The sori are very small and close, from 10-20 to a segment. It is the smallest species of this section.
13. *A, fructuosum,* Spreng.
14. *A. obtusum,* Desv.
15. A. *tetraphyllum,* Willd.

aaaaa. Fronds bi-tripinnate, rarely simply pinnate, leaflets dimidiate, sori interrupted (rarely entire) along the upper and generally round the outer margin.

16. *A. pumilum*, Swartz.
17. *A. nigrescens*, Fée.
18. *A. striatum*, Swartz.
19. *A. cristatum*, Linn.
20. *A. pyramidale*, Willd.
21. *A. crenatum*, Willd.
22. *A. melanoleucum*, Willd.

aaaaaa. Fronds decompound, rachises slender, polished leaflets on filiform padicels, variously shaped, sori in patches (polysorus).

b. Leaflets dimidiate.

23. *A. cultratum*, J. Smith.
24. *A. trapeziforme*, Linn.

bb. Leaflets more or less cuneate-flabellate.

25. *A. tenerum*, Swartz.
26. *A. emarginatum*, Bory.
27. *A. fragile*, Swartz.
28. *A. concinnum* H. B. K.

(See also *A. jamaicense.*)

1. *A. deltoideum*, Swartz. Stipites numerous, $1\frac{1}{2}$-4 in. l. castaneous, arising from a rather stoutish elongated fibrilose rootstock; fronds 3-7 in. l. $\frac{1}{2}$ - 1 in. w. simply pinnate or with one to several very short pinnate branches at the base, firm, naked or the slender rachis slightly ciliate; leaflets deltoid, terminal usually larger, upper approximate, lower subdistant, $2\frac{1}{2}$-6 li. w. and d. articulate at the apex of the short filiform pedical, underside pale, upper dark green; sori continuous (rarely interrupted) along both margins and usually round the slight basal auricles; veins free, flabellate, repeatedly forked, fine, close.

Var. *A. Jamaicense*, Fée.—Stipites and rachises rather flexuose, fronds 6 in. or over, l. 1-$1\frac{1}{2}$ in. w.; leaflets fewer, larger, $\frac{1}{2}$-$\frac{3}{4}$ in. each way, sub-deltoid, rather rounded; sori interrupted, in patches around the margin.—Fée Fil. Ant. t. 33, f. 3.

Abundant on the rocky north coast, and in stone walls, often within wash of the sea spray, gathered at St. Ann's Bay, Ocho Rios, Port Antonio, St. Thomas and elsewhere. A very distinct species, with no close ally. The margins of the triangular little leaflets are straight and the angles acute. In the var. *A. jamaicense* the stipes and rachises are more or less flexuose, pinnæ much fewer, larger, and rounded, the larger occasionally incised, and the sori uniformly in short patches. I have seen a fasciated form of the type gathered by Miss Harding.

2. *A. lucidum*, Swartz.—Rootstock rather stout, shortly repent; stipites subtufted, $\frac{3}{4}$ to $1\frac{1}{2}$ ft. l. those of the barren fronds shorter, finally naked, polished, very dark; fronds $\frac{3}{4}$—$1\frac{1}{2}$ ft. l. 3—6 in. w. with a terminal pinna and several or many spreading lateral ones, rarely bipinnate at the base, dark glossy green, paler beneath, firm in texture, rachis rusty-ciliate; pinnæ shortly stipitate, lanceolate-acuminate, subequal sided, obliquely truncate, or the upper side rounded at the base, 2—4 in. l. $\frac{1}{3}$—$\frac{7}{8}$ in. w. those of the barren fronds larger and finely serrate; veins very oblique, fine, close, forked, casually uniting; sori continuous, along both margins, falling a little short of the faintly serrate point.—Hook. Sp. Fil. vol. 2. t. 79. c.

Infrequent, gathered by Masson, (locality not recorded) whose specimens are at Kew and in the British Museum, at the Cascade, St. George, Portland, by Miss Taylor, whose specimens I possess, and, I understand, in the neighbourhood of Mt. Moses a few years ago by Syme. The fronds are separately barren and fertile, the latter being erect, 2-3 ft. high, considerably overtopping the former.

3. *A. Wilsoni*, Hookr.—Rootstock creeping, $\frac{1}{8}$-$\frac{1}{6}$ in. thick; stipites a span to $1\frac{1}{4}$ ft. l. dark, polished; fronds composed of a terminal equilateral pinna, 3-5 in. l. and $1\frac{1}{2}$-2 in. w. lanceolate or ovate-lanceolate, acuminate, and 1-2 pair of similar, spreading, lateral ones, which are petiolate and broadly rounded at the base, naked, glossy, firm; midrib evident at the base beneath, beyond which it is evanescent; veins fine, close, oblique, twice or thrice forked, casually uniting; sori continuous along both margins, falling short of the serrated apex —Hook. Sp. Fil. vol. 2. t. 72. A.

Plentiful in very damp situations in forests near rivers among the lower hills of the eastern Parishes; gathered abundantly on the banks of Ugly River, St Mary. The lateral pinnæ are usually somewhat subcordate at the base, being deeper on the lower side. It is closely allied to the mainland *A. dolosum*, Kze, which has narrower and more numerous pinnæ.

4. *A. macrophyllum*, Swartz.—Stipites a span to $1\frac{1}{4}$ ft. l. dark, polished, tufted on a rather stout, short, fasciculate, finely scaly rootstock; fronds $\frac{3}{4}$-$1\frac{1}{4}$ ft. l. 5-9 in. w. naked, glossy, passing from a delicate pink to green, composed of a terminal pinna and 4-8 pair of opposite or alternate similar lateral ones, which are subovate or lanceolate, 2-4 in. l. 1-2 in. b. acute or more tapering and acuminate, sessile or shortly stipitate, the base broadest and truncate or oblique on the lower side, the basal 1-2 pair casually expanded and auricled or subsagittate, margins entire, serrate, or inciso-lobate, no distinst midrib, or none evident beyond the base beneath; veins fine, close, repeatedly forked, free, flabellate; sori continuous along both margins, falling little or much short of the apex.—Hook. Icon. t. 132.

Common in woodland and forests among the lower hills of the eastern, and extending less abundantly to the central and western parishes, reaching 1,200 or 1,500 ft. alt. A well-known and very distinct species. The young fronds are of a beautiful red dish-pink tinge, turning green eventually. There are two distinct forms: the first with relatively short, wedge-shaped pinnæ, with the margins beyond the sori entire and even; the second with longer more acuminate pinnæ, which are inciso-lobate beyond the fertile sides. It was first collected by James Harlow, from whom Sloane's specimen in his herbarium, p. 76, mounted with A. Kaulfussi, Kze. was obtained.

No. 33. July, 1892.

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.
1892.

DRYING MACHINES.

In Bulletin No. 26, in a Report by Mr. C W. Meaden on drying bananas reference was made to the "Etna Pneumatic Fruit Drier." On writing to Mr. Meadon for further information, he very kindly furnished the following information :—

I can safely assert that the "Etna Drier" fulfills all that can be desired in drying bananas or anything else—what is objectionable about it is that the iron pipes and casing of furnace are not stout enough to resist the humidity of a climate such as that of Trinadad for any length of time.

I have had to replace the hot air pipes once in four years and replaced the outside iron of furnace by brickwork; this is an improvement as the brick-work retains the heat much better than the iron.

As far as the principle of drying fruit goes, it would be safe to invest in this machine and make such improvements as your situation, &c., may call for.

Bananas forming one of the staples of Jamaica, I venture to think that there is need of some process of drying to use up small and slightly damaged fruit. Here I regret to say fruit drying has received no attention, though I fully worked out the thing and proved that there was money in it.

This fruit drier is sold in Trinidad for £40, but you would perhaps do better by dealing direct with the makers in America, whose address I enclose in case you do not know it. I also enclose two letters, one of which gives full particulars, the other is from the Agent of the makers.

When not drying bananas, I use the drier for cocoa, coffee, corn, starch or for anything that requires drying, so that a machine that will do this, will quickly earn its cost. To-day I moved 40lbs. of cocoa out of the sweating box, dried it and sold it the same day, this will shew how useful such a machine is.

I shall be glad to furnish you with any further information within my power.

Port of Spain, 31st May, 1892.

C. W. Meaden, Esq.

Dear Sir,

We beg to offer you a Fruit Drying Machine of the same make and capacity as the one sold by us sometime ago to the Government, on the same terms.

An answer will oblige, yours truly,

Chas. Faleim & Son.

---

50 Charlotte St., Port of Spain.

C. W. Meaden, Esq.

In consequence of my not being able to carry out my industry of Banana Drying, I would be glad to dispose of my Dryer with all its supply of material, consisting of shooks for 800—2lbs. boxes, mill, &c., for $180.00. I have at present bananas prepared eight months ago which are in perfect condition.

Yours truly,

A. Grausaull.

P.S.—Enclosed is Specification of Dryer.

Specification of Universal Drying Apparatus.

The aparatus consists of an oblong box, having both ends open, one with doors for the reception of trays, the bottom of which are made of tinned wire wove to run on narrow brackets fixed to the side of the box. The other end is screwed to the flat side of a semi-circular iron drum, having a vertical fan in the centre, of the same size, the blades of which, at first start from the shaft in a curve, finishing with straight ends. This fan is made to revolve several hundred revolutions per minute by means of bevel gear, pully, and driving wheels at the outside.

The heating power consists of a furnace with ash pit enclosed, this is in itself enclosed in an iron box or oven, having three openings at the lower part, one of which is much larger and serves as regulator for the entrance of cold air. At the top of the box or oven is a circular opening in the centre of the upper part, for the exit of heated air, of the same diameter as the curved parts of the blade of the revolving fan.

To put the machine in motion the furnace is heated, the cold air enters into the oven or box by the three lower openings, and gets heated, ascends to the circular opening where it meets the revolving fan, which mixes the hot air and throws it in all directions in the box, and finds its exit through an aperture at the end of the box.

So great is the draught in this machine that by means of regulating the revolution of the driving wheel or by opening or shutting the regulator the temperature can be made to increase or decrease by twenty degrees.

Address of Makers :—Vermont Farm Machine Co., Bellows Falls, Vermont, U.S.A. Manager: Mr. N. G. Williams.

SALSAFY.

Salsafy, or Salsify, (*Tragopogon porrifolium*), is a culinary vegetable, cultivated for its long, white, fleshy roots. It is nearly related to Chicory, Dandelion, Lettuce, and still more nearly to Scorzonera.

It has smooth, grass-like leaves, a thickened hollow flower-stalk, and rose-coloured or purple flowers.

The root contains a milky juice on which its great value as a vegetable depends. It is antibilious, cooling, deobstruent, and slightly aperient. It is inferior in these properties to Sc orzonora, and does not keep so well, when taken out of the ground, but it grows more freely. It is cooked in the same way as Scorzonera, but requires longer boiling.

Sow during light rains, in drills 12 inches apart, and thin out so that the plants may be nine inches apart in the drills; or sow broadcast, and thin out to the same distances.

The soil should be deep, and well dug up before sowing, but not manured too soon before sowing, for in that case, the root will fork.

SCORZONERA.

Scorzonera, or the particular species *Scorzonera hispanica*, is an esculent vegetable, much like Salsafy, and has the same properties, being indeed considered superior, though more difficult to grow.

The cultivation is the same as for Salsify; the root is not generally used in England the first year, as it is small.

The "Treasury of Botany" speaks thus of it :—

"Its effects on the digestive organs are to increase the flow of gastric juice and bile, and as it acts as a deobstruent generally, it is slightly aperient. Its antibilious power is scarcely inferior to that of dandelion, if at all so, being, it is believed, superior in this property to any other esculent in use in this country; and it is on this account one of the best remedies in many (if not in most) cases of indigestion, and especially for that state of the digestive organs called bilious.

"These good effects, however cannot be insured unless the vegetable is properly cooked, as its medicinal qualities may be quickly destroyed. It should be cut as little as possible, and washed, not scraped, as the abundant milky juice on which its salutary properties depend then escapes. After boiling for about twenty or twenty-five minutes, or till it is quite soft (rather more salt being added to the water than usual in cooking vegetables), it is to be taken out and peeled, as the dark skin then comes off as readily as that of a boiled potato. When fresh from the garden a quarter of an hour may be sufficient, which it is of some importance to the invalid to know, because after it has become quite soft all further boiling is injurious to its medicinal qualities, and soon destroys them; but when it has lain out of the ground for a long time and become hardened. it may require twice the time boiling, the rule then being to boil it till it is soft. It is usually eaten in the same way as asparagus, which is the preferable mode for the invalid. As it is one of the most agreeable of vegetables in point of flavour, it undoubtedly deserves to be much more cultivated."

POTATOES.

Secretary Jamaica Institute. Good Hope, 27th June, 1892.

Dear Mr. Cundall,

I send a specimen of potatoes—14 weighing 7lbs.—grown at Good Hope, with ordinary care. You can show them to Mr. Fawcett or any others interested in tropical agriculture. It will show them to what perfection the potato can be brought in this country. Of course those sent are picked ones, but they are sold at Pinnock's as they are dug from the ground with the exception of a very few small ones. They are from the third crop from the same ground.

With kindest regards,
I remain yours truly,
H. C. Munn.

Mr. Munn has been good enough to give the following further information :—

" In a piece of ground less than ¼ acre, I planted 1½ barrels, or 225 lbs. of potatoes, and it yielded 2,334 lbs., sold at 1½d. per lb.—£14 11s. 9d.

Cost of seed, £1 4s. 6d.; labour, £1 8s.; manure, 15s.; cutting seed, 1s.; digging crop, 11s.; carriage to town, £2 6s.; total, £6 5s. 6d. Therefore clear profit—£8 6s. 3d.

BOTANICAL GARDENS IN JAVA.

The following account of these Gardens is taken from one by Dr. Treub. the present Director; it appeared originally in the "Révue des Deux Mondes," and later, as a translation, in the "Chautauquan".

"The number of Botanical Gardens situated within the tropical zone is much greater than is generally supposed. It is necessary to say however, that not all are Botanical Gardens, in the proper sense of the word, but rather limited agricultural stations or gardens of acclimatization. Some among them merit the name of great scientific establishments, and, holding the first rank in this list, are the gardens of Calcutta, and those on the Islands of Ceylon and Java. We propose briefly to trace the history of the last of these three, and to show by a study of its organization, how a new era is beginning for such institutions and that they are destined to play a steadily increasing part in the evolution of vegetable life.

On the 29th of October, 1815, a squadron, quitting the roadstead of Texel, in the north of Holland, set sail for the East Indies. It was taking to Java the commissioners-general to whom the sovereign of Holland had confided the office of taking back from England in his name the Government of the Netherlandish Indies. Guided by large views, the new King had added to the number of Commissioners a distinguished naturalist, Reinwardt, a professor of the Athenæum of Amsterdam, in order to establish upon a solid basis the study of the marvellous nature which forms the wealth of the Dutch possessions in southern Asia.

The squadron did not reach the Strait of Sunda until the last of April of the following year. The passengers were delighted after their long and dreary voyage, to sail among the charming islands set as so many emeralds in the narrow silvery bands into which they divided the strait ; and to breathe in the sweet perfumes wafted from the shores. They might well have desired to remain there and to put off the task awaiting them, for the future held many vexations.

Buitenzorg, situated about twenty-six miles from Batavia, in latitude 6°35′ south, longitude 106°53′ east, upon one of the long northern slopes of Mount Salak, a charming site enjoying a beautiful and healthful climate, was selected as the site of a Botanical Garden. Work upon it was commenced with 50 native laborers under the direction of two head gardeners one of whom had followed the same calling in Holland, while the other had been brought up in the Royal Gardens of Kew. It would have been difficult to find in all Java a place better adapted to an undertaking of this kind, because, thanks to especial conditions, Buitenzorg added to its other advantages that of not being visited by the dry monsoon.

It is evident that a period of drought almost continuous for four or five months, as is common in the Island of Java would be suitable for only a very small part of plant life. Even the climate of Batavia, where an absence of heavy rains for two or three months is not of rare occurence, would be much less adapted to a botanical garden than that of Buitenzorg, where they complain of it as an unfavourable year if in the midst of the dry season, so-called, there occur three consecutive weeks without rain. These frequent and heavy rains have a double advantage for the garden : first, Buitenzorg is indebted to them for its luxuriant vegetation which grows continuously ; and in the second place the rains cause a lowering of the mean temperature which renders possible the culture of many plants of the virgin forests of the mountains, although Buitenzorg is situated at an altitude of only about nine hundred feet. In order to give an idea of how much water falls yearly on an average upon this Sans Souci of Java it will be sufficient to say that here the rainfall measures about one hundred seventy-five inches, while in Holland, one of the most rainy countries in Europe, it reaches only about twenty-five inches.

At first no regular plan was decreed for the management of the garden. The archives contain no indication of any rules whatever regarding it. It is only known that its founder, Reinwardt, made numerous expeditions into the surrounding country for plants. The first Catalogue of the "State Botanical Garden," the name officially, adopted, published some months after the departure of Reinwardt, contains an enumeration of nine hundred and twelve species. Reinwardt returned to Europe in 1822, in order to occupy a chair in the University of Leyden. During the succeeding years there were several changes in the management of the garden and its experienced varying degrees of fortune. Finally, in 1830, J. E. Teysmann was named chief gardener. This man, who had had only the education of a Primary School received a half century later a testimonial, as remarkable as it was rare of the esteem in which he was held by the whole scientific world. Besides the Diplomas of Honour given him and the felicitations sent from all parts of the world, there was presented to him an Album in which more than one hundred Botanists, among them Darwin and Candolle, presented him their respects ; and this Album upon its gold plate bore the following inscription : "To the most distinguished and indefatigable J. E. Teysmann, who has spent half of his life-time in the exploration of the botanical treasures of the Indian Archipelago, from his admiring colleagues." It was under the management of this man that the garden became a scientific institution of the State, with a Director and a special budget and an entire independence of the Viceroy. Let us now rapidly glance over its actual organization.

The Institution comprises three distinct Departments. First there is the Botanical Garden, properly so called, in the centre of the town, occupying an area of about eighty acres. It is crossed by a large and beautiful walk called the Walk of the Kanaries, after the native name of the trees which border it, beautiful specimens of the *Canarium commune*, frequently reaching a height of ninety feet. Over this walk which runs along by the side of an artifical lake containing a little Island, pass daily numberless carriages and pedestrians. Leading out from it in every direction, numerous paths penetrate to all parts of the grounds. Plants of the same family are found grouped together, or occupying one of the entire divisions marked out by the paths. At one corner of each such plot is to be found a notice of the species which it incloses ; and each species is represented by two plants, one of which bears a label giving its scientific name, its common name. and usually its special characteristics. His attention being attracted to the great number of climbing plants in the tropical regions, Teysmann conceived the happy idea of giving them a special place in the garden, where each might be surrounded with its natural conditions ; and this department now offers a vast field for interesting observations. The total number of herbaceous plants comprised is about nine thousand.

In the middle of the garden is found a series of nurseries where young plants are cultivated partly under shelter which protects them from the heat of the sun and from injury by the heavy rains. Some plants demand particular care, notably certain species of ferns and of the *Araceæ* and of the orchid family. These are placed in buildings, resembling the hot houses of Europe, but with this difference that here they serve to keep the plants cool, instead of procuring for them a higher temperature. The gardon has its own carpenters for executing such constructions—a little detail, which, however, will serve to givo an idea of the scale upon which it is organized.

The nativo *personnel* is composed of a hundred individuals, among whom are three possessed of a special botanical knowledge, much more profound than one would expect to find among the Malays. This force works under the supervision of the Gardener-in-Chief and his Assistant.

The agricultural garden, the second department comprised in the Institution, situated about a mile from the centre of Buitenzorg, occupies more than one hundred and fifty acres. The local arrangement and the distribution of the plants at once indicate an object exclusively practical. All is laid out in regular order here; the roads and the paths cross each other at right angles, the plots which they set off are nearly all of the same size, the plants in each plot are of the same species and of the same age. While in the scientific garden each species had only two representatives, it has here on an average one hundred. But here the limitations are placed on the kinds of plants, which must be such as are or may become useful to agriculture or to colonial industries. There are to be found the different species and varieties of the coffee tree, of the tea plant, sugar cane, caoutchouc and gutta-percha trees, the *Erythroxylon Coca*, which furnishes cocaine, the trees which produce tannin and oils, plants used for fodder, etc. A special part of the garden is reserved for medicinal plants. A chief gardner conducts the work which is carred on by a force of seventy native workers.

The third garden is located at quite a distance from Buitenzorg, upon the slope of the neighbouring volcano, Gedeh. With an area of seventy acres, situated at an altitude of 5,000 feet, it possesses a climate which is marvelously adapted to the cultivation of the flora indigenous to mountains as well as to that of Australia and Japan. A force of a dozen natives works here under the direction of a European gardener. These tlree gardens which together constitute the State Botanical Garden, occupy an area of more than three hundred acres.

The Museum built opposite the first garden described, is a building about one hundred fifty feet long and comprises a large central hall and two wings. On the lower floor the hall contains cupboards running all along its walls and glass cases through the centre, in which are kept the botanical collections. Some of the specimens are dried and some are preserved in alcohol. A gallery running the whole length of the upper hall is exclusively occupied by the herbarium. The pressed plants are not kept in portfolios as in Europe but in tin boxes in order the better to protect them against insects and mould, the great enemies of such collections in tropical countries. The number of such boxes exceeds twelve hundred and each box contains one hundred specimens. One of the wings of the building is used as a Museum, and the other for a Library which contains five thousand volumes.

There are three Laboratories connected with the gardens to which a fourth is soon to be added, for the *personnel* is to be increased by the addition of two new officers, a Botanist and a Chemist, to whom will fall the special task of furnishing by long and patient researches, scientific information to those asking it, regarding the useful plants of the tropics. Behind the Museum in a special building is the Medical Laboratory where a Pharmacist makes researches into the nature of alkaloids and other curious and useful substances found in tropical plants. Of the other two Laboratories, placed behind the nurseries, one is reserved for the use of scholars who come from beyond the seas to study in this place. The room is lighted by five windows in each of which is a large work-table. Cupboards against the wall contain all the necessary implements. There is in it, besides a small collection of the books which are needed, always at hand, in order to save the trouble of going to consult them in the regular Library. It is now proposed also, in order to facilitate the work of the visitor, to place here an herbarium composed entirely of the plants cultivated in the garden, in order that a rapid identification can be made in any doubtful case without being obliged to have recourse to the general herbarium. The arrangement of this building is simple, and presents the two great advantages of plenty of light and plenty of room. The last point is a very essential one in a warm country where one can endure no crowding, especially in work requiring close research. The third Laboratory is devoted to the use of the Director of the Garden. Close to these buildings are the offices and a photographic and lithographic gallery. All of these well equipped buildings show the interest taken in the enterprise both by the Netherlandish Indies and by the mother country.

The Government of the Indies has authorized the Director of the Garden to distribute gratuitously the seeds and plants of useful vegetables. In 1888 fourteen hundred packages of seeds and cuttings and young plants were scattered through all parts of the Archipelago. It is especially the garden of agriculture which has been able to supply all of these demands; but it forms only one part of this scientific organization, and would very badly meet the requirements were it alone. The following statements will give a proof of this. When the remarkable anæsthetic properties of cocaine were discovered, it was only necessary to have recourse to the two plants of the *Erythroxylon Coca* in the botanical garden to make preparations for a large supply of the article. Enough seeds were gathered from these trees to set out a small plantation in the agricultural garden. When a year later a learned *savant* called the attention of the Dutch government to the necessity of the culture of the plant in Java, they were able to reply to him that the seeds gathered from the plants in the agricultural garden had already been planted by the thousands. The tree for a long time known as the producer of gutta percha has been in such demand and was so rapidly destroyed in order to obtain the juice that it was believed to be exterminated and it was even impossible to obtain seeds that it might be propagated again. In the plot devoted to the order *Sapotaceæ* in the Buitenzorg garden were found two trees aged about thirty years which produced yearly a great quantity of seeds. It was from these that a young plantation was started in the Garden of agriculture, and thus the great number of young trees were obtained which were required for the vast plantation established a number of years ago, by the Dutch Government, under the auspices of the Garden. The camphor tree of Sumatra, a tree of great value, is exceedingly difficult to grow, first, because it bears very few seeds, and second, because these seeds very soon lose their germinating power, often being found worthless after a very short voyage. With particular care Teysmann succeeded in raising the trees at Buitenzorg. In 1885 the plants began to fructify, and now the garden possesses a young plantation of the camphor trees and a great number of plants can be distributed from there during the next rainy season.

The researches made up to this time into the pathology and the physiology of plants have not been very extensive, and yet they have been such as to tax the powers of the present *personnel*. Upon the arrival of the two new functionaries to be set apart exclusively for this kind of work the force will be strong enough to meet fully all such demands.

Every one interested in natural history knows that Zoology owes a great part of its recent rapid development to the founding of various Zoological "Stations" (establishments in places where the species to be studied occur naturally.) Of still greater importance in the development of the science of botany, are such great botanical "Stations" as this one at Buitenzorg, destined to be in the near future."

It is interesting to compare what is said of these gardens by Dr. Trimen, Director of Botanic Gardens in Ceylon. He visited them in 1891, and in his Report he states his experience as follows :—

"The Dutch botanical establishment at Buitenzorg is maintained entirely on a scientific basis.

"The Director has the control of all the six departments into which the institution is divided, as follows :—1, the Herbarium, Library and Museum ; 2, the Botanical Laboratory ; 3, the Experimental Garden and Laboratory for Agricultural Chemistry ; 4, the Pharmacological Laboratory ; 5, the Botanic Gardens ; 6, the Photographic Institution. Each of these departments is under the immediate management of a highly trained scientific or technical chief from Holland, and most of these have also an assistant. There is thus a very large staff of Europeans. The Laboratories, Library, &c. are completely stocked, and kept fully up to the time, and everything is provided for close investigation and original research in all branches of botanical study. Many students are thus attracted from Europe, and the Laboratories afford accommodation for a considerable number of workers. A valuable serial publication, the "Annales du Jardin Buitenzorg," is issued at intervals, devoted to scientific botany, and another one, "Teijsmannia," occupied with economic and garden subjects.

"The Botanic Gardens themselves at Buitenzorg occupy between 60 and 70 acres, at an elevation of about 800 feet, with a fine soil and abundant water, and are well protected by a high iron railing and a barbed wire fence. Nearly the whole is occupied by a classified arboretum, each Natural Order being isolated by a road or path. The collection is extremely rich, and every species is elaborately labelled with upright labels made of the very hard wood of *Eusideroxylon*, which is never attacked by termites. The whole is now much too crowded, and cannot be said to be of much beauty but is of course extremely convenient for scientific study. Connected with Buitenzorg is a small Hill-garden at Tijbodas, 4,700 feet, also under a European Superintendent, where is also a house for the Director and a Laboratory and accommodation for four students.

"The Experimental Garden (Cultuur-tuin) is about two miles from the main garden, and is 200 acres in extent, but is not all at present occupied. It is laid out in square plots, each devoted to one product ; large labels at each corner give the name, date of sowing, or planting, and other information. Here are very many plants of great interest. Though a large distribution of seeds and plants is made to planters and others, no charge is made for anything.

"On the whole, I was filled with surprise and admiration at the completeness of Buitenzorg as a centre for botanical work ; the only weak side seemed to be the Herbarium, which is by no means kept up on a par with the rest of the means of study."

FERNS : SYNOPTICAL LIST.—X.

Synoptical List, with description, of the Ferns and Fern-Allies of Jamaica, by G. S. Jenman, Superintendent Botanical Gardens, Demerara, (continued).

5. *Adiantum Kendalii*, Jenm.—Stipites ½ – 1½ ft. l. polished, black, subtufted from a shortly repent fasciculate finely scaly rootstock ; fronds firm, naked, paler green beneath, ½ – 1 ft. l. simply pinnate, or with one to several pair of short, equally developed, lateral pinnate branches at the base ; segments of the terminal pinnate portion subdimidiate ; the upper and lower margin parallel in the superior ones, but the former longer, 1¼ – 1½ in. l. ⅓ – ⅜ in. w. the inferior ones shornboidal or subdeltoid, those of the basal branches smaller and quite dimidiate oblong or subfalcate, the terminal large and rather elongate-acuminate ; veins fine and close, repeatedly forked free ; sori continuous along the upper margin, and in the terminal simply pinnate portion also down the oblique outer edge, the barren points faintly denticulate.—Sloane t. 55 fig. 2,

Infrequent, but plentiful where found, in the eastern parishes, gathered on woodland slopes about a quarter mile on the Annotto Bay side of Castleton Gardens, and by Sloane at Archers wood and other inland woody parts of the island. Sloane's specimen is a fragment, with most of the segments removed but it shows the bipinnate state at the base. The top only where it is perfect, was figured. The figure is quoted by Grisebach for *A. lucidum*, Swartz. Mr. Baker has regarded it as a bipinnate var. of *macrophyllum*, but its more developed states show that it belongs to the *villosum* group of dimidiate species. Mr. Hart gathered a form of much stiffer texture striated surface and interrupted sori. It is named after a former Superintendent of Castleton Gardens who next found it 185 years after Sloane.

6. *A. villosum*, Linn.—Rootstock strong repent, fasciculate, densely scaly, stipes strong, tetragonal, 1-2 ft. l. channelled, polished, black, deciduously rusty-furfuraceous ; fronds bipinnate, ¾-1½ ft. each way, firm, glabrous, both sides dark green, upper glossy ; pinnæ spreading, 3 6 to a side, and a similar long terminal one ½-1 ft. l. 1½-2 in. w. ; segments contiguous, very numerous, ¾-1 in. l. 2½-1½ li. w. dimidiate or subdimidiate, margins straight, upper and lower parallel, the former longer forming an acute or bluntish point with the oblique outer one, denticulate when barren, rachis and costæ rusty-pubescent ; veins fine, repeatedly forked, free ; sori along the upper and down the outer margins where it terminates in a slight spur, continuous or rarely disconnected by a slight projection in the line of the upper margin.

Var. *A. oblique-truncatum*, Feé.—Margins of segments undulated, and sori interrupted thereby.—Fil. Ant. t. 7. fig. 3.

Frequent in woods, and half open and grassy situations, and in hedges, among the lower hills up 1,200 or 1,500 ft. alt. A large robust plant, which only differs from *tetraphyllum* by its continuous sori and rather firmer texture. The variety, which is marked by the marginal undulations is somewhat thinner in substance, and is less frequent.

7. *A. pulverulentum* Linn.—Stipes, strong, 1-2 ft. l. channelled, polished, blackish, deciduously rusty-scurfy, arising from a shortly creeping scaly rootstock; fronds bipinnate, subcoriaceous, bright green on doth sides, the upper glossy, 1-1½ ft. l. and nearly as w. glabrous, except the rachis and costæ which are rusty-pubescent; pinnæ spreading, 6-8 in. l. about 1 in. w., 4-8 to a side, with a similar terminal one; segments very numerous, close dimidiate, subfalcate or straight, ½-1 in. l. 2-2½ li. w. the under margin usually upcurved and denticulate at the end; veins free, close, repeatedly forked; sori continuous, extending partly or wholly along the upper margin.—Plum. t. 55.

Var. *caudatum*, Jenm.—Fronds nearly twice as long as wide, terminal pinnæ nearly twice as large as the lateral, the upper of which are the largest, those below being gradually shortened; segments subfalcate; sori not reaching the end.—*A. surrulatum*, Linn. Sloane t. 35, fig. 6.

Very plentiful in woods and forests throughout the country up to 1,000 or 1,500 ft. alt. When the segments are falcate, the sori fall short of the end, when they are straight it reaches the end and often extends quite round the trumcate or decurved outer margin. It appears to be uniformly bipinnate in Jamaica, but in Guiana it is frequently tripinnate, the lower pinnæ being shortly branched at the base. The variety is found on wet rocks near springs, and is common in the eastern parishes. It is well marked by the large terminal pinna and short lateral ones, while in the type the lateral pinnæ are as long as the terminal.

8. *A. Kaulfussii*, Kze.—Rootstock strong, short-creeping, fibrillose; stipes 4-10 in. l. slender, channelled, polished, black, quite naked eventually; fronds pinnate, 6-10 in. l. 3-5 in. w. base truncate, dark glossy green above, bright glaucous beneath, thin, naked or the slender rachis slightly ciliate; pinnæ composed of 4-8 pair and a similar terminal one, alternate, close or subdistant, 2-3 in. l. ¾-1¼ in. w. subequilateral, the inferior base cut away, the superior rounded and generally somewhat expanded auricle-like, the apex acuminate: veins free, fine, close, very oblique, repeatedly forked; sori intermittent, extending from the base along both margins but not reaching the finely serrated apex.—Hook. and Grev. Icon. Fil. t. 190.

Frequent in moist woods and forests bordering streams and rivers at low altitudes. The sori are close or a little apart, the margin often slightly notched between, and form shallow curves, extending partly at least around the basal auricle which overlaps the rachis. The relatively large pinnæ, bright glaucous underside, and uniformly simply pinnate habit well mark it from its allies.

9. *A. obliquum*, Willd.—Rootstock short-creeping, ¼ in. thick, fibrillose, stipes 6-10 in. l. deciduously furfuraceous, dark, polished, channelled; fronds simply pinnate or with a single or pair of short and usually unequal pinnate branches at the base, firm, dark green on both sides, the upper with a satin-like gloss, naked except the rachis which is rusty furfuraceous; segments 1¼-2 in. l. ½-¾ in. w. about 8-12 to a side, subequilateral, the inferior base cut away obliquely, the superior expanded and rounded, barren finely denticulate: veins free, close, forked, oblique; sori interrupted, close, extending along both margins from the base to the acuminate or blunt point.—Hook. Sp. Fil. vol. 2. t. 79. A. Plum. t. 52. *A. denticulatum*, Swartz.

Frequent in forests and shady places near streams and rivers at low elevations in the eastern parishes. Marked by its simply pinnate, or sparsely branched, habit, dark green colour on both sides and satiny gloss above. Swartz's name, quoted above, is the oldest, but the species is best known under Willdenow's. The plant of the same dark green colour on both sides, with more uniformly bipinnate fronds, the lateral pinnæ as long as the terminal and a branching wide-creeping cord-like rootstock is *A. forearum*, Radd. which is common from Trinidad to Brazil but which appears not to extent further north. This last agrees exactly with *intermedium* except in the absence of the glaucous colour beneath.

10. *A. intermedium*, Swartz.—Rootstock thick as cord, free-creeping, densely scaly, stipes scattered, ¾-1½ ft. l. deciduously rusty-furfuraceous, as are also the rachis and costæ, dark polished, channelled; fronds bipinnate, subcoriaceous, green above, glaucous beneath, composed of a long terminal pinna and 1-2 pair of similar horizontally spreading lateral ones, which are 5-8 in. l. 2-2½ in. b., segments numerous, 1-1¼ in. l. ¼-½ in. b. blunt or acute, naked, subequilateral, the inferior base more or less freely cut away in a curved or straight line, the superior fully developed and rounded, barren margins denticulate; veins free, very oblique, repeatedly forked; sori interrupted, close, extending fully along the upper, and down the under margin to the point where it is cut away.

Very abundant, chiefly in grassy half shaded situations at low elevations; probably the commonest species of all. Distinguished from its allies by its equally and uniformly branched habit, glaucous under surface, and free-creeping rootstock. Fully developed plants have two pinnæ on each side of the fronds, but in an early stage they are fewer, one, or two on one side and one on the other.

11. *A. triangulatum*, Hook., Griseb (non Kaulf).—Rootstock short-creeping, scaly; stipes 1-1½ ft. l. deciduously rusty-scurfy, black, polished, channelled, angular; fronds bipinnate, 9-10 in. l. and as much w., firm, dark glossy green above, light green beneath, glabrous except the rachis and costæ which are rusty scurfy; pinnæ 2-4 to a side with a similar or rather larger terminal one, contiguous, often upcurved, 6-8 in. l. 1¼-1½ in. w. segments numerous, close, dimidiate, oblong or linear-oblong, ¾-1 in. l. 2-3 li. w. blunt and rounded at the outer end, the upper and lower margins nearly parallel, but the latter slightly decurved at the base, inferior ones much reduced, the terminal linear, attenuated, sterile denticulate: veins free, repeatedly forked, fine, close; sori a li. or less l. contiguous, extending along the upper margin and usually round the blunt end.—Grisebach's Flora, p. 664.

Var. *acuminatum*.—Segments longer, upcurved or subfalcate, acuminate or acute, the end usually barren and inciso dentate.

Frequent in woodland and forest among the lower hills; gathered by Sloane at "Archer's Bridge." The pinnæ being few and close, the fronds are very short in relation to the long petioles, which disproportion gives them a characteristic appearance. As in a few other instances, the petioles are 4-sided at the base and 3-sided above. I have taken the identification from Grisebach's Flora, as quoted above, but neither in the *Species* nor *Synopsis Filicum* is the name mentioned with Hooker as the authority. Kaulfuss's plant under the same name is either *fovearum* or *intermedium*. However, the species is a well marked one, and is widely and plentifully spread through the West Indies, Guiana and Brazil, with hardly the least variation. The variety has exactly the same range, preserving a similar unity of character.

12. *A. fructuosum*, Spreng.—Rootstock short, fasciated, densely scaly; stipes 1-2 ft. l. angular, channelled, black, clothed with dark furfuraceous tomentum; fronds bipinnate, 1-1¼ ft. l. and nearly as w. firm, dark green and glossy above, paler beneath, rachis and costæ densely rusty-furfuraceous; pinnæ spreading, apart, about 5 to a side, with a similar long terminal one, 5-8 in. l. 1-1¼ in. w.; segments numerous, close dimidiate, oblong, rounded at the end, the base truncate, barren denticulate, 5-8 li. l. 2-2½ li. b. the lower ones reduced, terminal small, often minute, or elongated and linear; veins fine, free, close, repeatedly forked; sori numerous, close, small, extending along the upper and round the outer margins.

I include this species on the authority of a frond in Sloane's herbarium mounted on the sheet with *A. striatum*, Swartz, locality where collected not recorded. It is common in Guiana and Brazil. Marked by its densely furfuraceous stripes rachis and costæ, a few slight scales often appearing on the underside of the segments, very dark glossy colour, and uniform copious small sori, which extend quite round to the end of the basal margin. It comes nearest to *obtusum*. The mainland species of the *obtusum* and *tetraphyllum* group were nearly all named by the continental European Botanists, and much confusion exists in herbaria, books, and among workers and students as to the identity of the types.

13. *A. obtusum*, Desv.—Rootstock shortly repent, densely scaly; stipes 1-2 ft. l. dull black, nearly or quite naked, channelled; fronds 1¼-1¾ ft. l. 1-1¼ ft. w. bipinnate, chartaceous, both sides rather bright green, and with the dull, but blackish, rachis and costæ naked; pinnæ subdistant, spreading, 3-5 to a side with similar long termunal one, 6-9 in. l. an inch, less or more, w; segments numerous, close, dimidiate, oblong, the inferior reduced, ½-⅝ in l. 2½-3 li. w. the truncate base broadest, the apex rounded, barren denticulate, terminal linear elongated; veins repeatedly forked, free, fine, close; sori short, contiguous, along the upper and outer margins.

Infrequent in woodland and forest in the eastern parishes up to 1,000 ft. alt. In different countries different plants are ascribed to this species. The Jamaica form approaches *tetraphyllum*, but is distinguished by its smaller more rounded segments.

14. *A. tetraphyllum*, Willd.—Rootstock repent, scaly; stipes strong, angular, channelled, 1-2 ft l. polished, black, at first coated with deciduous rusty tomentum; fronds bipinnate, 1½-2½ ft. l. nearly or quite as wide, subcoriaceous, both sides dark green, upper glossy, rachis and costæ rusty-furfuraceous, other surfaces glabrous; pinnæ 3-6 to a side, with a similar long terminal one ½-1 ft. l. 1½-2 in w. subdistant; segments numerous, subdimidiate, oblong or lanceolate oblong, ½-1 in. l. ¼-⅜ in. w. contiguous but frequently the lower somewhat reduced ones becoming more remote, parallel margined, but the superior side ⅓-¼ longer, forming with the straight oblique outer margin an acute or roundish point, barren serrulate, terminal linear elongated; veins free, fine, repeatedly forked; sori interrupted, short extending along the upper and round the outer margins:—*A. prionophyllum*, H.B.K.

Infrequent in woodland and forest, and in shady situations generally, up to 1,000 ft. alt. A large species, with wide spreading pinnæ, not so coriaceous, but, as mentioned under that species, closely resembling *villosum* in size of frond and form of segments, differing by the interrupted sori. The framework too is not so strong, and appears weak for so large a plant.

No. 34. AUGUST, 1892.

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.
1892.

EXPERIMENTS IN THE CULTIVATION OF VEGETABLES.—V.

Peas.

The following Tables are a continuation of those published in Bulletin No. 31.

Names of Peas grown at Cinchona.	Date of Planting in November, 1891.	First appearance above Ground.	Days from Planting	First Bloom.	Days from Planting.	Pods of edible size.	Days from Planting.	Days during which 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.	Maximum Temperature.	Minimum Temperature.	Average Maximum Temperature.	Average Minimum Temperature.	Rainfall.	Number of Days on which rain fell.	Height in feet.	Time of Cooking in Minutes.	Quality.
Carter's Empress ...	3rd	12th	9	24.1.92	82	20.2.92	102	16	29.2.92	118	2.4.92	144	3	3	62.3	72.9	49.2	67.6	57.1	32.99	88	6	20	1
" Anticipation ...	"	"	9	28.12.91	55	28.1.92	86	12	5.2.92	94	21.3.92	139	3	5	62.2	72.9	49.2	67.5	57	32 46	82	3½	20	3
" First Crop ...	"	10th	7	7.12.91	34	10.1.92	68	14	30.1.92	88	21.3.92	139	5	5	62.2	72.9	49 2	67 5	57	32.46	82	3½	22	2
" Blue Express ...	"	"	7	7.12 91	34	21.12.91	49	20	22.1.92	81	1.4.92	150	3	5	62.3	72.9	49.2	67.6	57.1	32.99	88	3	15	1
" Stratagem ...	"	"	7	28.12.91	55	6.1.92	64	16	5.2.92	94	21.3.92	139	4	3	62.2	72.9	49.2	67.5	57	32.46	82	3	20	1
" Telephone ...	"	12th	9	23.12.91	50	24.1.92	82	16	20.2.92	109	19.3.92	136	4	6	62.1	72 9	49.2	67.3	56.9	32.42	81	6	15	1
" Little Wonder ...	"	10th	7	22.12.91	49	Dead. 26.12 91			.	53	.	.	.	.	64.1	72.9	54 2	68.6	59.7	22.04	38	2½	.	.
" Balmoral Castle ...	"	"	7	22.12.91	49	20 1.92	78	16	18.2.92	107	18 3.92	135	7	5	62.1	72.9	49.2	67.3	56.9	32.42	81	5	20	2
" Wonder of the World	"	12th	9	24.1.92	82	Dead. 30.1.92			.	88	.	.	.	.	63.3	72.9	54.2	68.1	58 5	29.23	57	3	.	.
" Progress ..	"	10th	7	23.12 91	50	Dead. 30.12 91			.	57	.	.	.	.	64.1	72.9	54.2	68.6	59.7	22.08	39	6	.	.
" Telegraph ...	"	10th	7	21 12.91	48	24.1.92	82	18	20.2.92	109	26.3 92	142	6	5	62.3	72.9	49.2	67.6	57.1	32 84	87	7	20	1
" Elephant ...	"	12th	9	21.12.91	48	Dead. 30.12.91			.	57	.	.	.	.	64.1	72.9	54.2	68.6	59.7	22.08	39	7	.	.
" Pride of the Market	"	12th	9	26.12.91	53	2.2.92	91	14	24.2.92	113	26.3.92	142	3	3	62.3	72.9	49.2	67.6	57.1	32.84	87	2½	15	2
" G. F. Wilson ...	"	12th	9	28.12.91	55	20.1.92	48	14	19.2.92	108	27.3.92	143	5	5	62.3	72.9	49.2	67.6	57.1	32.84	87	5	20	3
" Lightning ...	"	10th	7	7 12.91	34	21.12.91	48	28	12.1.92	70	29.2.92	118	3	4	61.7	72.9	49.2	67.6	55.9	32.03	78	5	20	2
Laxton's Alpha ...	"	10th	7	7.12.91	34	23.12.91	50	18	9.2.92	98	2.3.92	120	14	4	61.7	72.9	54.2	67.6	55.9	32.03	78	4	20	3
" William the 1st ...	"	10th	7	10.12.91	37	21.1.92	79	16	18.2.92	107	19.3.92	136	6	4	62.1	72.9	49.2	67.3	56.9	32.42	81	5	18	3
" Fillbasket ...	"	10th	7	28.12.91	55	1.2.92	90	9	12.2.92	102	18.3.92	135	3.5	3	62.1	72.9	49.2	67.3	56.9	32.42	81	4	25	2
" Prolific ...	"	10th	7	21.12.91	48	21.1.92	79	20	20.2.92	109	2.3.92	120	10	4	61.7	72.9	54.2	67.6	55.9	32.03	78	5	20	3
" Supreme ...	"	12th	9	28.12.91	55	21.1.92	79	18	20.2.92	109	2.3.92	120	6	4	61.7	72.9	54.2	67.6	55.9	32 03	78	5	20	1

Emperor of the Marrows ...	"	12th	9	28.12.91	55	1.2.92	90	24	28.2.92	117	27.3.92	143	6	4	62.3	72.9	49.2	67 6	55.9	32.03	78	7½	25	2
Early Sunrise ...	"	12th	9	7.12.91	34	29.1.92	87	20	28.2.92	117	18.3 92	135	7	5	62.1	72.9	49 2	67.3	56.9	32.42	81	3	25	3
Kentish Invicta ...	"	10th	7	9.12.91	36	21.12.91	48	18	1.2 92	90	21.3.92	139	9	5	62.2	72.9	49.2	67.5	57	32 46	82	5	15	2
Omega ...	"	12th	9	De	ad	21.12 91	48	.	.	.	.	.	.	.	64.1	72.9	54.2	63.6	59.6	21.05	35	.	.	.
Advancer ...	"	10th	7	10 12.91	37	10.1.92	68	20	9.2 92	98	21 3 92	139	7	4	62.2	72 9	49.2	67.5	57	32.46	82	3½	20	3
McLean's Little Gem ...	"	10th	7	9.12 91	26	8.1.92	66	12	9.2.92	98	2.3.92	120	5	3	62.2	72.9	49.2	67.5	57	32.46	82	2	15	2
Abundance ...	"	12th	9	22.12.91	49	21.1.92	79	14	28.2.92	117	18.3.92	135	8	4	62.1	72.9	49.2	67 3	56 9	32 42	81	2	20	1
Duke of Albany ...	"	12th	9	23 12.92	55	21 1 92	79	16	20.2.92	109	12.3.92	130	8	8	62.2	72.9	49.2	67.5	57	32.3[illegible]	80	6	26	1
James' Prolific ...	"	12th	9	De	ad.	21 12.91	48	.	.	.	.	.	.	.	64.1	72.9	54.2	68 6	59.6	21.05	35	.	.	.
Hundredfold, or Cook's Favourite	"	12th	9	22.12.91	49	21.1.92	79	20	20.2.92	109	18.3 92	135	5	4	62.1	72.9	49.2	67.3	56.9	32.42	81	5	20	3
Bishop's Long Podded ...	"	12th	9	2.1.92	60	2.2.92	91	12	6.3.92	124	27.3 92	143	6	8	62.3	72.9	49 2	67.6	57.1	32.84	87	2½	25	4
American Wonder, or Emerald	"	10th	7	7.12.91	34	10.1.92	68	12	28.1.92	86	25.2.92	114	4	2	62.3	72.9	54.2	67.6	57.1.	31.30	77	1	18	3
Sturdy ...	"	12th	9	De	ad.	30.12.91	57	.	.	.	.	.	.	.	64.1	72.9	54.2	68.6	59.7	22 08	39	3	.	.
Sharpe's Invincible ...	"	12th	9	28 12 91	55	24.1.92	82	15	28.2.92	117	21.3.92	138	5	4	62.2	72.9	49.2	67.5	57	32.46	82	4	20	3
Princess Royal ...	"	10th	7	28.12.91	55	1.2 92	90	21	28.2.92	117	18.3.92	135	14	4	62.1	72.9	49.2	67 3	56.9	32.42	81	6½	20	2
Champion of England ...	"	12th	9	28.12 91	55	31 1.92	89	18	1.3.92	121	21.3.92	139	6	4	62.2	72.9	49.2	67.5	57	32.46	82	6½	20	1
Marvel ...	"	12th	9	28.12.91	55	21.1.92	79	18	24.2.92	113	12 3.92	130	3	2	62.2	72.9	49.2	67.5	57	32.33	80	6	20	1
Tall Sugar ...	"	12th	9	De	ad.	21.12.91	48	.	.	.	.	.	.	.	64.1	72.9	54.2	68.6	59.6	21.05	35	.	.	.
British Queen ...	"	12th	9	26.12 91	53	28.1.92	86	21	10.2.92	99	26.3.92	142	7	3	62.3	72.9	49.2	67.6	57.1	32 84	87	8	20	1
Ne Plus Ultra ...	"	12th	9	De	ad.	21.12.91	48	.	.	.	.	.	.	.	64.1	72.9	54.2	68.6	59.6	21.05	35	.	.	.
"Dwarf" Sugar ...	"	10th	7	28.12 91	55	2.2.92	91	15	28.2.92	117	12.3.92	130	7	4	62.2	72.9	49.2	67.5	57	32.33	80	7	20	3
Carter's Dignity ...	"	10th	7	28.12 91	55	31.1.92	89	12	20.2.92	109	18.3.92	135	6	5	62.1	72.9	49.2	67.3	56.9	32.42	81	6	15	1
Mclean's Blue Peter ...	"	10th	7	12.12.91	39	10.1.92	68	16	25.1.92	83	25 2.92	114	2	2	62 3	72.9	54.2	67.6	57.1	31.30	77	½	15	3

The Pea named "Dwarf" Sugar is not dwarf, but a tall variety 7 feet high—a fairly good kind, however.

On comparing the above figures it will be seen that the varieties that have given the best results are "Abundance," "Duke of Albany," "Champion of England," "Carter's Dignity," "British Queen," "Carter's Supreme," "Carter's Telegraph," and "Carter's Telephone," the latter not a heavy cropper, but a fine flavoured pea. "Laxton's Alpha" and "Princess Royal" produced the heaviest crops, but the peas were not so finely flavoured as some of the other kinds. I might add that, with a very few exceptions, all the varieties named are very good; in making selections from the list, intending growers would do well to consult the column giving the heights of the various kinds, and give preference to those of medium height, say 3 to 5 feet. They do not require so much attention in the way of staking as the taller kinds, and are not so likely to be blown down by strong breezes.

With next list I purpose giving a few general hints on the cultivation of Peas, for the information of amateurs.

W. H.

COCOA AT THE HOPE INDUSTRIAL SCHOOL.

The Industrial Boys at Hope have for some time been under special instructions in the cultivation and curing of Cocoa under the superintendence of Mr. McNair. The following correspondence refers to the Cocoa cured during the months, December, 1891, and January, 1892, which was forwarded to London by the firm Messrs. Lascelles, de Mercado and Co.

The boys have planted out half an acre of Cocoa seedlings, and they will have the care of them as they grow up. Complete instruction is in this way being given to a certain number of boys. One boy is quite capable now of instructing others in curing.

Mr. McNair who started a Botanical Station in Lagos under H. E. Sir Alfred Maloney, has just been appointed to do the same work in British Honduras.

Kingston, 23rd April, 1892.

Dear Sir,

We have only just received the samples of Cocoa mentioned in your letter of the 12th April. We have received four samples numbered 1, 2, 3 & 4. We consider that samples 3 and 4 are the best, samples, 1 and 2 having a slightly sour taste, the berries looking as if they had not quite matured when picked and cured. We do not know in what quantities you are likely to be able to supply the cocoa. The last quotation from England for Jamaica Cocoa was 50/6 to 52/ for ordinary and 62/6 for fine fermented, but we imagine that the Cocoa you send would be worth a little more. Of course you understand that the English quotations are in cwts. Provided the quantities offered were not too small we would be willing to give 36/ to 38/ per 100 lbs. according to quality, for the Cocoa in Jamaica, or, if you prefer it, we would be quite willing to receive the Cocoa and ship it to London for you giving you the benefit of whatever it is sold for there.

Yours faithfully,
LASCELLES, DE MERCADO & Co.

Kingston, 11th July, 1892.

Dear Sir,

We regret to report that the Cocoa we recently shipped for you and for which you asked a special report has unfortunately been mixed by the Dock Co., so that we are not able to give you separate valuations, they having been sorted into two lots as follows:—

3 bags, good, bright, part fermented, purple break, and valued at about 60/ per cwt.

1 bag good greyish rather lean, part fermented, purple break, valued at about 58/ to 60/. "Fermentation does not appear to have been fully carried out."

Yours faithfully,
LASCELLES, DE MERCADO & Co.

Kingston, July 21, 1892.

Dear Sir,

We have to own receipt of yours of 19th. The values given in our last were merely brokers' idea of prices, since then we have heard that the 4 Bags were actually sold as follows:—

3 bags at 60/ per cwt.
1 bag at 57/ " "

The sales have not reached us as yet, but as soon as they do we will forward them to you and remit you the nett proceeds.

At the same time as the above sold for you, we sold Jamaica Ordinary Cocoa at 56/ per cwt. This quality was described as "Ordinary mixed with wormy and unripe."

Another lot described as 7 bags pale reddish mixed with unripe sold at 57/6.

We may mention that the Ordinary Cocoa purchased in Kingston from the St. Andrews district is as a rule poor as is also that obtained from the settlers in St. Thomas in the Vale—the Cocoa obtained in St. Mary's and Portland from the settlers is of better quality and we think the 13 bags of Cocoa which sold at 56/ belonged to the former class and the 7 bags that sold at 57/6 to the latter class.

The value of Ordinary Cocoa is about 36/ or 38 per 100 lbs. in Jamaica and Cocoa, such as you shipped would be worth 40/ to 42/ per 100 lbs.

We may mention that the market for Cocoa in England is at present higher than it has been for some long time.

We are, &c.,
LASCELLES, DE MERCADO, & Co.

Kingston, 6th August, 1892.

Dear Sir,

We have much pleasure in enclosing herein Account sales of a small lot of Cocoa forwarded to London for Account of the Jamaica Government showing nett proceeds of £6 17s. 2d. which we remit to you, less a small charge for attending to the shipment and drayage here of 1s., say, £6 16s. 2d. Should you have any more Cocoa we shall be very glad to ship same for you or if you prefer we would buy it from you. The market for Cocoa from last advices is very good and we enclose you Prices Current of our London Firm which we have requested them to send you direct by each Royal Mail Steamer for the future. The following particulars may interest you in reference to the weights of your Cocoa. According to our shipping weights the gross weights of the four bags of Cocoa were 320lbs. less tare for bags say 10lbs., 310lbs. The gross weights as you will see in London were 319lbs. the tare and draft in London was 4lbs. per bag. Comparing the gross weights in Jamaica with those in London the loss in weight is only 1lb., which is simply marvellous and says worlds for the curing of the Cocoa. On the ordinary Cocoa that we buy the loss in weight even though it be re-dried is much more.

Yours faithfully,

LASCELLES, DE MERCADO & Co.

Account Sales of Cocoa received ex Don S.S. from Jamaica and sold by the Undersigned for Account of Messrs Lascelles, de Mercado & Co.

ACCOUNT OF JAMAICA GOVERNMENT—KINGSTON, JAMAICA.

J. G. Lot 9.	3 Bags Cocoa Fr. 3s. 1d.	2c. 0q. 17lb.			
		12	2 0 5 @ 60s.		£6 2 8
Lot 10.	1 Bag " "	0c. 2q. 22lb.			
		4	0 2 18 @ 57s.		1 17 8
					£8 0 4
	Discount 2½ per cent.		...		0 4 0
					£7 16 4
CHARGES.—					
Freight on 2c. 3q. 15lb. @ 50s. 7s. 2d. prim. 4d. ...		£0 7 6			
Wharf Charges, 2s. 5d. Discount 4d. stps 6d. ...		0 2 7			
Insurance on £10 and stp		0 1 9		£0 11 10	
Printing and Advertising 1s. 6d. Insurance 2d., Rent 2d. ...		...		£0 1 10	
Brokerage ...		...		0 1 7	£0 15 3
					£7 1 1
	Commission 2½ per cent. on £7 16s. 4d.			...	0 3 11
	Net proceeds due 30th July, 1892			...	£6 17 2

E.O.E.

London, 15th July, 1892.

E. A. DE PASS & Co.

The following letter from Mr. Morris, and report from Messrs. Wilson, Smithett & Co., refer to Cocoa obtained from Dr. Neyland, Bachelor Hall Estate, and cured at Hope immediately after the above. This Cocoa has not yet been shipped, but as it was cured about the same time, the report is inserted for comparision.

Royal Gardens, Kew, 24th June, 1892.

Dear Fawcett,

The enclosure is a copy of a report on a sample of Cocoa cured by McNair at Hope. He sent it for my opinion and I have no hesitation in saying that it was excellently cured.

Any defect that was noticeable in it was due to the sort, and to the fact that some of the beans were not fully matured.

As you know you cannot alter either of these in the curing. If all Jamaica Cocoa could be so well cured as McNair's sample, the Island would be benefited to the extent of several thousand pounds annually. In fact, the saving effected in this one Industry would more than meet all the expenses of the Botanical Department.

With kind wishes,

Very sincerely yours,

D. MORRIS

W. Fawcett, Esqr., F.L.S.

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41 Mincing Lane, London E. C., June 22nd, 1892.

SIR,

We have carefully examined the sample of Cocoa prepared at the Hope Gardens, Jamaica, which you have submitted to us, and report that the colour and appearance are very good, and that it would consequently command a ready sale.

The market value is 62/ or 63/ per cwt. compared with 56/ or 57/ for ordinary Jamaica Cocoa.

The bean is dry and crisp, but the shell is rather too brittle and is liable to be broken when packed in large quantities. The value depends more on the appearance than on the fracture which is of too dark and violet a colour to compete with the finer growths in the estimation of manufacturers.

We are, &c.,

WILSON SMITHETT & Co.

D. Morris, Esq., Royal Gardens, Kew.

Description of the Cocoa plantation made by boys of Hope Industrial School under the Superintendence of Mr. McNair.

Land cleared.—Half an acre of land has been cleared and levelled.

Cocoa planted.—105 plants of 5 different varieties of Cocoa have been planted.

Varieties planted.—Of the Calabacillo variety, 23 plants. Milanado variety, 21. Red Cocoa, 21. Forastero Cocoa, 22. White Cocoa, 18. The first four varieties are from seeds received direct from Mr. Hart of Trinidad; the fifth (white Cocoa) is from our own seeds.

Shade Plants.—Permanent shade trees have been planted through the plantation. The "Madre di Cacao" *(Erythrina umbrosa)* the tree ordinarily used as shade for Cocoa, is planted alternately with cedar (Codrela odorata).

Temporary shade plants have been planted, the Castor oil *(Ricinus communis)* being used Four plants of Castor oil to one plant of Cocoa are planted, 18 inches from the Cocoa plant. Bananas are planted one in the centre of each square formed by every four Cocoa plants.

Watering.—The young plants are being carefully watered by hand, and 22 chains of trenches have been dug so that every time waste water is procurable from the water works, the whole of the land is properly irrigated. It is necessary at Hope to water the plants, on account of the small rainfall, and dry atmosphere.

Curing of Cocoa.

The method of curing adopted was that recommended in Bulletin No. 14 for July, 1889.

The beans were taken from the pods, and placed to ferment in boxes with holes in tho bottom through which the moisture drained out.

After six days, the beans were taken out, and spread on wooden trays in the sun in a thin layer. Now and then, they were rubbed between the hands, and the refuse removed. At night, or when there was the slightest rain, the Cocoa was placed under cover in the store-room.

After from four to six days, if the beans break easily, are of a chocolate (not purple) colour without any white skin inside, and have a sweet (not bitter) taste, they will be cured.

The beans were not washed.

EBONY.

The name "Ebony" is applied to a black wood, which is hard and heavy. The Ebony of Jamaica and Cuba, (*Brya ebenus*), which is so common in the Liguanea Plains, in Clarendon, &c., is known in Commerce as "Coccus Wood."

True Ebony is heavier than water, a cubic foot weighing from 1,100 to 1,330 oz. It is close-grained and takes a high polish. It is chiefly used for inlaying and fancy work,—to make pianoforte keys, &c. The best kind of Ebony is very valuable on account of its maintaining a permanent shape and not warping; it is therefore used for rules and measures. The price of the timber as imported into England varies from £5 to £20 per ton; from 700 to 1000 tons are annually imported.

Wood of a high specific gravity, close-grained and black, is called Ebony, whatever the tree may be which produces it. It is however, yielded principally by species of Diospyros, natives of the East Indies and tropical Africa.

Amongst these species is one, *Diospyros discolor*, Willd, a native of the Philippine Islands, a few plants of which are now ready for distribution.

This tree grows to about 40 feet high. The wood is at first of a dark flesh colour, becoming in time of an exceedingly deep black colour, very hard and compact.

The reddish fruit is edible, after removing the skin.

The tree will probably only succeed well in Jamaica, where there is a heavy rainfall, for instance in Portland, St. Mary's and St. Thomas in the East.

Plants will be delivered in Kingston, at the rate of 1d. each. Applications will be dealt with in order of receiving them,—the preference, however, being given to those living in localities where they are most likely to succeed.

COTTON.

At the end of last century there were over 100 Cotton Works in the Island, but Sugar was paying so well that Cotton was gradually given up.

Good Cotton has lately been grown in Turks Island. If any Planter in Jamaica wishes to experiment with Cotton, an endeavour will be made to obtain seed from Egypt of a variety which is obtaining tho highest price in tho market.

Applicants should stato what weight of seed he requires. From 7lbs. to 10 lbs. of seed is necessary per acre.

NUTMEGS.

Soveral specimens of Nutmegs have been sent from various parts for examination. They had dropped from tho trees when half grown, or much smaller.

In ono instance, it seemod that there was defect of fertilisation, owing either to lack of male trees or to scarcity of insects that carry the pollen. But in most casos, it was clear that there was a want of plant-food in tho soil. The tree could not obtain sufficient nourishmont to provide for the full development of all the Nutmogs, and this food was distributed along various channols in the branches and twigs in greater or less quantity according to tho position of the young fruit. As soon as tho point was reached in the stage of development of the Nutmeg, when the supply of food could not meet its requirements, the young fruits dropped off, thus setting free its food to supply tho wants of others. This natural process is somowhat wasteful. The crude food taken up by the plant is elaborated into the complicated materials of a Nutmeg. When the fruit drops undeveloped, even although by its decay it restores to the soil tho amount of food taken up, yet there has been loss of energy to the plant in the elaboration; and besides other Nutmegs which have also dropped might have had sufficient food for full development. This natural waste can be prevented by the care of man, and that in two ways, either by providing sufficient food in the soil for all the fruit; or by picking off in the youngest stage all the surplus Nutmegs, only leaving such a number as will come to full maturity. The best food is cattle, or stable, manure. Even in the supply of food, care has to be taken that the tree is not weakened by over production of fruit, and so rendered an easy prey to disease. Some years ago the Nutmeg groves of Singapore, which were very highly manured, and bore enormous crops, were suddenly destroyed by some unknown disease, and many planters were ruined.

Mr. J. Richard Reece, who takes a keen interest in the agricultural progress of the Island, has since forwarded the following note by Mr. Dobson:—

"The Nutmeg tree at Carton is 22 feet high. It is 26 years old and has been bearing for the last 10 years. At first great numbers of the nuts dropped off before reaching maturity. Seeing this, I had the ground around the tree about the radius of 8 feet thoroughly picked (with a pick axe), and had a hogshead of sheep manure (which had not been exposed to the weather, consequently very strong) scattered around. From that time hardly any of the nuts have dropped and it has borne very plentifully. We must gather fully 200 nuts per annum from it. The tree is very luxuriant. The soil on which the tree grows is of a black loose sandy nature. The nuts when properly cured are the size of the average nutmegs bought at the shops. I have tried several times to plant the seed (which grows very readily) but as fast as they sprout, insects eat them down."

To prevent the attacks of insect, the seedlings might be dusted over with Paris Green, or lime might be sprinkled on the surface of the ground round the young plants.

Manure will hasten the production of fruit by the young tree, so that it will bear some years earlier, especially if it is not situated favourably in deep rich soil.

Manure is also valuable in preventing the dropping of the Nutmegs unripe, and it in this way prevents loss.

It also increases the natural productiveness, and the tree yields a larger crop.

If a tree yields only 10 pounds of Nutmegs in the year and one pound of mace; and even putting a low value on both, viz., two shillings a pound for Nutmegs, and two shillings and sixpence for Mace, the annual value of a tree is £1 2s. 6d.

A child sowing a few good Nutmegs, and tending the plants with care, will in 7 or 8 years begin to get fruit, and for every tree that bears will receive at least £1 a year for 60 or 70 years.

FERNS: SYNOPTICAL LIST.—XI.

Synoptical List, with description, of the Ferns and Fern-Allies of Jamaica, by G. S. Jenman, Superintendent Botanical Gardens, Demerara, (continued).

15. *Adiantum pumilum*, Swartz.—Stipes slender, 1½-3 in. l. polished, rusty or naked; fronds simply pinnate, or the base bipinnate, the former ½-¾ in. w. the latter 1-2 in. w. firm, naked, dull glossy and faintly striated above; segments few or several to a side, alternate, oblong, subdimidiate, rounded or subovate, 2-4 li. l. 1½-2 li. w. barren finely denticulate terminal narrow, lobed at the base, inferior subdistant; veins free, radiating, fine, close, forked; sori close; short, subreniform or roundish, around the upper margins.

"Rare on shady rocks and old trees."—Swartz. The above description is chiefly taken from Swartz's specimens in the British Museum, aided by larger bipinnate ones of my own that appear to be the same. There are six little fronds in all of Swartz; only one of which is fertile, three segments of which bear a simple sorus each, about a third of a line wide, The stipites are 1-1½ in. l. fronds simply pinnate, 2 in. l. ¼-½ in. w., segments 6-8 to a side, the lower ones orbicular-cuneate the upper ovate-cuneate, the terminal rather elongated and bluntish. A doubtfully distinct species, probably some member of the striatum group in young state.

16. *A. nigrescens*, Fée.—Stipes 5-8 or more in. l. black polished, channelled, slightly scaly at the very base; fronds bi-tripinnate, ¾-1 ft. l. ½-¾ ft. w. firm, dark dull green, striated, rachis and costæ polished, glabrous, or slightly rusty-puberulous; pinnæ spreading nearly horizontally, 3-4 or more to a side, subdistant or distant, shortly petiolate, 3½-6 in. l. 1-1¼ in. w. the lowest usually shortly bipinnate at the base segments numerous, contiguous or close, subdimidiate, rather widest at the base; the upper edge much longer than the lower, forming with the oblique outer edge a blunt or acute point, denticulate, slightly pedicillate, ½-¾ in. l. 2-3 li. w. terminal largest, subdeltoid, equilateral, rather elongated, lobed or incised at the base; veins fine close, repeatedly forked, radiating; sori contiguous, small, slightly concave; occupying the centres of the slight lobules of the upper and probably also of the outer margins.

Infrequent, collected by Miss Taylor, who gives no locality, but probably on the Port Royal or Portland Mountains. The specimen agrees exactly with a type specimen of Fée's in the Kew Herbarium, and is a very distinct species, but Fée's figure, Icon. t. 11 fig. 2 appears to be a variety of *A. striatum*, Swartz. *A. nigrescens* has the striated surface of this group, but with smooth brightly polished black stipites, rachis, and costæ, and hair-like similarly black and polished short podicels to the segments. Its nearest affinity is with *crenatum*, which however is much more robust.

17. *A striatum*, Swartz.—Rootstock short-creeping, densely scaly; stipites ¾-1¼ ft. l. naked, dull blackish, rough surfaced, fronds stiff, tripinnate at the base, ¾-1¼ ft. l. 6-10 in. w. the substance hard and rigid but not thick, dull dark green, the upperside rather glossy and much striated, rachis and costæ dull, stiff, though relatively slender, the latter slightly scurfy; pinnæ erect-spreading, 4-7 in. l. ½-1 in. w. contiguous or subdistant; segments very numerous, close, subdimidiate, oblong, or the lower ovate or

subrhomboidal, $\frac{1}{4}$-$\frac{1}{2}$ in. l. $1\frac{1}{2}$-4 or 5 li. w. rounded, blunt or acute, flat or concave, barren crenate dentate; veins free, flabellate, repeatedly forked; sori contiguous, extending along the upper and outer and turned shortly also on to the under margins—Plum. Fil. t. 97.

Var. *a.* Habit very lax,—pinnœ 2 in. apart; segments contiguous, hardly close, texture stiff but less rigid.

Var. *b.* Fronds smaller, bright green, compact, segments close, 2-3 li. l. $1\frac{1}{2}$ li. w., the outer minute, terminal linear-elongate, $\frac{1}{2}$-$\frac{3}{4}$ in. l.

Var. *c.* Habit and size of the type, but segments elongated and acutely or bluntly pointed the inferior more uniformly subrhomboidal.

Very abundant on stony well drained ground in woods and on open banks and cliffs up to 1,000 ft. alt. or more. The branches of the lowest pinnæ are occasionally, but rarely, again shortly branched, making the frond quadripinnate. Very variable. In the type the habit is more or less compact, the segments rounded and about two-thirds as broad as long. Var. *a.* has similar segments, often however more uniformly oblong, the habit very lax. Var. *b.* is the most distinct, of smaller size, compact habit, very tapering pinnæ and bright rather grass green colour. In var. *c.*, which is as large as the type, the inferior segments are more uniformly subrhomboidal, those next above elongated and pointed though generally blunt, the sori extending down half or two-thirds of the outer and inferior margin. Hooker confounded the species with *A. cristatum*, Linn., and Grisebach in his West Indian Flora followed him. Swartz's type specimens are in the British Museum.

18. *A. cristatum* Linn. Rootstock short-creeping, finely scaly; stipes $\frac{1}{2}$-1 ft. l. dull blackish, rough surfaced; fronds tripinnate, $\frac{3}{4}$-$1\frac{1}{2}$ ft. l. $\frac{3}{4}$-1 ft. w. rigid, hard, coriaceous, dark dull green beneath, glossy above and striated, naked, or the dull coloured rachis and costæ slightly rusty; pinnæ 5-8 to a side with a terminal similar one, approximate or subdistant, 5-8 in. l. $\frac{1}{2}$-$\frac{3}{4}$ in. w. the lower 1-3 pair branched at the base on one or both sides; segments numerous, close, dimidiate, 3-5 li. l. 2 li. w. the lower edge upcurved, the upper usually straight subfalcate, or slightly decurved, the end generally acute, but occasionally blunt, not denticulate; veins free, forked, close, fine; sori confined to the upper margin, subcontinuous or in two or more contiguous elongated oblong or short patches.

Common in similar situations to the last, but at a higher elevation, extending from 1,000 to 2,000 or 2,500 alt., plentiful among the hills between Gordon Town and Guava Ridge and in all that region of St. Andrew, and on limestone ground generally through the island. Possessing the texture and general character of *striatum* but with more decidedly dimidiate segments and scant often elongated sori confined to the upper margin. In fructification the fronds pass from a single to several sori to each segment, being generally uniform in the possession of one or the other.

19. *A. pyramidale.* Willd.—Stipes erect, dull, dark, naked except at the rough surfaced base; fronds bitripinnate, lax, 1-$1\frac{1}{2}$ ft. l. 8-10 in w. stiff, naked, dark dull green beneath, glossy above, faintly striated, rachis and costæ slender, dull, blackish, the latter slightly rusty; pinnæ erect-spreading, alternate, several to a side, with a similar, usually longer, terminal one, 6-8 in. l. $\frac{1}{2}$-$\frac{3}{4}$ in. w. tapering to the point, the lower 1-2 pair branched, petiolate, segments very numerous, close dimidiate,, 2-6 li. l. $1\frac{1}{2}$-2 li. w. lower margin upcurved, upper usually falcate or sub-falcate, acuminate or acute, the margins not toothed; veins free forked, radiating, fine, close; sori confined to the upper margin, often a solitary elongated patch in the hollow of the segment, or variously interrupted. Plum. Fil. t. 54. *A. microphyllum,* Klf.

Gathered at Stony Hill, St. Andrew, where it grows in the open and in light woodland with *cristatum,* of which it seems to be hardly more than a variety marked by the long narrow pinnœ and small falcate acuminate segments. The slender pinnæ, of which the upper ones are often much the longest, hang down of their own weight. The segments are variable, some being short, falcate and acute, with the sori extending nearly to the point of the upper margin, while the majority are elongated and acuminate, the sori being confined to the inner half of the margin. As regards both this and *cristatum* some fronds might be placed in the polysorus and others in the monosorus groups.

20 *A. crenatum,* Willd.—Stipes strong, black, polished, a few scales at first at the base; fronds 1-$1\frac{1}{2}$ ft. l. nearly the same w. triquadripinnate, chartaceous, naked, light rather glossy green, striated, rachis and costæ channelled, polished black, very slightly rusty at first; pinnæ forming several alternate pairs, the lower large and compound, the upper reduced and simply pinnate, with a similar terminal one $1\frac{1}{2}$-2 in. w.; segments subdimidiate, shortly pedicillate, contiguous, $\frac{1}{2}$-1 in. l. 2-5 li. w. oblong and obtusely pointed, or many subrhomboidal, terminal subdeltoid or elongated; veins free, fine close, repeatedly forked, radiating; sori copious, occupying the shallow lobes or crenatures formed by the uniform incisions of the upper and outer margins.—Plum. Fil. t. 53. *A. Wilesianum,* Hook. Sp. Fil. vol. 2. t. 83 C.

Infrequent or local, gathered by Wiles and Lambert and a few years ago by Hart, at Bull Head. There are specimens at Kew from both the former, and very fine ones from Wiles in J. Smith's ferns in the British Museum. The short pedicels of the segments are hair-like.

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BULLETIN

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JAMAICA.

CONTENTS:

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JAMAICA:
GOVERNMENT PRINTING OFFICE, 79 DUKE STREET, KINGSTON.
1892.

REPORT ON THE FIBRE INDUSTRY OF YUCATAN.

By Captain E. Jerome Stuart, Resident Justice of Long Island, Bahamas.

Nassau, N. P., 30th April, 1892.

To His Excellency Sir Ambrose Shea, K.C.M.G., Governor and Commander-in-Chief, &c., &c., &c.

May it please your Excellency,

In accordance with instructions received from your Excellency on the 15th ultimo, I sailed on that date for Yucatan, for the purpose of comparing the soil of the Bahamas and its adaptability to the fibre industry, with the soil of that State; to find out the different species of Agaves planted, and their liability to disease; the character of the machinery used for extracting the Henequen fibre; and the cultivation and general management of the crops.

When in the State, I visited 28 Henequen Estates, and after careful enquiry I have the honour to submit the following report:

The Soil of Yucatan Compared with that of the Bahamas.

The soil in the "fibre producing district" of Yucatan is gravelly and stony, and varies in colour, being black, brown, and red. There are large tracts of land in the district, similar to that on most of our Islands, and known as "mixed land." The soil has an average depth of 8 inches, and is underlaid by soft limestone rock, similar to that of our "Pine Barren" lands.

The largest fibre fields in the State are to be found on this shallow stony soil; and the yield of fibre is greater than on the deeper soil 30 miles further inland.

I could not—when looking at the fibre fields of Yucatan—doubt for a moment that the fibre fields of this Colony are equally good; and if the growth of plants is any guarantee of the virtue contained in the soil in which they grow, I do not hesitate in saying that the soil of the Bahamas is equally as good as the soil of Yucatan.

Any one who will look over the grounds of Fort Charlotte will see the soil, trees, and weeds of the fibre fields of Yucatan, with this difference, that the soil there is more stony.

The Different Species of Agaves.

The "Henequen." The "Bahama Hemp."

There are several species of Agaves to be found in Yucatan, but as two only are of commercial value, I confine my report to those two.

The "Henequen"—The species of fibre plant grow in Yucatan, and known as the "Sacqui" or "Henequen" is a different and distinct Agave to that of the Bahama Hemp.

The plant is hardy, and has, when cultivated, an average life of 18 years; and propagates itself by sending out "suckers" from its roots.

The "Henequen" requires from 5 to 8 years growth to produce a marketable length (three feet) of fibre. The leaf from which the fibre is extracted has a thorn at the point, and spines on its edges, and averages 3¼ feet in length.

The fibre of the plant is white, but being inferior to that of the "Bahama Hemp" is rated* in the market, at from £6 to £8 per ton lower.

The "Bahama Hemp"—The "Bahama Hemp" differs from the "Henequen" inasmuch as the leaves are without spines on their edges; and the fibre is superior in texture. The plant matures from 2 to 3 years earlier than the "Henequen," and has an average life of 12 years. Like the "Henequen" it propagates itself from "suckers," but is also capable of producing over 2,000 plants from the "pole" that grows from the centre of the plant.

The "Bahama Hemp" is found both in Yucatan, where it is known as the Yaxqui, and in Cuba, but is not cultivated, as it requires a more congenial climate than these countries afford. In this Colony the plant luxuriates, the length of leaf being 4½ feet to 5 feet, weighing 1½ to 2 lbs. In Yucatan a leaf of the "Yaxqui" from a plant of the same age would measure 3¼ feet, and weigh 11 ounces only.

The Plant's Tenacity of Life.

The "Henequen" and "Bahama Hemp" are the hardest of all the Agaves. Their power to withstand drought is almost incredible. I have known plants of the "Bahama Hemp" to lie on the ground for 3 months, exposed to the rays of the sun, and when planted to grow with the greatest vigour.

It has never been known for these plants to be troubled with any disease. No fungus or insect can damage or affect them, and in 1883 when the locust devastated the State of Yucatan, the cattle and birds dying of starvation and men where on the eve of despair, the only green living plants to be seen were the different species of Agaves, and they are now looked upon as the salvation of the State.

Although not subjected to disease and capable of resisting a drought of 11 months in 12, the plant is not altogether free from the effects of sudden changes of heat and cold; and is liable to be damaged by floods of rain, immediately after a long drought, if accompanied by a *sudden fall of temperature.* This happened in Yucatan in 1888, when after a severe drought the rains came on suddenly with hail, and a heavy wind from the north west, with a fall of temperature from 89° to 57°, and within one night about 90o/o of the plants were damaged or blasted on the ends of the leaves, about an average of 3 leaves to the plant being affected, causing a loss of 3o/o to 5o/o of leaf. A similar change after a protracted drought happened in this Colony in March last, when a few of our farms were

*At present date, 20th June, rated at £6 lower.

affected, but after cutting off the ends of the injured leaves, there was nothing more seen of the trouble, and the plants remained healthy and strong. I am told that this frequently happens in Florida, as the atmosphere is more changeable than in the Bahamas; but as this colony is protected by the Gulf Stream, there is no probability of its happening here with frequency, and in Yucatan it has happened once only in 30 years. The blast is caused by a sudden atmospheric change over which we have, and can have, no control, and may happen at any time, but the loss of leaf 3o/o to 4o/o even 5o/o would be so slight that it is looked upon with unconcern.

I walked through hundreds of acres of the "Henequen," but beyond noticing that a leaf here and there had a few inches dried on its end, similar to what is seen in this colony and Cuba, the plants were perfectly healthy and free from disease.

Kind of Machinery Used.

Cleaning Machine. Engines and Boilers. Press. Locomotives, &c.

There are several kinds of machinery used for extracting the fibre on the different estates.

Those cleaning less than 75,000 leaves per day, used the large common wheels, Raspador and Barraclough, and those cleaning from 80,000 to 120,000 per day, use the larger and more complicated machines, the Prieto, Villamore, Weicher, Death & Ellwood, &c.

The planters if using one of the large machines, keep several of the Raspadors in reserve for use in case of accidents; for should the large machine break down or get out of order, leaving seventy or eighty thousand leaves on hand, and there be no means of cleaning them, it would involve a loss of over 4,000 lbs. of fibre.

Cleaning Machines.—The *Raspador* is a fifty-four inch "wheel" said to be invented and manufactured in Mexico. It requires a two horse power engine to run it at a steady rate of two hundred revolutions per minute, at which speed the best results are obtained. Capacity 500 lbs. dry fibre per day of ten hours: requires the services of two men.

The *Barraclough*, constructed by T. Barraclough & Co., Manchester, England, is similar to the Raspador but of superior make. Capacity 500 to 600 lbs. dry fibre daily.

The *Prieto* machine is manufactured by Ping & Negre, Barcelona Spain; requires a 16 horse power engine, and the services of two men and a boy. Capacity 7,000 lbs. dry fibre per day of ten hours. Cost $4,500.

The *Villamore* machine, made by Krajewski & Pesant, 35 Broadway, New York, requires a 15 horse power engine, and the services of two men and a boy. Capacity 6,000 lbs. fibre per day of ten hours. Frame made of wood. Cost $500.

The *Weicher* machine, constructed by J. J. Weicher, 108 Liberty Street, New York, is fitted with a service pipe for throwing a stream of water on the fibre as it is being cleaned, and is claimed by the inventor to lose but 1½o/o only, as the leaves are fed into the machine endwise. Requires 12 horse power engine and services of 3 men. Capacity 2,500 lbs. dry fibre per day of ten hours.

The *Death & Ellwood* machine, constructed by W. E. Death, of Braxton, England, requires a 3 horse power engine to drive it at a velocity of 400 revolutions per minute and washes the fibre when cleaning. Like the "Weicher" the leaves are fed into the machine endwise. Capacity 250 lbs. of dry fibre per day of ten hours.

With the expection of the Raspador and Barraclough all the other machines are automatic; they rasp the pulp from the fibre on the same principle as the Raspador. Their wheels being smaller, require a velocity of 500 revolutions to the minute to give good results. Beyond cleaning a greater number of leaves, they do not appear to do better work as the percentage of loss is as great in the one as the other, and the fibre is equally as clean.

Engines and Boilers.—The engines used were from 6 to 80 horse power, manufactured by Marshal & Son, London; Appleby Bros., London; Fawcett & Preston, Liverpool; Watts, Campbell & Co. Newark, N. J.; H. M. Sciple, Corner 3rd and Arch Street, Philadelphia.

The estates running 60 to 80 horse power engines have two boilers, using them alternately every 15 days.

Press.—Most of the small estates use small screw presses, baling from 3 to 8 bales daily. The large estates baling 16 to 30 bales daily, use hydraulic presses, construoted by Appleby Bros., London; and Fawcett & Preston, Liverpool.

Locomotive, tramway rails, &c.—The Locomotive cars are made of wood, 20 feet by 4 feet. The rails are of iron with guage 3 feet, and sleepers of wood 2 feet apart.

Tramway trucks are of iron or wood; they are 12 feet by 3 feet. Rails and sleepers of iron with guage 2 feet 4 inches, and sleepers 2 feet apart.

Locomotives and tram cars with rails are manufactured by Charles Wood, Trees Iron Works, Middlesborough, England.

Cultivation of the Agaves.

The Estates. Preparing the Fields. Planting.

The Estates—There are 200 Henequen estates in Yucatan, varying from 500 to 28,000 acres in extent, having a total number of 105,000 acres under cultivation, employing 12,000 Indian labourers.

The largest and best estates are on the rocky, gravelly lands, and they are valued from $100,000 to $500,000 each. Each estate is managed by 3 principal men: the Attorney, the Manager, and Assistant Manager. The largest of them employ locomotives for hauling in the crop from the fields; others using tramway trucks or carts drawn by mules or oxen.

Estates with less than 800 acres under cultivation, erect one Raspador, for every 100 acres. Those of 1,000 acres use the large automatic machines.

Preparing the Fields.—The size of the cultivations on the estates range from 250 to 3,500 acres They are laid out in fields, or sections, of 50 to 200 acres, and contain from 600 to 900 plants to the acre.

When preparing the fields the land is cut during the dry season; is then allowed to spring up, after which it is "sprig weeded," and burnt after the first fall of rain The stumps are cut close to the ground, so as to be out of the way of the leaves of the plants, and to facilitate the running of the line for planting, and getting the rows straight.

Planting.—The plants are "set out" on the different estates at various distances, being 6 ft. x 11 ft., 5 ft. x 11 ft., 4 ft. x 11 ft., 6 ft. x 10 ft., 5 ft x 10 ft., 4 ft. x 10 ft., 6 ft. x 9 ft., 5 ft. x 9 ft., 4 ft. x 9 ft., 6 ft. x 8 ft.

The rows are kept perfectly straight, for if they be otherwise, there would be the greatest difficulty in getting through the fields.

When planting the labourers have a small line with the distances at which the plants are to be "set out" knotted on it, and a pole cut to the length that the rows are to be apart. A man and a boy are employed at each line. The boy drops the plants along the row at the distance marked on the line, and then removes the line to the next row, dropping the plants as before. The man does the planting, and is responsible for the rows being straight. When coming to a rock the planter does not turn aside, but goes on and places the plant in the row a little beyond.

The row system facilitates weeding, admits a free current of air and sunlight, which is necessary to harden and give strength and texture to the fibre; allows the labourer to cut and bring out the leaf with despatch, and what is of the greatest importance, gives room for replanting the field when the life of the old plants are about to terminate, which cannot be done if the plants are growing over the field irregularly.

Plants of less than 15 inches are not planted.

Management of the Crop.

Cutting.—Cleaning.—Yield per Acre.—Cost of Working and Profit.

Cutting.—In Yucatan the Henequen matures in 5 to 8 years. In the Bahamas the Bahama hemp matures in 3 to 5 years.

To neglect cutting the leaves after the plant is matured retards its growth which causes it to "pole," at the appearance of which the life of the plant is ended, and the planter after reaping a few leaves only, must then plant his fields afresh. On the other hand, when the cutting is regularly attended to, the life of the plant is prolonged; the plant will produce a greater number of leaves, and fibre of a greater length and superior quality.

The plant is cut every three months, when 7 to 9 leaves are gathered. The leaf is taken from the plant with a "clean cut" making the cut down and inward at an angle of 45°.

Cleaning.—As soon as the leaves are cut they are taken to the machine for "cleaning." The cleaning is so arranged, that one half of the leaves to be cleaned is taken from the cuttings of the day previous, and the other half from the cuttings of the same day, as in this manner the work can be commenced early in the morning, and steadily carried on without waiting for leaves to be brought in from the field. The leaves are not allowed to accumulate beyond half a "day's cleaning," for if left to dry beyond the second day, they become hard, and the fibre when extracted will be dark.

When the Raspador is used for extracting the fibre, 2 operators are required; one stands to the left of the wheel and the other to the right. The operator on the left taking a leaf fastens the small end with a lever to prevent the whole of it being drawn into the machine; the larger end is inserted and cleaned; the other operator then hauls out and reverses the leaf putting in the uncleaned end, at the same time taking a turn with cleaned end of the leaf around a brass cleat which is fitted to the machine for the purpose, and managing a break that regulates the pressure required for cleaning the leaf, finally drawing out the clean fibre. In this manner 14 leaves per minute or 8,400 leaves are cleaned for a day's work.

When cleaning with the Villamore, Prieto or other automatic Machines, all that is necessary is to lay the bundles of leaves on a platform fitted for the purpose, when an endless chain draws them into the machine, the mechanism of which is so arranged that one wheel cleans one half of the leaf, the chain taking it along, where another wheel cleans the other half, and then throws out the clean fibre at the opposite end. Two men and a boy are employed at the machine; one man to see that the leaves enter the machine on their length, and that they do not "ride" one on the other: one to attend to, and regulate the machine, and the boy to receive the fibre as it is brought out by the endless chain.

As soon as the fibre is extracted it is dried, for if allowed to remain without being exposed to the sun, immediately after cleaning, it becomes dark and spotted.

Yield per acre.—The yield of fibre from an acre of "Henequen" is from 1,000 lbs. to 1,470 lbs. per annum. The number of plants usually set out in an acre are 650, giving an average of 33 leaves from each plant; and from 50 to 70 lbs. of clean fibre to the 1,000 leaves Making an average calculation of 650 plants to the acre, 33 leaves from each plant, yielding 60 lbs. of fibre to the 1,000 leaves, the return would be as follows:

$33 \times 650 = 21,450$ leaves yielding $60 \times 21 \frac{450}{1000} = 1,287$ lbs. clean fibre per annum. The planters never speak doubtfully of their returns, as experience shows them that their crops can be relied on with almost complete certainty.

Cost of Working and Profits.—The planter estimates his crop to cost for cultivating, cutting, cleaning, baling and marketing from $2\frac{1}{2}$ cents. to 3 cents per lb. At the present price of fibre 5 per cents. per pound taking three cents. as the cost of production, an acre yielding 1,287 lbs. would give a net profit of $25.

After comparing the soil and plants of the Bahamas with that of Yucatan I do assure your Excellency that the one compares most favourably with the other; and that we have in this Colony every requirement for the development of the enterprise, and I am most sanguine as to the ultimate result of the Bahama Hemp industry.

Trusting that this report will meet with your Excellency's approbation.

I have the honour to be,

Your Excellency's most obedient servant,

E. JEROME STUART,

Resident Justice,

Long Island.

DISEASE IN SISAL HEMP IN TURKS ISLAND.

The following letter refers to attacks on Sisal Hemp by insects in Turks Island.

From enquiries made of the growers of Sisal Hemp in Jamaica, it appears that there is no sign of this disease at present. The letter is however published to put planters on their guard, and to suggest a remedy which has proved effectual, applied while only a few plants were affected.

Grand Turk, June 16th, 1892.

Honourable Henry Higgins, Commissioner.

My dear Sir,

In regard to the possibility of the blight to the fibre plants, which prevails in the Bahamas, having extended to this colony, I desire to say that, not having complete information as to the character of the disease, I am not in a position to write with absolute certainty.

About a year ago, in going over some of the old fields at my place at Haulover, I found a few of the plants, some that were beginning to pole or that were near the poling period, showed signs of withering in the centre. On examining the suckers surrounding them, about two and a half feet in height, I found some of them also affected. A close examination of the outside of one plant showed no ground for the withering. Upon cutting into the trunk it was found to be swarming with insects and grubs, which had riddled the interior but never showed themselves on the outside. It was a peculiarity that only suckers dependent upon an affected plant were affected. Other neighbouring suckers from sound plants were free from the pests. Thus in a field of about 200 plants a single matured plant would be withered, together with four or five of the largest suckers surrounding it, and all other plants and suckers would be in a perfectly healthy condition. From this I concluded that the insects did not migrate overland but found their way inside the roots from the parent plant to the largest suckers. In the entire plantation I found only a very small number affected. These pests were readily exterminated by putting dead bushes over the clump of trees and suckers and setting fire to them. With a little care the fire could be confined to the diseased plants, usually five or six, including suckers, so that adjoining healthy plants would not be injured. Since then no further reports have reached me of unhealthy plants in the old fields. When I was informed that some kind of blight had been prevailing in the Bahamas, I did not hesitate to say that nothing of the kind had extended to my plantation, presuming it was something different from the trouble which I have described and which was of no special importance. Afterward upon inquiring of the manager I was told that a few of the plants in fields recently laid out had shown signs of being affected in the same way as those in the old fields, but that the number was so trifling and the difficulty was so easily overcome that it was not deemed worth mentioning.

The insect is about three quarters of an inch in length, somewhat like a beetle and of a dark bronze colour. The grub is perfectly white. The holes made by them are about a quarter of an inch in diameter. They seem to prefer the part of the leaf at its junction with the trunk.

If the blight in the Bahamas is the same as that which I have described, it need give the proprietors no uneasiness, as the insects are readily extirpated in the way I have mentioned. If it is different it certainly has not extended to these Islands.

Yours, &c.

JOS. A. HANCE.

I forward this as it may interest your Excellency and also perhaps be useful to Mr. Fawcett. The writer is our only exporter as yet, of Pita Hemp.

Haulover is on Grand Caicos, the island next Breezy Point Island.

18.6.92. H. H.

A TREE FOR BEE-KEEPERS.

" I send you herewith some sprigs of a shrub or dwarf tree which seems to me to be botanically interesting and economically useful.

" My son keeps many hives of bees here, and does very well with them. He has, as his crop this spring, shipped 27 barrels of honey of 30 gallons each, and about $1\frac{1}{2}$ cwt. of wax, although he uses much of his wax in making "foundation comb" for his comb frames. My attention was first called to the plant I am noticing by the way all sorts of bees, wasps, flies, and ants, swarm upon it when in flower. It is a night blossomer opening at about an hour before dusk and closing about the same time after sun-rise, but in that short space of time, especially in the evening, it is simply alive with hymenoptera, so that it is difficult to pick a flower without being stung.

" When it is in flower it is one sheet of white-looking flowers, I say white-looking, because it is the stamens only that are white, but I have pricked as many as 152 of these out of one flower set in a bed within the calyx, and surrounding the single pistil. The stamens are about 2 inches long and are filamentous and therefore do not stand out in any star-like form, and the bees and wasps just cut them down by the dozen to get at the two or 3 drops of nectar, secreting from the thalamus. The calyx is small and four-fold. The corolla is also four-fold; when it opens it folds back over the calyx, but it remains without still quite green and within also of a silky sheeny green, and might, to me, easily be taken for an inner foliation of the calyx.

" These green petals of the corolla soon drop, or are just gnawed out by the bees and wasps, and the calyx-leaves, or sepals, also soon after drop, and the stamens by that time have all disappeared also, leaving just the bed and the pistil.

" Hitherto the flower has been upright, and when in bloom its perfume is fine and delicate, not so strong as the jasmine, and a little like the coffee; but when the flower has dropped, the end of the pistil begins to swell and the stalk of it to elongate, until as shewn in the samples sent the pistil turns into a a bean-pod, 6, 8 or even 10 inches long!

" I have seen this morning 2 or 3 of these pods, they are not ripe yet, 10 inches long. I do not pluck them as I want them for seed and when ripe I will send you some of them, if you care to have them. The plants grow here naturally in the lowlands, and stand drought well. The wood is small but knotty and close-grained.

" The swelling of the pistil and turning itself at the extreme end into a bean pod seems to me remarkable. The Leguminosæ seems within their papilionaceous flowers to develop the seed-pod.

" I have sent you specimens by which you can see this gradual transformation when in flower. The head of the pistil is quite blunt even to a pocket magnifying glass, and seems just as fragile and as likely to dry and fall off as the staminal filaments.

" Wasps and ants at least feed upon the reddish fruity matter that lines the inside of the open pod."

In the above notes, the Rev. H. Scotland has pointed out the economic value of this tree to bee-keepers, and especially to those who live in dry situations, subject to droughts.

The root tastes like Horse-radish, and Dr. Macfadyen states that it has been recommended as a specific in dropsy.

This plant is commonly known as the Bottle-cod Root. Its botanical name is *Capparis cynophallophora.* It belongs to the Caper family *(Capparideæ.)* Mr. Scotland has very well pointed out a characteristic of the family, the peculiar fruit with a long stalk. Another species, a shrub native in the Mediterranean region, *(Capparis spinosa,)* yields commercial capers, which are the flower-buds preserved in salt and vinegar. The Garlic-Pear Tree, common in the Liguanea Plains, (*Cratæva gynandra.)* belongs to the same family. The bark applied externally is said to produce vesication.

The only other member of this family growing in Jamaica which is of economic value is the Five-leaved Bastard Mustard (*Gynandropsis pentaphylla*). It is an herbaceous plant, about 2 feet high, found in dry places; petals white with a slight tinge of purple; stamens 6, united below; leaflets generally 5, sometimes 3.

Macfadyen states: " This plant has a warm bitter taste. It is said to be a very wholesome green, and to be a preventative against belly-ache; but to render it palatable, it requires a long boiling, and the water to be frequently changed. The juice either plain, or mixed with sweet oil is a certain remedy for the ear-ache. It ought to be warmed previous to being used. A preparation may be made by beating up the young branches of the plant with sweet oil, in a mortar".

FERNS: SYNOPTICAL LIST.—XII.

Synoptical List, with description, of the Ferns and Fern-Allies of Jamaica, by G. S. Jenman, Superintendent Botanical Gardens, Demerara, (continued).

21. *Adiantum melanoleucum,* Willd.—Rootstock shortly repent, fasciculate, densely scaly; stipes ½-1½ ft. l. slender or strong, dark, channelled, naked, slightly asperous or not; fronds bi-tri-pinnate 1-1½ ft. l. 8-10 in. w. chartaceous, dark green on both sides, upper rather glossy, rachis and costæ slender polished blackish, naked; pinnæ spreading or erect-spreading, 3-8 to a side, with a similar long terminal one 3-8 in. l. ¾-1¼ in. w. the inferior ones branched at the base or not, segments close, numerous, dimidiate, curved or sublunate, rarely straight, 5-8 li. l. 2-3 li. w. oblong, usually rounded at the end, barren finely dentate; veins free, radiating, repeatedly forked, fine, close; sori reniform or crescent-shaped, extending along the upper and decurved outer margin, with shallow incisions between. Plum. t. 96. *A. cubense,* Hook. Sp. Fil. vol. 2. t. 73. A.

Var. *nanum,* Jenm.—Fronds very delicate, pinnate or rarely bipinnate at the base, 2-3 in. l. ¾-1 in. w.; segments 6-10 to a side with a larger subdeltoid or somewhat elongated terminal one.

Abundant in different parts of the Island from sea level up to 1,000 or 1,500 ft. alt, preferring wet calcareous rocks and banks. Very variable, there being apparently three or four distinct forms. The largest state is tripinnate at the base, and of this Plumier's figure is a good representation. Hooker's *cubense,* which is simply pinnate, was probably founded on an undeveloped plant. Apparently there are one or two Jamaica forms uniformly bipinnate only smaller than the large state mentioned. The variety *nanum* which was gathered plentifully on the dripping perpendicular banks of St. George's spring, Chesterfield, St. Mary, is a delicate little plant, two or three inches long, including the filiform stipes, simply pinnate as a rule with relatively large segments and copious sori. The shape of the segments vary in different forms. In some the upper margin is decurved, the under being lunate; in others the upper margin is hollow and the under upcurved. In the former the sori extend round the outer margin; in tho latter they are confined to tho upper margin only.*

22. *A cultratum*, J. Smith.—Stipes strong, erect, polished, black; fronds tri-quadri-pinnate, 1-1½ ft. l. and w, firmly chartaceous, naked, bright green on both sides, the upper glossy and finely striated, rachises polished and black; pinnæ spreading, lower compound, upper simply pinnate; segments subdimidiate, pedicillate, approximate, ¾–1¼ in. l. ¼–½ in. w. oblong-rhomboidal, terminal and basal ones deltoid-rhomboid, the under margin plain the upper and outer inciso-lobate, parallel, straight or decurved, terminating in an acute bluntish or rounded point, the sterile finely denticulate; veins free, close, fine, radiating, repeatedly forked; sori one to each lobule of the upper and outer margins; involucres deep, rounded, cernuous.—Plum. Fil. t. 95.

Infrequent, gathered by Syme near Castleton, St. Mary, and ascribed also to the Island by Grisebach. Resembling *trapeziforme*, but with much smaller more oblong rounded segments, in which the interior base is rather rounded and laps over the slender rachis, and the pedicels are not articulate at the top.

23. *A. trapeziforme*, Linn.—Stipes erect, tufted, 1½-3 ft. l., strong, black, polished, with a few deciduous scales at the base; fronds ample, spreading, 1½-2½ ft. l. and w. usually broader than deep, tri-quadri-pinnate, naked, firmly chartaceous, bright green and glossy above, pale or rather glaucescent beneath, rachises flexuose or zigzag, polished, black; pinnæ distant, spreading, the lowest largest and most compound with the branches on the inferior side longest, the next above less developed, simply pinnate; segments subdimidiate, 1-1½ in. l. ½-¾ in. w. on black filiform pedicels 3-4 li. l. upper and lower margins straight or curved, nearly parallel, the outer more or less oblique and forming with the upper an acute or acuminate point, both inciso-lobate, terminal and basal segments the same shape; veins free, radiating, fine, close, repeatedly forked; sori contiguous along the upper and outer margins, as wide and deep as the marginal incisions; involucres deep, rounded, cernuous.—Sloane t. 59.

Common in shady situations and light woods below 1,500 ft. alt., extending from the eastern to the central and western parishes. The stipites are stiffly erect, but the fronds spread rather flatly. In small plants the habit is pedato-ternate, the central not much exceeding the lateral branches.

24. *A. tencrum*, Swartz.—Stipes tufted, erect, polished, ebeneous ¾-1¼ ft. l. slightly scaly at the base, fronds 1-1½ ft. l. and w. quadri-pinnate, chartaceous, dark green, naked, rachises polished, black, slender; pinnæ much the same shape as the fronds, spreading lowest largest, all divisions freely petiolate; segments, same obliquely flabellate-cuneate, others rhomboid-dimidiate, ¼-¾ in. w. and d. on articulated filiform pedicels 1-2 li. l. base unequally cuneate, outer margin cut into shallow uniform lobules; veins free, flabellate, fine and close, repeatedly forked; sori more or less contiguous, oblong or occasionally rather subreniform, between the marginal incisions.—Eat. Fer. N. Am. pl. 124.

Abundant throughout the greater part of the country on limestone banks and on old ruins of coffee and other properties, from sea level up to 3,000 ft. alt The outline of the fertile margin of the segments is not even, and by a sharp incision on each side forms three inconspicuous lobes; there being fainter incisions or slight notches between as well. The general habit is lax and spreading. This is the commonest species of the typical maiden hair group. Sloane's specimen ascribed to *A. Capillus veneris*, is this in a young state.

25. *A. emarginatum*, Bory.—Stipes tufted, polished, ebeneous or dark chesnut, slender, 5-10 in. l.; fronds tripinnate, ½-1 ft. l. nearly as w. papyraceous-herbaceous, clear green, naked, rachis slender, polished; pinnæ spreading, lower largest and most compound, upper simply pinnate, all parts freely petiolate; segments deciduous, ½-1 in. b. and d. varying from rhomboidal to flabellate-cuneate, the outer margin usually rounded, and freely incised, the incisions deeper in the barren fronds, pedicels hair-like 1-1½ li. l. articulated at the top; veins free, flabellate, fine and close, repeatedly forked; sori oblong or subreniform, varying in length as the lobes of the margin vary in width.—Hook. Sp. Fil. vol. 2. t. 75. a.

Very abundant on the rocky cliffs of the north coast, in some places within wash of the sea spray, and gathered recently by Mr. Fawcett at Mt. Industry on the road from Gordon Town to Newcastle. The freely and deeply incised margins give this a close resemblance to *Capillus veneris*, from which it is however clearly distinguished by the articulation of the segments, which are almost as deciduous as those of *fragile*. It is generally a smaller plant than *tenerum*, which in general habit it resembles, the segments larger and much more deeply cut, the incisions being from 1-3 li. d. The plant figured by Hooker is not so deeply incised and has more evenly rounded segments. West Indian specimens of *A. Capillus-veneris*, gathered in Cuba, St. Vincent and Trinidad I have verified, possessing the characteristic unjointed pedicels of the leaflets, and the species is reported as having been gathered in Jamaica in Pedro Cave, St. Ann's parish, but I have seen no true specimens.

26. *A fragile*, Swartz.—Stipes 1-8 in. l. tufted, naked, polished, dark; fronds ovate, quadripinnate, ¾–1¼ ft. l. 4–7 in. w. papyraceous-herbaceous, naked, green on both sides, rachises dark, polished; pinnæ erect-spreading, petiolate, lowest pair not much the largest, the simply pinnate upper ones extending to near the apex of the frond; segments very deciduous, orbicular-cuneate, 4-7 li. d. and w. the outer margin rounded, very slightly incised, the dark filiform pedicels 1-1½ li. l. and jointed at the top; veins free, flabellate, fine, repeatedly forked; sori slightly obreniform, contiguous, around the outer margin, with slight notches between.—Hook. Icon. Pl. t. 965 a.

Very plentiful on calcareous rocks below 2,000 ft. alt. in many parts of the country. The species

* *A hispidulum*, Swartz, in which the fronds are about a span long, pedatiform, the central pinnæ simply pinnate and the lateral shortly branched at the base, all extending upwards together side by side, segments oblong, dimidiate, hairy, rounded and laxly dentate at the end, with numerous close punctiform sori along the upper margin, was found at King's House by Mr. Hart, among a collection of ferns, brought in from the hills, all of which were supposed to be ative. It was probably introduced.

is peculiar for shedding all its leaflets in dry weather, leaving nothing to show the presence of the plants but the stems and branches. Herbarium specimens, however carefully dried, drop their leaflets in the same way. This character, the ovate fronds much longer than broad, hardly enlarged basal pinnæ, rounded segments, with the margin only slightly incised, well mark the species. It was first gathered by Sloane, who, however failed to discriminate it from *tenerum*, with which it is mounted in his herbarium, only four leaflets remaining on the fronds.

27. *A concinnum,* H. B. K.—Stipes tufted, 4-9 in. l. dark chesnut brown or blackish, deciduously scaly at the very base ; fronds lanceolate-oblong, pendent, 1-1¾ ft. l. 4-9 in, w. tripinnate, papyraceous-herbaceous, naked, pale green, rachis and costæ polished, costulæ filiform ; pinnæ numerous, erecto-spreading, approximate or the inferior subdistant, 3-6 in. l. 1-2½ in. w. gradually reduced to the top of the frond, almost sessile by the presence of a reduced leaflet near the axil of the costæ and distant from the next above it; leaflets except the terminal which too, are largest, nearly sessile, not articulated, flabellate-cuneate, 2-6 li. w. and d. the sides of the base equal or unequal, the outer margin inciso-lobate, barren denticulate : veins free, flabellate, repeatedly forked ; sori approximate, rather rounded, obreniform, 1-2 to each marginal lobe ; involucres pale, deeply reniform.

Abundant in situations distant from each other on wet and dry rocky banks ; especially common between Gordon Town and Mavis Bank, St. Andrew. The habit is pendent, the fronds, which are regularly and copiously pinnate and have a beautiful pinkish tinge before maturity, hanging one over the other. Usually the pinnæ are deeper on the under than the upper side. The stipites are fragile and easily broken, though not particularly slender.

CONTRIBUTIONS TO THE LIBRARY.

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Musci. By John Macoun—From Geol. and Nat. Hist., Survey of Canada.

Michigan Flora. By W. J. Beal and C. F. Wheeler—From Authors.

From U. S. Department of Agriculture :—
Bulletin No. 13 : Food and Food Adulterants.
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Blue Books : (1) Correspondence relative to Trade between W. Indies and U. States.
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No. 36. October, 1892.

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.
1892.

ONION AND TOBACCO SEED FOR DISTRIBUTION.

Onions.

Onions have been so successful in some parts of this Island, that the importance of this product should be made widely known to small settlers. Much money is made in Bermuda by the export of Onions. The seed there is obtained regularly from the Canary Islands every year.

In order to encourage the starting of this cultivation generally, seeds has been imported from Teneriffe, and small quantities will be distributed free to those who make application for it for themselves, or to Ministers of Religion, and others, who will undertake to distribute it amongst small settlers.

Bulletin, No: 18, contains notes on cultivation, and will be sent free to those desiring information.

Tobacco.

The export of Cigars for year ending 31st March, 1892, was more than three times the amount exported three years ago, and it is likely to increase in even greater proportion, if Tobacco of really good quality, properly cured can be obtained.

Messrs. Machado have kindly supplied the Department with good seed from plants grown from seed imported last year from Havana. This is now ready for free distribution to those who make application for it. It should be stated how much land it is intended to plant.

Information on cultivation and curing of Tobacco is given in Bulletin, No 13, which is available to growers.

EUCALYPTUS.

Eucalyptus trees have obtained a reputation for destroying the germs of malaria in districts where fever is prevalent.

The Campagna of Rome is extremely unhealthy in summer, owing to malaria, but an interesting experiment with Eucalyptus has proved the value of this tree and shown conclusively that the repuation it has earned is well deserved. About two miles from Rome is the Convent of Tre Fontane, commemorating the martyrdom of St. Paul. A few years ago the Convent was always abandoned by the monks during the summer months as it was impossible to live there in the malarial season. Now, however, since Eucalyptus trees have been planted all round the Convent, the monks remain throughout the year.

There are numerous species of Eucalyptus in Australia (of which country it is a native) adapted to various conditions of climate, soil, elevation, &c. Experiments have been carried on in the Public Gardens to ascertain what species best suit the various conditions existing in Jamaica. The difficulties in raising seedlings at Hope have been great, but it is hoped that in time sufficient plants may be obtained to supply free all the demands that may be made. If species were found capable of such acclimatisation as logwood, spreading naturally in malarial districts, it would be of the very greatest benefit to the Island. But meantime if seedlings can only be grown in sufficient quantity for general distribution a vast improvement in the present condition of the Island may be made by judicious planting of belts of trees round dwellings, and between towns and swampy districts.

The destruction of the fever germs is due to the fact that the leaves contain a volatile oil and a volatile acid, which are given off into the surrounding air, and by combination with oxygen are changed into peroxide of hydrogen. Germs passing through such an atmosphere are invariably killed.

While the Eucalyptus oil is oxidising there appears to be an action going on by which oxygen is changed into the very active and healthful ozone.

Mr. Bosisto, whose extensive works for the manufacture of Eucalyptus oil in Australia are famous, wrote on the subject nearly twenty years ago, giving results which he had obtained by experiment, not in a chemical laboratory only, but by dealing with 4 tons of material daily for about 20 years. He showed not only in what way the leaves acted, but pointed also to the very powerful rootaction which absorb immense quantities of water from swampy soils. The roots thereby to a great extent drain swampy land and their absorbent powers are assisted by the very abundant leaf surface which enables the tree to pass the water off into the atmosphere as healthy vapour. This draining action is in itself of immense service in preventing the possibility of the malarial germs finding a suitable soil. Australia possesses in a very high degree immunity from fever maladies, the fevers of the large towns being due to insanitary conditions.

Dr. Day of Geelong recommended, according to Mr. Bosisto, as an excellent and very agreeable disinfectant, deal saw-dust, mixed in the proportion of about one ounce of Eucalyptus oil to the bushel, and remarked that after keeping it mixed for four months, he found it to contain a much larger quantity of peroxide of hydrogen than it did when first mixed and that it continued to accumulate.

Eucalyptus oil is said to have proved valuable in Europe during the epidemic of influenza, and it is probable also that it may prove of service in visitations of cholera. Dr. Day's method is certainly worthy of trial.

Applications for plants should be addressed to the Director of Public Gardens and Plantations, giving descriptions of locality, as plants will be supplied first to malarial districts. A few plants are now available for free distribution.

CONCENTRATED MANGROVE JUICE FOR TANNING.

The following correspondence has been received on the subject of the use of Concentrated Mangrove Juice for the purpose of Tanning:—

Royal Gardens, Kew, to Colonial Office.

Royal Gardens, Kew, 9th August, 1892.

Sir,

I am desired by Mr. Thisilton Dyer to inform you that in November, 1890, there was sent to Kew, by Mr. Fawcett, Director of Public Gardens and Plantations, Jamaica, a sample of the Concentrated Juice of the Mangrove bark, (Rhizophora) for tanning purposes.

2. Mr. Thisilton Dyer interested several persons in this subject, and obtained from the Right Hon. W. L. Jackson, M.P., a promise to try the extract in case a sufficient quantity was prepared to be worked on a moderately large scale.

The further quantity desired was forwarded by Mr. Fawcett to Messrs. Dalton & Young in April last, and it is now in this country. I enclose herewith an interim report from Messrs. Dalton & Young. This report is not of an encouraging character as the supply of good tanning materials just now is large, and the prices consequently very low.

In the latter part of their report Messrs, Dalton & Young state that they have had a large quantity (about one thousand bales) of crude Mangrove bark from Jamaica placed in their hands, and they have been unable to find a buyer for it. Under these circumstances Mr. Thisilton Dyer would suggest that a copy of Messrs. Dalton & Young's letter bo communicated to the Government of Jamaica in order to inform those interested in the subject that it is undesirable at present to make any further shipments of tanning substances to this country.

I am, &c.,

D. Morris.

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

Messrs. Dalton & Young to Royal Gardens, Kew.

29 Mincing Lane, London, E. C., 6th August, 1892.

Sir,

In reply to your letter of 3rd instant, in reference to the Mangrove Extract consigned to us by the Director of the Public Gardens and Plantations, Jamaica, we beg to say that in our opinion the demand, if any, would be very limited for the article. We have submitted it to tanners and others in the trade, but we cannot induce them to try it, all other tanning materials and well known extracts being so plentiful and never cheaper. We have sent down a sample drum to the works of the Right Hon. W. L. Jackson, Leeds, and he has promised to test it, and give us report on it. As soon as we receive this we will send you a copy.

We may mention that we have had about 1,000 bales of Mangrove bark from Jamaica placed in our hands for sale. but so far we have not been able to find a buyer.

Yours, &c.,

Dalton & Young.

D. Morris, Esq., Royal Gardens, Kew.

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29 Mincing Lane, London, 21st Sept., 1892.

W. Fawcett, Esq.,
Botanical Department,
Gordon Town P. O., Jamaica.

Dear Sir,

We have duly received your favour of 22nd August. On the other side you will find report from the Right Hon. W. L. Jackson on the Mangrove Extract. We have endeavoured to get other tanners to try it but without success. Other known tanning materials and extracts are in such large supply and so very cheap now that we cannot induce anyone to experiment with an article that is unknown, and of which the supply would be very uncertain. There is no inducement for a tanner to take up an article like this unless he knows that it can be produced on a very large scale, and be of regular supply. The objection to Mangrove is that it gives a very dark tan. We have a large quantity of the bark here now from Jamaica, but cannot induce anyone to buy it, although we have given out several samples.

Regretting that we cannot give you a more favourable report.

We remain, Dear Sir, yours truly,

(Signed) Dalton & Young.

Extract from letter received from the Right Honble. W. L. Jackson.

"I have examined the sample of Mangrove Bark Extract, and I regret that I am not able tc report very favourably upon it. Gambier at present is much cheaper as a tanner, and I do not think buyers could be found who would pay a proportionate price for this extract."

"I am afraid you will have to tell the consignors that it has come upcn the market at a most unfavourable time, and there is no chance of its competing with Gambier at present prices."

VERANDAH GARDENING.

To the Editor of the "Bulletin."

Sir,

Perhaps a few lines on the subject of Verandah Gardening might not bo unwelcome to your readers. It is, I consider, a very important branch of tropical gardening. What the Green-house is to the English drawing-rooms, the Verandah is to our tropical sitting-rooms—indeed perhaps the latter is even more indispensable. Flower beds in the English sense of the word, can scarcely be achieved in this climate at anything much under 3,000 feet above sea-level, but a very large number of beautiful plants which could not be grown under the direct rays of the tropical sun thrive and bloom perfectly in partial shade. The most completely successful Verandah I happen to be acquainted with, is that of "The Hermitage," in the parish of Hanover. By judicious and skilful management it is kept forever fresh and bright; to step into this cool retreat, this fairy bower of geenery and bloom, out of the glow and glare and flash of the sunshine, is always a luxury and a drlight. The lady to whose care and skill it owes its perennial loveliness has—in answer to my reqeuest that she would do so—sent me a short description, and a few excellent practical hints, which I will copy verbatim for the benefit of those to whom they should be useful.

"My Verandah faces due North, the Stephanotis (of which there are several plants both old and young) is the principal creeper; it is trained in festoons, which come about half way down the trellis work pillars, thus affording shade to both Verandah and sitting rooms. At intervals, between the pillars, I have small shelves, on which I place long narrow boxes filled with the lovely foliage begonias, etc. The pots along the edge of the stone flags contain gloxinias, the delicate pale blue flax, pepperomia, and different kind of lilies, amaryllis and so on, geraniums, caladiums, Phlox, Achimenes and other well known pot plants. I must not forget to mention among the plants that I find flourish most luxuriantly in my Verandah, the tall graceful Begonia rubra and the white waxlike begonia, these I have growing in large pot shaped boxes, they send up strong healthy shoots which twine in and out among the Stephanotis, and the drooping clusters of their scarlet blossoms contrast charmingly with the white Stephanotis. The Verandah is not more than two feet from the ground, and I have a border of Eucharis lilies and maiden-hair ferns extending from one end to the other, completely hiding the mason work. Being under the deep eaves of the house the lilies are not injured by heavy rains, and they flower abundantly. At both corners of the Verandah I always plant large clumps of climbing nasturtiums, which are very effective.

The compost I use, and which I find equally satisfactory for all the plants is well-rotted stable manure, leaves and cut grass mixed with a certain amount of silver sand. This compost is well sifted and the pots kept constantly supplied with it, without disturbing the roots of the plants. My nursery is under a large Ficus Benjamina, and as soon as any plant on the Verandah begins to get shabby it is taken away to the nursery, carefully trimmed, transplanted and left to recover itself, and in a very short space of time it is in a condition to reappear in public. Fuchsias grow and flower well in my cool shady nursery, but if removed to the Verandah they soon droop and wither."

Another lady from the same district mentions that she finds asters grow well and readily in a Verandah. She says:—"I sowed my asters in boxes out of doors, and when strong enough transplanted them into a box in my Verandah, where they throve and were quite covered with large flowers pink, white, purple and lavender. Begonias of various kinds also do well, and pinks, Phlox, and candy tuft."

No doubt this small list of plants suitable to Verandah Gardening could be almost indefinitely enlarged if other ladies would also give us the benefit of their experience.

Selina Heaven.

PLANTS IN FLOWER OR FRUIT AT CASTLETON GARDENS.

It may be convenient for visitors to Castleton to know which of the more interesting plants in the Garden may be expected to be in flower or fruit during the month, and therefore the following short notes are drawn up for their use:—

Flower.—*Pachira aquatica*, a tree with large handsome flowers, belonging to the same family as the Silk Cotton Tree, and the Mahoe. It is a native of tropical South America and some of the West Indian Islands. Some of the species yield good fibre from the bark.

Gordonia anomala is a shrub, only known from Hong Kong, with large white flowers. It belongs to the same family as the Tea and Camellia.

Eugenia caryophyllata is the tree yielding cloves, which are the dried unopened flower-buds. It is a native of some of the famous Spice Islands of the East Indies.

Quassia amara. The wood is the original Quassia from Surinam which acquired reputation as a drug When the demand exceeded the supply, it was found that a native tree of Jamaica *(Picræna excelsa)* was of equal value; it is known as Jamaica Quassia or Bitter Wood.

Erythroxylon Coca is the shrub which yields the famous coca leaves, indispensable to the Indians of Peru. An Indian with a chew of coca leaves in his mouth will travel for two or three days without food, and with no desire to sleep.

Fruit.—*Semecarpus Anacardium* is the Marking Nut Tree of India. The juice of the nut is used for marking cotton clothes; it is mixed with a little quicklime and water. But it is so acrid in its nature, that care has to be taken in its use. It is, however, applied in India by the natives for rheumatism and sprains, for warts, and in scrofulous eruptions. This tree is related to the Cashew, but the receptacle (the Cashew fruit) is small in the Marking Nut Tree.

Barringtonia speciosa has a remarkable four-angled fruit. From the seeds an oil is expressed used for lamps, and also for mixing with bait to stupefy fish.

Averrhoa Carambola, the Carambola tree of the East Indies, produces an abundance of prettily-shaped yellow fruits, which are acid and make an agreeable preserve. The dried fruit is given in fevers, and is also an antiscorbutic. The Bilimbi *(Averrhoa Bilimbi)* has a somewhat similar fruit, which grows on the trunk of the tree.

COCCIDÆ, OR SCALE INSECTS.

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

The *Coccidæ* constitute a very well-defined family of the order *Hemiptera*. They are related to the *Aphides*, the *Cicada*, the *Phylloxera*; and also, but more distantly, to the plant bugs, such as *Dysdercus* (the cotton-stainer) and *Blissus* (the chinch-bug). Nearly five hundred species are known, living on a great variety of plants. Some infest the leaves, some the twigs, others the bark, while certain kinds are found underground on roots. Some are naked, others clothed with a mealy secretion, others covered with wax, while very many construct a well-defined scale; it is to the latter that the name scale-insect is more properly applied. The *females* have a beak, whereby they extract nutriment from plants; when adult they usually become entirely stationary and unable to move, and very many species lose their legs and antennæ. At no time do any of the females possess wings.

The *males*, on the contrary, are winged in nearly all the species, and well able to move about. They have legs and antennæ, but no beak; their wings are two in number, after the manner of flies, thus totally differing from all other Hemiptera, which have four wings.

There is an allied family, the *Aleurodidæ*, which might be confounded with the Coccidæ, and indeed was in former times. When immature they resemble scale-insects, and the adults look not unlike the males of Coccidæ. But an examination at once reveals differences; both sexes are winged, and there are four wings instead of two. In Kingston, species of *Aleurodes* are common on pepper *(Capsicum)* and lignum-vitæ.

Another insect resembling a Coccid is the *Cerataphis lataniæ*, which, as the generic name indicates, is really one of the plant-lice *(Aphides)*. Mr. Campbell sent me specimens from Castleton Gardens, found on a palm; and since then I found it quite commonly on a palm in the yard of the Museum, in Kingston. It looks something like an *Aphis*, but is surrounded by a beautiful white waxy fringe.

Destructiveness of the Coccidæ.

Professor Comstock, in his excellent report on Scale-Insects published in the Report of the U. S. Department of Agriculture for 1880, writes—

"There is no group of insects which is of greater interest to horticulturists to-day than that family which includes the creatures popularly known as 'scale-insects' and 'mealy bugs.' There is hardly any shrub or tree but that is subject to their attack, and in certain localities extensive orchards have been ruined by them. The minute size of the creatures, the difficulty of destroying them, and their wonderful reproductive powers, all combine to make them the most formidable of the pests of our orchards and ornamental grounds. It is only necessary to cite the mealy-bugs of green-houses, the oyster-shell bark-louse of the apple, and the various species of scale-insects destructive to citrus-fruits to establish this fact."

This was written with reference to the United States, but may be taken as applying with even greater force to tropical countries, where the Coccidæ are apparently much more abundant. The amount of damage done in any particular case is not always easy to estimate, from various causes. Thus, in the case of the coccanut, it is probable that those who have attributed the death of the palms to Coccidæ have over-estimated the influence of these insects, since we now know from the researches of Dr. Plaxton and Mr. Fawcett that the cocoanut is subject to the attacks of fungous and bacterial parasites, and the probability is, that the scale-insects in this instance only hasten the end inevitable from other causes. On the other hand, I believe the damage done is frequently under-estimated. When a tree or shrub is dotted all over with scales, behind every one of which is an insect living on the sap, the drain on the resources of the plant must be considerable, In the case of small plants, as for example a capsicum attacked by *Diaspis lanatus* (n. sp.), death may speedily ensue; but trees as a rule survive the injury, and finding that they continue to live and bear fruit, we are apt not to reflect that they would do better if protected from the attacks of insects. In order to ascertain accurately the influence of insect pests on any kind of tree, it would be necessary to take several growing in the same locality, and carefully spray some, while neglecting the others. If this were carried on for a number of years, no doubt the difference to be observed would be very marked; and in the case of very seriously attacked plants, it would be a difference between living and dead.

It may be objected, that a drain on the vegetative tissues of a tree is not necessarily harmful; as we are obliged frequently to check exuberant growth by pruning: but to this it can be replied, that the purpose of pruning is not so much to check the energies of the plant, as to divert them to the production of flowers and fruit; while the Coccidæ attack not only the fruiting branches, but the fruit itself, injuring the very parts we desire to protect.

Mr. Bowrey and other observers have noted that weakly plants are those usually attacked, strong ones escaping. It would often be difficult to prove this, as if the facts are stated another way, namely that the plants attacked are weakly, we have but a truism. Nevertheless, it is apparently well-ascertained that plants suffering from other causes do especially harbour scale-insects, and in any case it is perfectly evident that given the same amount of insect-injury in any two cases, the plant which was also injured in some other way would soonest die.

As an instance of the severe way in which some plants are attacked, we may take the genus *Citrus*, which includes the orange, lemon, &c. These trees are attacked in America by four or five species of *Aspidiotus*, one *Chionaspis*, one *Parlatoria*, two of *Mytilaspis*, two of *Ceroplastes*, one *Dactylopius* (mealy-bug), one *Icerya*, and three of *Lecanium*. Of these 14 citrus-scales, eleven appear to be found in Jamaica, though not all as yet on *Citrus*.

The special injury done by the several species will be discussed later on.

While blaming the Coccidæ for their injuries, it must be remembered that certain species are very useful. We have one such in Jamaica, the Cochineal Insect (*Coccus cacti*), which abounds on the *Opuntia* in the Parade Gardens, Kingston.

METHODS OF DESTROYING THEM.

Excellent methods of destroying scale-insects have been devised by the Entomologists of the U. S. Department of Agriculture, and very full details of their experiments have been published. The most useful remedy for ordinary purposes is the Kerosene Emulsion, made according to the formula originated by Mr. H. G. Hubbard, and usually recommended by Prof. Riley, as follows:—

"Kerosene Oil	... ...	2 gallons	= 67 per cent..
Common Soap, or Whale-Oil Soap	... ...	½ pound	= 33 per cent.
Water	... ...	1 gallon	

Dissolve the soap in the water by heating, and add the solution, boiling hot, to the kerosene and churn the mixture by means of a force-pump and spray-nozzle for five minutes. The emulsion, if perfect, forms a cream which thickens on cooling and should adhere without oiliness to the surface of glass. Dilute, before using, one part of the emulsion with nine parts of cold water. The above formula makes 3 gallons of emulsion, and when diluted gives 30 gallons of wash."

This is applied by means of a pump and nozzle, and the more finely it can be sprayed on the better. Many different modifications of both pump and nozzle have been brought into use in the United States, and are discussed by Prof. Riley in Dr. Packard's work on Forest Insects (5th Report U. S. Ent. Commission). The best known nozzle is that called the Riley or Cyclone nozzle; and a modification of it, the Vermorel nozzle, has proved successful in France. The Nixon or Climax nozzle is also said to be very satisfactory, especially where considerable force is required.

Resin washes have been used extensively in California against scale-insects, as also various compounds of kerosene with resin, &c. In adopting these methods for Jamaica, it must always be remembered, that some remedies which may serve excellently in temperate regions, at times when there is no fresh foliage on the trees or they are bare of leaves, might be extremely injurious in a tropical country, where there is always a quantity of foliage liable to injury. It appears to be the custom in California to apply the resin washes principally in the late summer and autumn; and no doubt we might do well in Jamaica, by selecting that time for spraying when the affected tree has fruited, and is undergoing a period of more or less rest.* The extent of this resting period in the tropics varies very much among the different species; thus, the *Poinciana regia*, as every one in Kingston has the opportunity to observe, has a very distinct interval between the successive flowering-periods, while the orange of course exhibits flowers and fruit at once. There can be little doubt I suppose that every species of tree has some period when a wash could be safely applied,. which would at another time prove injurious.

Prof. Riley writes (5th Report U. S. Ent. Com., p. 37) regarding the Resin washes:—

"Mr. Koebele had good success with the resin compound prepared as follows: Dissolve 3 pounds of sal-soda and 4 pounds of resin in three pints of water above fire; when properly dissolved, add water slowly, while boiling, to make 36 pints of compound. A very strong solution of this was used on pear trees without injury to the foliage, the solution consisting of 3 pints of the compound to 4 of water. Numerous successful experiments were made with one part of the compound and 8 parts of water, and this strength for most purposes will be sufficient.

"Mr. Coquillett has found the following to be an excellent formula for the preparation of this compound—

Caustic soda	...	...	1 pound.
Resin	...	...	8 pounds.
Water to make	...	...	32 gallons.

"Dissolve by boiling the caustic soda in a gallon of water; add the resin to one half the soda solution and dissolve it by boiling; add the remainder of the soda solution and boil over a hot fire, stirring constantly. When sufficiently cooked it will assimilate with water like milk, which it much resembles. Add water and strain through a fine sieve.

"An emulsion of kerosene with resin compound was satisfactorily accomplished by taking equal parts of both substances and working them together for two minutes with a pump. The emulsion is not so stable as the emulsion with soap, but it is eminently effective against scale-insects and aphides. At my suggestion the addition of arsenic in the proportion of 1 pound to from 75 to 300 gallons of the resin, or resin and kerosene wash, was made, and this addition was found to greatly increase the efficiency of these insecticides."

Mr. Coquillett's resin wash has been used on Orange and Lemon trees without causing any injury to foliage or fruit. It proves fatal to a large proportion of the black scales, (*Bernardia oleæ*), but probably some always survive, making it expedient to apply the remedy more than once. The black scale, however, seems exceptionally hard to exterminate, being well-protected by its structure and very prolific, and the kerosene emulsion is also reported to have failed to destroy it. Mr. Ellwood Cooper, of Santa Barbara, California, applies the kerosene emulsion hot (140°) against the black scale and considers it the best remedy.

The kerosene emulsion is the most convenient for use, but it is found that the resin wash is cheaper. One difficulty with the resin wash is that the nozzle frequently becomes clogged, but Mr. Coquillett found that this could be almost entirely prevented by first straining the solution through a piece of thin tarlatan cloth.

* It is to be observed that the condition of the scale-insects, whether old or young, &c., has to be also considered; this is a matter rather to be dealt with under the head of the several species. Sometimes the empty sacs make a considerable show after the insects have left them, but of course there would be no use in spraying these!

Another remedy now much used in California against the red scale *(Aspidiotus aurantii)*, is hydrocyanic acid gas. Professor Riley thus describes the process:—" The cyanide is dissolved by boiling in water for a few minutes, using 1 gallon of water for each 5 pounds of cyanide. To generate the gas, sulphuric acid is caused to flow upon the cyanide solution in a fine stream, causing the gas to be rapidly given off in the form of a whitish fog. The moisture is taken up by passing the gas through sulphuric acid, which by reason of the water taken up becomes diluted, but may still be employed to generate fresh quantities of gas."

" The gas is confined to the trees under treatment by means of a suitable canvas tent or fumigator, of which a number of styles have been patented. They are constructed so as to be lowered over the tree from above or to inclose it from the sides." It is found that the gas must be dried as above described, as otherwise it is injurious to the foliage of the trees. It is also stated by Mr. Coquillett that the trees are less liable to injury when fumigated at night, than when treated in the day-time. The apparatus has lately been simplified, so that it is possible for a planter to fumigate his orchard at the rate of 30 to 40 trees a night. The ordinary commercial fused potassium cyanide is used in the manufacture of the gas, which, it must be remembered, is highly poisonous.

Very full accounts of the gas treatment, with figures of the apparatus, will be found in the Reports of the U. S. Department of Agriculture and other works, which may be consulted in the library of the Institute of Jamaica. If any one resident in the country is desirous of using these remedies, and wishes for more complete details, I shall be happy to give any information in my power; but the essential features of the remedies are given above, and doubtless the exact method of working and kind of apparatus used would have to depend in each case on the available facilities, the kind of plant attacked, and so forth.

I shall be greatly obliged to all those who try these remedies, if they will communicate the result to me, so that it may be published for the benefit of the community. The kerosene emulsion has proved very successful on Orange trees near Kingston, but there has been very little experimenting with these remedies in Jamaica

Natural Enemies.

Nature has methods for destroying scale-insects which are more effectual than anything which can be accomplished by human means. These consist in other insects, preying upon them. either predaceous in the ordinary way, or infesting them as parasites. They may be grouped as follows;—

Hymenoptera.

(1.) Family *Chalcididæ.*—Minute four-winged insects, the larvæ or grubs of which are mostly parasitic within the bodies of insects. They can be at once distinguished from the larger Ichneumon flies, by their wings, which instead of being covered with a network of veins, have the venation extremely reduced, the most conspicuous part being a short vein ending in a knob or stigma, which extends from near the middle of the upper edge of each fore-wing. They are often beautifully metallic green or blue. Mr. L. O. Howard remarks (Proc. U. S. Nat. Mus., 1891, p. 571.) that hardly a species of scale insect can be found which does not have a formidable parasite among the *Chalcididæ*, of the sub families *Aphelininæ* and *Encyrtinæ.* These interesting and important little parasites can be reared by keeping the scales in a closed box with a glass top, which admits of their easy observation. When scales are examined with a hand-lens, they may very often be seen perforated by small round holes, where the parasites have escaped; and in other cases, the parasite will appear as a dark spot or patch within the body of the Coccid. In such cases, by counting the number of infested, and the number of healthy scales, we may estimate the importance of the parasite.

(2.) Family *Mymaridæ.*—These are similar to the Chalcididæ, but still more minute, and Mr. Howard is of the opinion that many, if not most, of those bred from scale-insects are parasitic upon the eggs. Considering the minute size of a Coccid egg, it does indeed seem wonderful that these creatures should be able to undergo their metamorphoses within them! When we examine a Mymarid under the microscope, the antennæ are seen to be somewhat different from those of the Chalcids, and the wings are narrow, especially the hind pair, with very long fringes. A few *Proctotrupidæ* have also been recorded as bred from scale-insects; these are very similar to the Mymaridæ, but differ in some important structural characters. Many writers class the *Mymaridæ* as a sub-family of *Proctotrupidæ.* Of the *Braconidæ,* which have distinctly veined wings, one species (*Lysiphlebus citraphis* Ashmead) has been recorded, (Insect Life, Vol. III, page 60), as bred from a mealy bug.

Lepidoptera.

The caterpillars of some moths live upon Coccidæ and their eggs. No instance of this sort is yet known in Jamaica, but several have been recorded in the United States, and in Australia the black scale (*Bernardia oleæ)* was observed by Mr. Koebele to be kept well in check by the larva of *Thalpochares cocciphaga.*

Neuroptera.

Lace-wing flies *(Chrysopa)*, easily recognized by their green colour and four finely reticulated wings, have been found to destroy Coccidæ in the United States and Australia. These flies, of which one species breeds abundantly on the lignum-vitæ in Kingston, are very delicate and harmless-looking creatures. but their larvæ are extemely voracious, and as they live upon injurious insects, they are very useful.

Coleoptera.

The many beetles now recorded as attacking Coccidæ belong almost entirely to the family *Coccinellidæ,* or lady-birds. They are great helps to the gardener, and should be encouraged in every way; their appearance is so well known that there is no occasion to describe them.

Diptera.

Two or three species of true flies have been found to be parasitic on scale-insects ; but no instance of this sort has been observed in Jamaica. I have, indeed, bred numbers of a new species of Cecid fly (*Diplosis coccidarum* n. sp.) from scale-insects found in Kingston, but I believe that this breeds merely in the secretions and old skins of the Coccids, being thus a guest or inquiline, rather than a parasite.

Hemiptera.

A few species of true plant-bugs are known to prey upon Coccidæ.

Arachnida.

Some species of mites have been found to destroy Coccids. In Jamaica, small mites are frequently found associated with scale-insects, but I have not ascertained that they do them any injury.*

How Coccidæ are spread by human means.

The injuries due to Coccidæ have probably been much more than doubled by the way they have been carried from one country to another on plants. It is a well-known fact that many species of animals and plants thrive more in foreign countries than in their native land : and the reason of this is, that they are, through the change of locality, removed from most of their natural enemies and competitors. The fluted scale, *Icerya purchasi,* is a well-known example. When introduced into California from Australia, it multiplied enormously, and became a far more serious pest than it had been considered in its native country. It was, indeed, attacked in its new home by a few insects, but they were quite insufficient to keep it in check. Mr. Koebele went to Australia to look for the natural enemies of the fluted scale, and found the scale itself quite rare there, being attacked by very important enemies, some of which he brought alive to California. These were liberated in the infested districts, and one especially, the lady-bird *Vedalia cardinalis,* proved extremely effective, so that the *Icerya*-pest was speedily reduced, and the despair of the fruit-growers gave way to hope as the equilibrium of nature began to be restored.

Mr. R. Allan Wight has written a graphic account of the *Icerya* and *Vedalia* in an Australian paper, the "Garden and Field," which has lately been reproduced in "Insect Life." In New Zealand the *Icerya* is sometimes a great pest, and Mr. Wight gives the following description of the way it is cleared off by the beetle ;—

"Some two years ago everything seemed white around Auckland with the clustering *Icerya,* a great many orange and lemon trees (including one entire lemon orchard), were dead, and the prospect was as gloomy as could be, till *Vedalia* (which had been accidentally imported from Australia) appeared on the scene. Astonishing as it may seem to be, and incredible, within one year hardly any of the scales were left, and the lady-birds had also disappeared. The little beetles are rank cannibals when pressed by hunger, and as no one was able to discover any other food but *Icerya* upon which they will feed, it was feared that, in the absence of *Icerya,* they would become extinct."

If scale-insects, when taken to new countries, were only as injurious as in their native homes, there would be strong enough reasons for not importing them ; but when we see that being freed from their enemies, they may increase to a much greater extent, the necessity for preventing their introduction becomes a very pressing one. The ease with which scale insects may be carried from one part of the world to another is well known. Some of the most interesting scales described in late years have been found on foreign plants in hot-houses in England, where they must have been carried from the tropics. In the West Indies, we have two mango scales, the *Vinsonia* and *Lecanium mangiferæ,* which doubtless reached us on plants from the East Indies ; while quite recently, a New Zealand species, *Chionaspis minor* of Maskell, has been found commonly in Kingston. Various species of European origin have spread widely in the United States, and while some of them, as the black scale (*Bernardia oleæ*), are now abundant in Jamaica, there are others which do not seem to have reached this Island,—and it may be hoped, will never be allowed to do so.

One of the destructive scales found in other West Indian islands, and in the United States, but not apparently as yet in Jamaica, is *Chionaspis citri,* which affects the orange. The following account of its introduction into Bermuda is from a report by U. S. Vice Consul J. B. Heyl, of that island :—

"This island was clear of insect pests until sometime in 1858 or 1859, when a vessel was brought here in distress, with a cargo of oranges, which were sold at auction, and the fruit was carried all over the island, and in a few months our flourishing trees were covered with an insect which gave the trees the appearance of being whitewashed. This insect fed on the bark of the tree, extracting the yellow sap therefrom and causing the bark to curl up. Every device thought of was tried, but the island was soon cleared of nearly every tree. All this came from the distress cargo."

When we import a useful plant from another country, it is almost sure to be attacked by some of our own insects, and if at the same time we import its natural enemies, and these increase abnormally as described above, it is easy to see that we are placed in a position of great disadvantage, so much so, that even though soil and climate are favourable, we cannot hope to cultivate the new plant so successfully as it was cultivated in its own country.

But, on the other hand, if we introduce any plant and *exclude* its natural enemies, it will almost certainly not be attacked so severely here as it was where it came from, and we are in consequence, placed in a more favourable position for cultivating it (always assuming a suitable soil and climate) than those who raised it in its native country. The more the plant in question differs from any of our native plants, the more is this likely to be the case, because there are less likely to be insects here ready to attack it.

* Certain fungi are found on dead scale insects ; such as *Microcera coccophila,* Mont ; found by the writer associated with *Aspidiotus articulatus* on *Citrus* at Moneague.

It is not proposed in the present article to discuss the measures which should be taken to prevent the introduction of pests; whether there should be a government quarantine, or the matter should be left to the public spirit and good sense of private individuals. It would undoubtedly be a matter involving a certain amount of trouble and expense, to inspect all imported plants and rid them of insects, but when it is considered that a few shillings thus spent to-day, may save us from a pest which would cause the loss of perhaps hundreds of pounds annually for an indefinite number of years, the subject appears to deserve serious consideration. No doubt, as in the case of human maladies, there will be an occasional leaping of the bounds in spite of much care, but that is no reason for utter recklessness.

Importing the Enemies of Coccidæ.

As a general principle, it is extremely unwise to disturb the balance of nature. The importation of new animals, whether mammals, insects, or what not, is a risky business, very generally attended with unfortunate results, as we in Jamaica have excellent reason to know. But when we have already upset nature's arrangements by introducing foreign Coccidæ without their enemies, the best remedy is to search out those enemies, and introduce them too, as in the case of the *Vedalia*. Even in such a case, however, care is needed, to ascertain very exactly the habits of the enemy we are importing. It was true enough that the mongoose fed on rats, but it also feeds on poultry and wild birds. The European sparrow, taken to America, has no doubt *some* virtues, but if the introducers of that bird had had a proper knowledge of its habits, they would have been horrified at the idea of inflicting so serious an injury on their country as has resulted from their actions.

Fortunately, however, there are some enemies, including all those really important in connection with Coccidæ, which we can import with perfect impunity, as their habits are well-known, and there is no reasonable possibility of their proving injurious. Such are the lady-birds, and the parasitic *Chalcididæ* and *Mymaridæ.* If we had an extensive Cochineal industry at some future time, it is possible that *some* of these enemies might attack the dye-producing insect so as to interfere with the value and amount of the product, but there seems no likelihood of such an event, and even were it to so happen, the saving to other crops would much more than counterbalance the loss in this direction.

The present writer has lately made some studies of the fauna of Jamaica, the results of which when more complete, will appear elsewhere. The general conclusions arrived at are, that we have two distinct faunæ in this Island; one, very ancient and dating back to the time of connection with the continent; the other, of more recent origin, consisting of species which have reached us from over the sea. The former contains few species, and these highly peculiar,—often representing genera now found nowhere else. The latter includes species either identical with, or very closely allied to, those found elsewhere, In that grand genus of butterflies known as *Papilio, P. homerus* and *P. thersites* belong to the old fauna, and *P. polycrates* and *P. thoas* to the recent.

The majority, at least, of the destructive Coccidæ in Jamaica are allied to or identical with species found elsewhere, and consequently they must be classed with the recent fauna which has come over sea—in this case no doubt in ships.

The importance of this appears when we consider that if the parasites of the Coccidæ have not been imported with them, there will be nothing ready to attack them here. In the United States, if you import a *Lecanium* or an *Aspidiotus*, there is almost sure to be a parasite of an allied native scale that will attack it; but in a case where there are *no* allied native scales, there will probably be no available native parasites. Such Chalcids, &c., as belong to our ancient fauna, probably will not attack introduced Coccidæ to any great extent; while we are not likely to have any suitable recent fauna parasites until after the advent of the scales, since if by chance a Chalcid came to us over sea, it would find nothing in which to propagate its species.

Some of our imported scales, as will be explained in detail when the species are discussed, are infested by parasites. For example *Mytilaspis citricola*, an injurious orange scale, is infested both in Jamaica and in Antigua. But so far as I have been able to observe, the Jamaica Coccidæ have few enemies, and to this, in large part, is probably to be attributed their great abundance. It is hoped, at some future time, to introduce some of the Coccid-enemies that are likely to be useful, but of this more hereafter. Prof. C. V. Riley, who is more competent than anyone else to judge of such a matter writes (March 25, 1892): "I think it would be an easy matter for you to import the parasites of any particular scale which may be common to Jamaica and this country, and I will gladly help you when opportunity offers."

How to send Scale-insects by Post.

Later on, it is proposed to treat of the various species separately and in detail. In the meanwhile, the writer will be very glad to receive Scale-insects from any part of Jamaica or the West Indies. They are as a rule extremely easy to collect: all that is necessary is to cut off some of the infested leaves or twigs, and put them in an envelope, writing on the outside the name of the plant, the estimated severity of the attack, the locality, and the name of the collector. Such envelopes may be enclosed in a larger one, and sent by post in the ordinary way. Species that are soft, or liable to be damaged, can be sent inside a small joint of bamboo, or any convenient receptacle. It is better not to put the specimens in any air-tight box, especially if the leaves are fresh, as they are liable to rot.

Any specimens sent will be duly acknowledged and identified, and proper credit given in publication. They should be addressed to the Curator of the Institute of Jamaica, Kingston.

June 18, 1892.

FERNS: SYNOPTICAL LIST.—XIII.

Synoptical List, with description, of the Ferns and Fern-Allies of Jamaica, by G. S. Jenman, Superintendent Botanical Gardens, Demerara, (continued).

TRIBE VI.—*Pterideæ.*

Sori marginal, punctiform but often confluent, crescent-shaped or linear; involucres exterior, the form of the sori.

11. *Hypolepis.*—Sori dot-like, situated in the sinuses, covered by a crenature of the margin or a distinct involucral scale.

12. *Notholæna.*—Sori of few sporangia, at length confluent, supported but not fully covered by the margin.

13. *Cheilanthes.*—Sori dot-like, isolated or confluent, involucres the same form covering a single on several sori.

14. *Pellea.*—Sori confluent, linear, involucres the same form.

15. *Plagiogyria.*—Sori roundish, on the forked summits of the veins, at length confluent, involucres linear uninterrupted.

16. *Lonchitis.*—Sori chiefly crescent-shaped, and confined to the sinuses and hollows of the lobes, involucres the same form.

17. *Pteris.*—Sori linear, uninterrupted, involucres the same form.

The features which characterise this tribe are the marginal sori seated on the apices of the veins, or (in other cases) running transverse, on a special very slender receptacle, with the summits of few or many veins, together with the exterior attachment of the involucres, which consequently open interiorly—i. e. on the side nearer the centre of the leaf or leaflet. In other characters the Tribe present great diversity.

Genus *XI. Hypolepis,* Bernh—Sori marginal, in roundish isolated dots, in the hollows of the final lobes or teeth, terminal on the club-like summits of the lower exterior veinlets; involucres formed of the reflexed crenatures of the' margin, changed or not into pale reniform membranous scales; fronds decompound, veins free, rootstock free-creeping.

The affluent size of the fronds and basal situation in relation to the lobes of the sori, which are borne only on the lower exterior veinlets instead of on all, are the only characters which define this genus from *Cheilanthes;* while, when mature, and the involucral crenatures have opened out, the members can barely be distinguished from Polypodium, one local species of which—*P. punctatum*—identically resembles in conformation and habit one or two of the species.

a. Fronds medium sized, not prickly.
  1. *H. Purdieana,* Hook.

aa. Fronds ample, prickly (one variety excepted).
  2. *H. repens,* Presl.

aaa. Fronds ample, scandent, prickly.
  3. *H. nigrescens,* Hook.

1. *H. Purdieana,* Hook.—Rootstock as thick as a quill, free-creeping, dark scurfy; stipes scattered, ½—1 ft. l. or more, glandulose—pubescent, chesnut, rather glossy channelled; fronds herbaceous, dark green, tri—or quadri-pinnate, 1—2½ ft. l. ¾—1½ ft. w. ovate—lanceolate, rachis and costæ freely glandulose pubescent and castaneous, other surfaces also slightly glandulose—ciliate, chiefly the upper on the costulæ and the final ribs, which are flat; pinnæ ½—1 ft. l. 2-5 in. w. ovate—lanceolate, opposite, the lowest pair most distant; pinnulæ oblong—lanceolate, pointed, but not acuminately; final segments oblong, dentate or inciso—dentate, 2-4 li. l. 1½ li. w. obtuse; sori at the base of the ultimate lobes or teeth, covered at first by a marginal crenature.—Hook. Sp. Fil. Vol. 2, t. 91. B.

Common on the ridges and peaks above 6,000 ft. alt. A smaller plant than any of the forms of *repens,* very glandulose and sticky when fresh, but not prickly, of dark colour, and broader more dentate and venose final segments. Usually the segments are cut into shallow lobes which are again dentate, and the teeth are carried quite round the margins, as in *nigrescens,* a feature characteristic of both these species as distinguished from *repens.* In large specimens the surface is slightly rough at the base of the stipes, but not actually asperous.

2. *H. repens,* Presl.—Rootstock pencil-thick free-creeping, scurfy-tomentose; stipes 2—5 ft. l. channelled, stramineous, or darker with a reddish or dark-brown tinge, prickly, puberulous or glandulose villose beneath; fronds ample, nearly deltoid, tri-or quadri-pinnate, 2-5 ft. l. about the same w. at the base, chartaceous, green, paler beneath, naked or ciliate, sometimes glandulose beneath rachis and costæ more or less asperous, brown or stramineous, glandulose-pubescent; pinnæ sub-opposite, the lower 1½—3 ft. l. ½—1½ ft. w. or more, broader usually on the inferior side; pinnulæ generally sub-distant, lanceolate or oblong-lanceolate; ultimate segments oblong rounded at the top, faintly or deeply lobed 3—6 li. l. 1—2 li. w. the lobes faintly serrulate; sori in the hollows of the lobes or lateral teeth; involucres scale-like, pale, cordate.—Hook. Sp. Fil. Vol. 2. t. 90. B; Plum. Fil. t. 12.

Var. *inermis,* Hook.—Stipes and rachises devoid of prickles, bright, or of a clear straw green, and nearly or quite naked.

Var. *H. hostilis,* Presl.—Fronds as large, but cutting finer; final segments 1–1½ li. l. ½-¾ li. w.—Hooker and Baker, Syn. Fil. p. 130.

Plentiful and widely spread from 2000-6000 ft. alt. on the skirts of forests, open banks, and in coffee fields. Varying greatly in prickliness and vestiture, one form being densely aculeate nearly to the top of the rachis and on the lower part of the costæ, and also pubescent and glandulose, and very sticky when fresh; others being only slightly armed, or like the var. *inermis* not at all, and more or less naked. The second variety which is much more finely cut. and is common in Guiana and Brazil, was gathered by Purdie in Westmoreland in 1844, and subsequently in the eastern parishes by Wilson. Naked, unarmed plants, in which the involucres are not evident, should be compared with *Polypodium punctatum.*

3. *H. nigrescens*, Hook.—Rootstock creeping, dark-scurfy; stipes 2-5 ft. l. naked, dark reddish brown, very prickly, channelled; fronds usually scandent, erect, ascending several ft. high, 4—8 ft. w., tri, or quadri-pinnate-glabrous, chartaceous-herbaceous, dark green, rachis, costæ &c., channelled (the final parts margined) light or dark brown, very prickly throughout, costæ and costulæ, generally flexuose; pinnæ lax, distant, opposite, horizontal 3—5 ft. l. 1—2 ft. w.; pinnulæ ¾—1¼ ft. l. 4—8 in w.; all but the basal ones alternate; tertiary segment lanceolate. or ovate-lanceolate, acuminate, the quadriary ovate-oblong and blunt, 3—8 li. l. 1½—3 li, b. lobate or deeply pinnatifid, lowest on the superior side largest; sori small, one or more to each lobe on the inferior crenatures of one or both its sides; involucres small.—Hook. Sp. Fil. vol. 2. t. 90. C.; Plum. Fil. t. 42.

Common on the skirts of forests, pushing erect through bushes and young trees, by which its slender parts are supported, from about 2500-6000 ft. alt. or more, A peculiar species, possessing the habit of growth of *Davallia aculcata* and *fumarioides*, with, in relation to the very considerable height and spread of the fronds, slender vascular parts. The inferior of the lowest pair (but on the superior side) of the secondary and tertiary segments is conspicuously smaller than the others, or is sometimes entirely absent.

Genus XII. *Notholæna*, R. Br.—Sori marginal, terminal on the veins, confluent in a continuous line: sporangia few to each sorus; the inflexed margin, which externally supports but does not cover the sori, forming a rudimentary involucre; fronds small, pinnæ articulate at the base, under surface tomentose or farinose.

A small genus closely allied to *Cheilanthes*, and occupying similar situations, differing in habit, and technically distinguished by the absence of involucres, which in view of the otherwise close affinity of the two genera may be regarded as undeveloped. The sporangia in each group are so few that in some instances they form only a single line along the margin.

a. Pinnæ oblong-ovate, or deltoid-oblong, subentire.

1. *N. trichemanoides*, R. Br.

aa. Pinnæ linear—oblong, or lanceolate, uniformly lobed.

2. *N. ferruginea*, Desv.

1. *N. trichomanoides*, R. Br.—Rootstock shortly elongated, fasciate, densely clothed with dark, hair-like, ciliate-edged scales; stipes 2-4 in. l,, tufted, numerous, spreading, wiry, chestnut, with few deciduous stellate scales; fronds simply pinnate, linear-lanceolate, prostrate, 6-10 in l. ½-1 in. w. elastico-chartaceous, dark green above and lightly ciliate, beneath densely coated, pad—like, with dark rusty stellate tomentum, and farinose, rachis coloured and clothed like the stipes; pinnæ deciduous, 2-5 li. l. 1½-3 li. w., apart, subdistant or the inferior remote, the upper cordate—oblong, those below broader and more ovate or deltoid, all expanded lobed or auricled at the base, entire or sinuate—margined; veins pinnately branched, curved, forked; sori continuous, more or less concealed by the recurved margin and dense tomentum.—Plum. Fil. t. 75.

Var. *subnuda*, Jenm.—Fronds often larger and more lax; pinnæ more oblong, more sinnate or deeper lobed; under surface stellate-ciliate around the margin, the white farinose disk fully exposed, and almost or quite devoid of scales.—Sloane t. 35. fig. 1.

Frequent between 2,000-4,000 ft. alt. on open rocks and banks in the cleared region of the Southern slopes of the Blue Mountain range. In the type the pinnæ are so densely tomentose beneath that they look like little hair-pads or cushions, and the farina can only be discovered by removing the tenacious coating. The absence of this coating, and the exposed farina, readily reveal the variety. Both are common in the region above Gordon Town, St. Andrew.

2. *N. ferruginea*, Desv.—Rootstock shortly elongated, fasciate, bearing small bulblike buds, which are densely coated with dark hair-like, pale margined scales; stipes 4—6 in. l. tufted, wiry, suberect, glossy, chestnut, deciduously tomentose; fronds ¾—1¼ ft. l. 1—1½ in. w. pinnate elastico-chartaceous, grayish tomentose above, beneath densely coated with fine rusty felt-like tomentum, rachis stiff, rather flexuose, remaining after the pinnæ have dropped, coloured and clothed like the stipes; pinnæ ½—¾ in. l. 2-3 li. b. oblong, spreading, apart or rather distant, the reduced lower ones most so, base truncate, nearly sessile, apex blunt, sides cut ½-⅔rds deep into uniform subdeltoid or oblong lobes which are ½-¾ li. b. and ½-1 li. d.; veins pinnate, forked, very oblique, curved, fine, close; sori continuous, partially covered by the recurved margin.—Hook. 2nd Cent. Ferns t. 52; Eat. Ferns N. A. pl. 39. *N. rufa*, Presl; *Cheilanthes*, Willd.

Frequent over the same region, and altitudinal range as the preceding, common on the banks of waysides diverging among the hills above Gordon Town, St. Andrew. The fertile margins are scarious edged, recurved, involucre like, from which the sporangia protrude, and the matted felt on the underside looks like rusty or brownish scurf. This last feature and the regular toothing or lobing of the pinnæ readily distinguish the species.

DONATIONS TO THE DEPARTMENT.

Library.

From Director Royal Gardens, Kew :—
Kew Bulletin. Nos. 67, 68. July and August, 1892.
Flora of British India. By Sir J. D. Hooker, C.B., K.C.S.I.
Hooker's Icones Plantarum. Vol. II. Part I. July, 1892.
Lithograms of Ferns of Queensland—From Colonial Botanist.
Contribution to the Queensland Flora Bulletin, No. 18: Dept. of Agriculture, Brisbane—From Colonial Botanist.

Chemist and Druggist. Nos. 642 and 643.—From Editor.

West Indian and Commercial Advertiser. August.—From Publisher.

The Times of Ceylon. Nos. 28–32.—From Editor.

The Florida Despatch and Farmer and Fruit Grower. Nos. 32–35.—From Editor.

From Hon. Col. Secretary :—
Laws of Jamaica, 1892.
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Return, 1892. British Museum.—From British Museum.

Proc. of the Agri.-Hort. Soc. of Madras, April–June, 1892.—From the Secretary.

Proc. and Journal of the Agri. and Hort. Soc. of India, Calcutta. April–June, 1892.—From the Secretary.

Occasional Bulletin, Botanical Station, Barbados. No. 3.—From the Superintendent.

Agricultural Gazette and Planter's Journal, Barbados, Sept., 1892.—From Secretary.

The Planter's Monthly, Honolulu. August, 1892.—From Editor.

Seeds.

From Botanic Gardens, Saharanpur—Dendrocalamus strictus.
" " " Demerara—Licuala grandis.
" " " Trinidad—Pimenta acris.
" Mrs. Henderson—Guava.
" Rev. H. H. Isaacs—Guava.

No. 37. November, 1892.

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.
1892.

THE BOGARDUS ECCENTRIC MILLS.

Applications have frequently been received for information on the subject of mills for grinding Cocoanuts, and other substances. Through the kind offices of Mr. W. Griffin, of the firm of Messrs. Gillespie, Bros. & Co., cuts have been obtained of the Bogardus Mills for publication in the Bulletin. The descriptions are taken from the pamphlet on the mills published by the makers, Messrs. Simpson, Rodney St., Brooklyn, from whom the mills can be obtained direct, or through Messrs. Gillespie Bros. & Co , 41 Beaver St., New York.

Description of the Bogardus Eccentric Mills.

The Bogardus Original Universal Eccentric Mills were first manufactured by the patentee whose name they bear, about half a century ago, and at that time completely revolutionized milling industries.

Mills are nearly the oldest machinery on record, and yet however varied their form, they have hitherto been constructed on one uniform principle, namely: one stone or plate is stationary while the other revolves and by its rapid revolution communicates a centrifugal force to the substance introduced between the plates, whereby all the material is thrown to the outer edges of the plate and the effective action is thus limited to the smallest area and to the place furthest away from the motive power.

In this Mill the principle is entirely new. Both plates revolve in the same direction (with nearly equal speed) on centres which are apart from each other one or two inches more or less. The centre of one or the axis thereto affixed resting or revolving upon a stationary bearing, whilst the prime mover by means of a belt or gearing causes the motion of the other plates, whereby the substance to be ground is subjected to an unlimited variety of twisting, wrenching, sliding and grinding motions in every direction over the entire surface of both plates.

The peculiar motion of the plates causes them of themselves to discharge the ground substance, so that many substances can be ground by this mill which would altogether choke others.

By the use of mills with one stationary and one revolving plate the pressure increases with its distance from the centre, being very much greater at the outer edge, consequently mills of larger sizes are necessary than would be required if the pressure on the plates were equal over the surface, and greater power is needed to operate them. The wear of such plates is confined to the outer edge, that of the greatest pressure, and the period of their service is limited to the time the outer edge will endure.

By the use of the Bogardus Mill the pressure is equal in every portion of the plate and their surfaces wear uniformly, causing them to last much longer; every portion of the surfaces of the plates from the centre to the circumference is effective in grinding and much smaller mills are required for any given amount of work than in single revolving plate mills.

In mills with single revolving plates, one plate continually describes the same circle on the other, and material ground in these mills is subject to motion in one direction only, and much greater power and time is necessary to accomplish a desired result, than if the material were acted upon in various directions and by different motion.

In the Bogardus Mills one plate travels to the other in an infinite variety of directions over a surface embraced between two eccentric circles apart from each other twice the distance that the centre of the plates are apart, and the substance to be ground is moved about in every conceivable manner, and acted upon by the plates at every point, and is subject to a peculiar wrenching, twisting, sliding, cutting, breaking and grinding motion which rapidly disintegrates it with large results in quantity ground, using little power to accomplish it.

The everchanging action of the mills and the quick discharge of the substance ground prevent the plates from becoming heated, so that it may be profitably employed in grinding substances which in other mills would be spoiled or deteriorated in quality, or which could not be ground on account of their melting. If other mills were driven with the speed which can be applied to the Bogardus Mills, they would become red hot in a few minutes.

The Bogardus Mills have superseded the old stone mills, from the fact that it does away with the use of a crusher, which must be used in connection with stone mills. The stones have to be re-cut every 4 to 8 days at great expense and a considerable loss of time, as the mills have to stand idle while this is being done; while in the Bogardus Universal Eccentric Mills the plates last a long time, and can be replaced in a fow minutes at any time at light expense.

The Bogardus Mills are more economical in the power required to drive them, and the labour to attend them. They are less costly for the work they do, and more portable, and are capable of being applied to purposes for which other mills are useless.

The wear and tear are trifling.

The plates are made in great variety to suit the purposes for which they are required.

The Bogardus Mills are used for the following kinds of Grinding.

Nos. 3 and 4 Mills are used for grinding wet substances, such as paints in water, oil or varnish, printer's ink, paste blacking, starch, chemical precipitates, and many other moist substances.

In Mills Nos. 3 and 4, the hopper revolves with the shaft, and acts as a mixer.

Nos. 2 and 5 Mills are used for grinding dry substances, such as bones, raw and dried; beans, castor; corn, (or cobb); coffee; cocoa; cocoanut; cocoanut shells; cotton seed; gum; ginger; horns; hoofs; lime; oats; phosphate, rock; peas; rocks; roots, (of all kinds); shells, oyster; sugar; seeds; spices; stones; wheat, and all similar substances.

Schedule of Prices of the Original Bogardus Patent Universal Eccentric Mills, with Patented Improvements. Terms—Cash. Draft for Mill must Accompany all Orders from Parties at a Distance.

These Mills have been thoroughly studied in every part; are not liable to get out of order and in case of accident are easily repaired at little expense. They are of the best workmanship and material, being now made with tempered steel shaft, steps, etc., and all modern improvements. The same parts in mill of the same size are interchangeable, so that in ordering parts for repairs it is simply necessary to state the part wanted, and it will fit accurately. For names of parts see sectional view.

No. 1 Mill—not now in use.		No. 4 Original Mill for grinding wet substances	$360 00
No. 2 Original Mill, for grinding dry substances	$180 00	No. 5 Original Mill— " dry "	390 00
No. 2 Improved Mill— " " "	240 00	No. 5 Improved Mill— " " "	510 00
No. 3 Original Mill— " wet "	156 00	No. 6 Mill—not now in use.	

No. 8 Improved Mill—for grinding dry substances . $600 00

The above prices include boxing and delivering free on board in N. Y. City or Brooklyn, and includes one extra pair of grinding plates with Nos. 2, 5, 8 Mills.

No extra grinding plates are required for Mills Nos. 3 and 4. Additional plates for Mills Nos. 2, 5, 8 as per prices below.

In ordering plates, state exactly what they are to grind, and if to be granulated or ground fine.

		No. 2 Mill.	No. 5 Mill.	No. 8 Mill.
A.	"Ore Plates."—These plates are used for grinding coarse or fine, crushing, granulating or pulverising Flint, Quartz, Ores, Cinders, Sea Coal, Foundry Facing, Old Crucibles, Carbon, Pot and Oyster Shells. Glass, Emery, Enamel, Sand, Coal, Black Lead, Charcoal, Stones, Brick, Salt, and other materials of similar character	$3 50	$12 00	$14 00
B.	"Bone Black" Plates. These Plates granulate only and are used to granulate, Burnt Bones, Charcoal, Tankage, Dry Paint and materials of similar character	2 25	10 00	12 00
B2.	"Bone Black" Plates, shallow pattern not now in use ...			
B3.	"Bone Black" Plates, special for grinding fertilizers ...	2 25	10 00	12 00
B4.	"Bone Black" Plates, improved special plate for burnt bones ...	2 25	10 00	12 00
C.	"Raw Bone" Plate, old pattern used for cracking bones, roots, woods, barks, and materials of similar character	3 50	11 00	13 00
C1.	"Raw Bone" Split Plate, none now in use			
C2.	"Raw Bone" Plate, New Pattern.—This plate is similar to the C plate, but finer, and used for the same purpose when a different degree of fineness is required	4 50	13 00	14 00
C C.	"Raw Bone Corrugated" Plate.—These plates are used for crushing Roots, Wood, Guano, Leather. Cork, Asbestos, Bark, Spices, Horns, Oil Cake, Fish, Pork Scrap, Ivory, Rubber, Nutmegs, Cocoa Shells, Mica, also Green, Dried or Steamed Bones, etc., etc. ...	3 50	11 00	13 00
D.	"Coarse Feed" Plates. } Will grind Oats, Wheat, Bran, Rye, Tobacco			
D D.	"Fine Feed" Plates. } Stems, Roots, Berries, Leaves, Bark, etc. ...	3 00	11 00	13 00
E.	"Corn" Plates. } The character of these plates will be determined by their names and will grind all similar			
F.	"Corn on Cob" Plates. } materials	3 00	11 00	13 00
G.	"Sugar" Plate.—These plates will grind coarse or fine granulate or pulverizo Sugar, Salts, Cocoanut, Plants, Cocoa, Oil Cake, Guano, Tomatoes, Drugs, Gums, Beef Fabrine, Indigo, Tankage, and materials of similar character	5 00	16 00	18 00
G6.	"Plates. { These plates are finer than the Standard G Plates, and are	5 50	17 00	19 00
G12.	used more specially for grinding Cocoanut, pulverizing Sugar,	6 00	18 00	20 00
G14.	Spices, Soap Powder, Guano, Rosin, Gum, Sulphur, Chemical	6 50	19 00	21 00
G18.	Salts, etc., according to the fineness required ...	7 00	20 00	22 00
No. 1.	"Fire Clay" Plate.—These plates are used for granulating Fire Clay, Plaster, Aluminous Clay, Dry Paints, Charcoal, etc., etc. ...	2 50	12 00	14 00
No. 2.	"Coffee" Plate.—Used for granulating Coffee and similar materials ...	5 50	16 00	18 00
No. 3.	"Flaxseed" Plate. } Besides all kinds of spices such as Mustard,	6 00	16 00	18 00
No. 4.	"Spice" Plate. coarse new pattern. } Ginger, Pepper, Mace, Allspice, these plates will grind fine Salts, Starch, Roots, Berries,	6 00	18 00	20 00
No. 5.	"Spice" Plate. fine new pattern. } Leaves, Seeds, Sumac, Drugs, Cork, Leather, and materials of similar character. Spices, Roots, etc., should first be ground on C. C. plates before using these fine plates.	6 50	20 00	22 00

NOTE.—The above mentioned plates from "A" to "D" are made of a special brand of very hard iron, and will wear a long time before being worn out.

The plates from "G to No. 5" are cut plates and may be resharpened in the lathe from 4 to 6 times, and will also wear a long time, viz.: to grind sugar they require redressing once a year.

Terms—Cash with order or on receipt of invoice and bill of lading.

NOTICE.

To insure prompt fulfillment of orders, persons residing at a distance are requested to remit the price of the Mill in a check or draft on one of the New York or Brooklyn City Banks, or give satisfactory commercial reference.

Also to prevent any mistake in execution of orders please designate the mill by numbers and the plates by number or letter prefixed to each, or state what the material is to be ground, and if coarse or fine as in the schedule above and allow us to select proper plates.

We will send a mill on 10 days trial if specially agreed, provided the party will guarantee to return the mill to us in good order, and pay all freight and other expenses both ways, (to and from our works,) and also be responsible for damage that may happen to the mill of any kind if it should not prove satisfactory.

Full directions for setting up and operating the mill are sent with each machine, but we will state that they do not require any skilled labor to set them up or attend to them, as they can be put up on any ordinary factory floor and be attended to by a boy, being fed either by hand or from the hopper on the mill.

We can refer to hundreds of parties (all over the world) who are using our "Bogardus Mills," and will always be glad to do so on application.

If more detailed information is required than is contained in this catalogue, please state accurately:

1st—What kind of material your require to be ground.

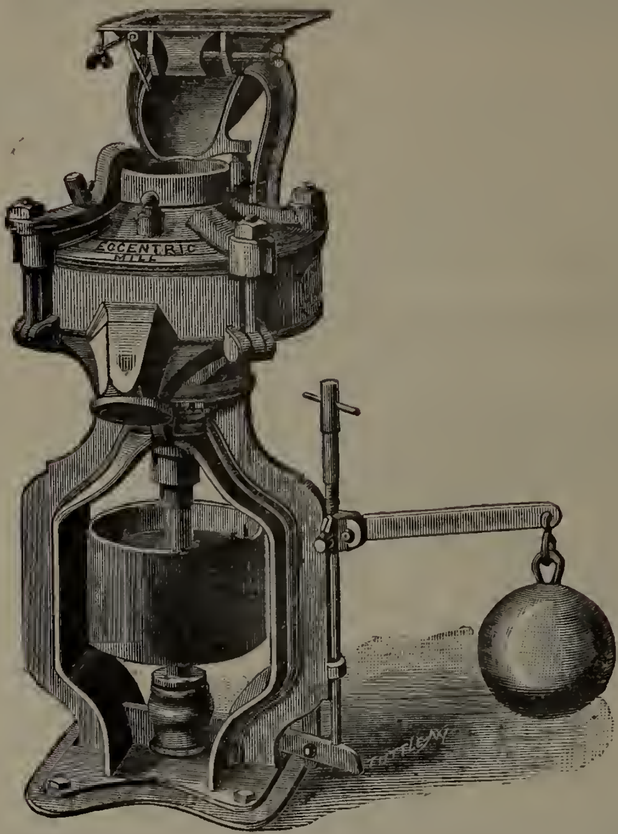
2d—The power at your disposal for this purpose.

3d—Quantity required to be ground per hour.

4th—Send a postal sample showing fineness required.

We are always pleased to receive (freight paid) a sample of the material itself, say 25 to 50 lbs., which, (at a slight cost,) we will grind either in the presence of the owner or his representative, or we will grind and return it in good order with a full report on same in order that a fair idea may be arrived at as to the suitability and capacity of the mill for this purpose.

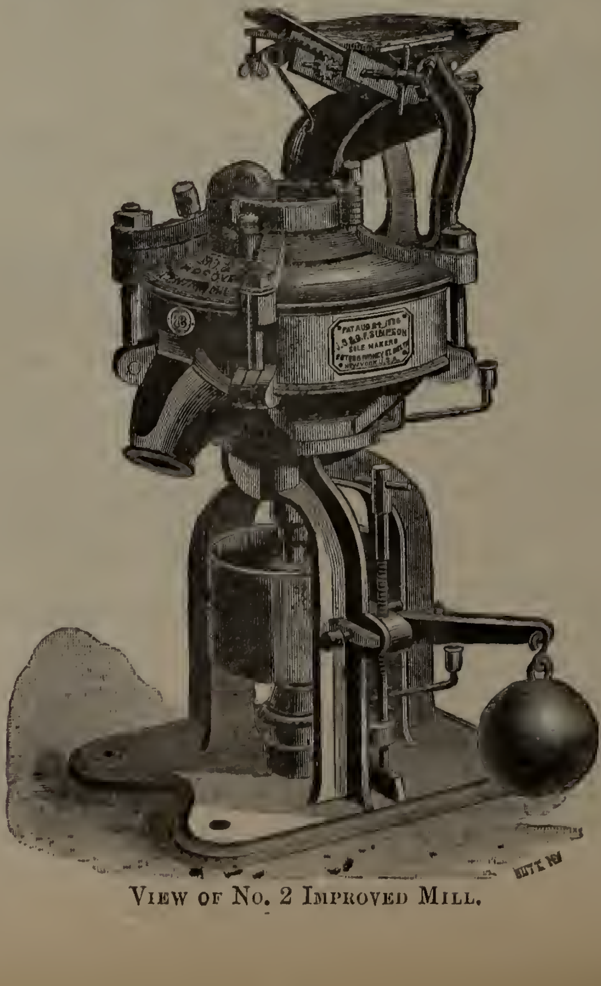
View of the No. 2 Original Bogardus Patent Universal Eccentric Mills, with Patented Improvements.



Floor space, 12″ x 14″. Diameter of pulley, $9\frac{3}{4}$″. Face of pulley, 6″. Height from floor to centre of pulley, $11\frac{1}{2}$″. Height from floor to top of hopper, 48″. Opening in top of mill, $4\frac{1}{2}$″ diameter. Height from floor to end of spout, 22″. Net weight of mill complete, 450 lbs. Gross weight of mill complete,boxed 600 lbs. Power to run 3 to 5 horse. Price, $180.00. F O. B., N. Y.

View of the No. 2 Improved Bogardus Patent Universal Eccentric Mill.

This improved No. 2 Mill has a much heavier and more substantial base, with three upright braces, which enables it to stand the jar of heavy usage; run steady and be belted from the back as well as side. By means of the side swing bolts and adjustable shaft and shaft plate, the Mill can be readily taken apart and thoroughly cleaned in a few minutes' time. By the new composition, neutral ring, and anti-friction metal, and the new style step with new oiler, all possibility of heat and wear is avoided. The construction of the spout and pan are so arranged that with the patented propeller, the Mill will readily discharge all materials as soon as ground. The new adjustable slide to hopper enables the feed to the Mill to be regulated as desired.

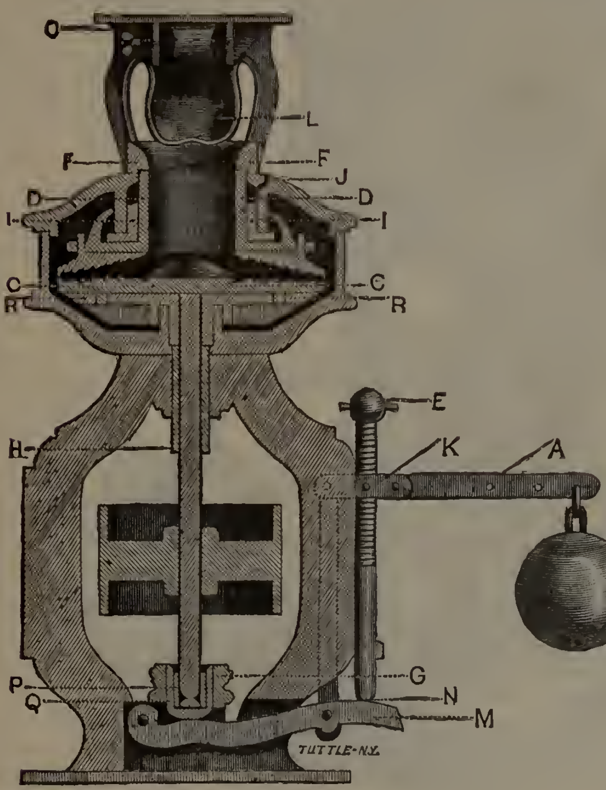


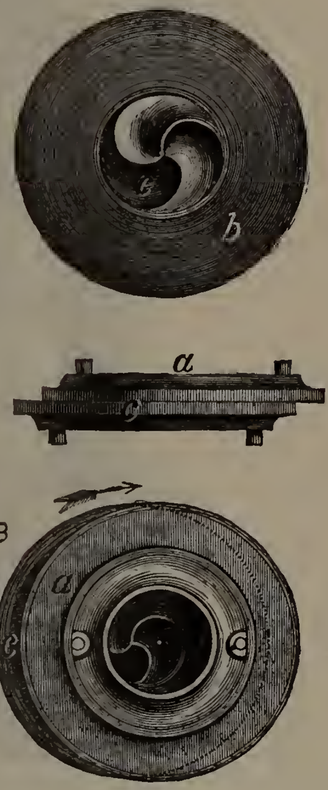
View of No. 2 Improved Mill.

Floor space, 22 x 22″. Diameter to pulley, 9$\frac{1}{4}$″. Face of pulley, 6″. Height from floor to centre of pulley, 11$\frac{1}{2}$″. Height from floor to top of hopper, 48″. Opening in mill, 4$\frac{1}{2}$″ diameter. Height from floor to bottom of spout, 22″. Net weight of mill complete, 575 lbs. Gross weight of mill complete boxed, 750 lbs. Power to run 3 to 5 horse. Price, $240.00, F. O. B., N. Y.

SECTIONAL VIEW OF No. 2 ORIGINAL BOGARDUS' PATENT UNIVERSAL ECCENTRIC MILL, WITH PATENTED IMPROVEMENTS AND PLATES GIVING DETAILED DESCRIPTION OF MILL, WITH NAME OF EACH PART.

Nos. 5 and 8 Mills are similar to No. 2.





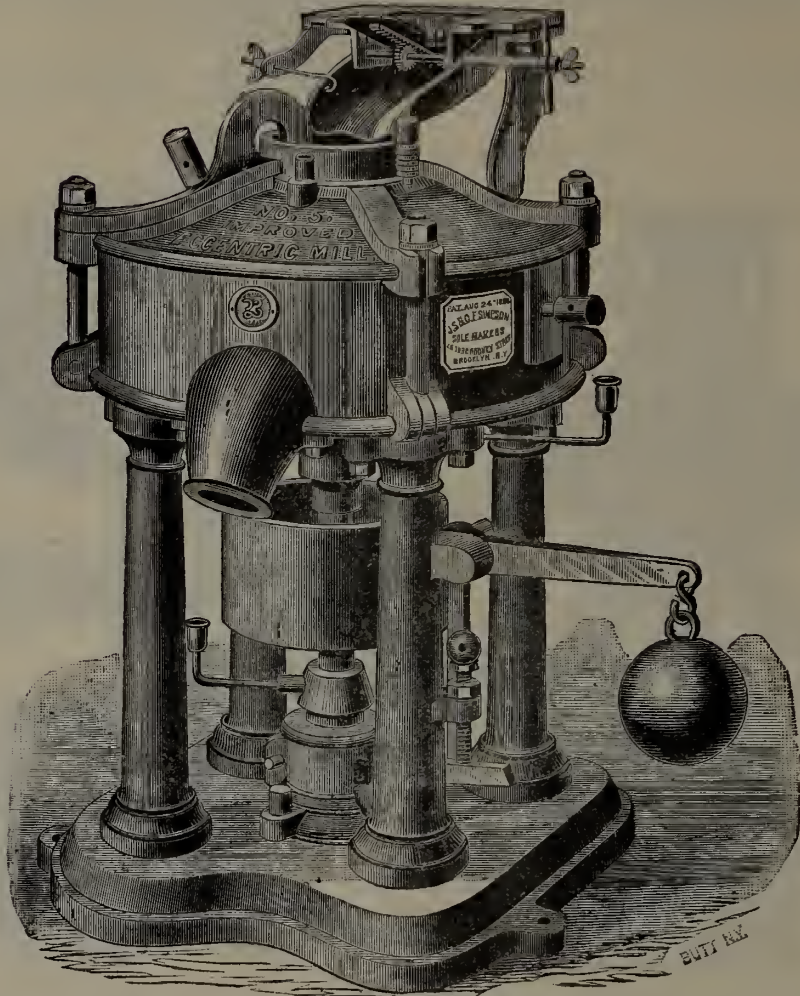
The body of the Mill consists of a Cast Iron Frame, upon which rests the Pan, upon which is placed the Cover and bolted to the pan by means of side bolts. On the underside of the cover a steel ring called the steel for cover is fastened, which rests upon the neutral ring I. I.

A.—Ball Weight Lever.
B.—Ball Weight.
C. C.—Bottom Grinding Plate.
D. D.—Ring Plate.
E.—Adjusting Screw.
F. F.—Nut.
G.—Cast Iron Step.
H.—Bearing Box.
I. I.—Neutral Ring.
L.—Shoe, which is held in position by means of a spring, called the Hopper Spring.
M.—Bottom Lever.
O.—Hopper.
P.—Steel Lining and Button in Step.
Q.—Cast Iron Cup in Step.
R. R.—Shaft Plate.

Figure 1 is a sectional view of Mill No. 2 for grinding dry substances. The power operating the Mill is applied by means of a belt and pulley attached to the shaft, which is vertical. To the top of the Shaft the *Shaft Plate* (*R R*) is fixed, and upon the Shaft Plate the *Bottom Mill Plate* (*C C*) is laid, being kept into position by projecting pins. The *Bottom Plates*, or the substance between the *Plates* communicates motion to the *Top Plate* which is fastened by bolts and pins to the *Revolving Collar*. This *Revolving Collar* is made up in two parts, the *Ring Plate* (*D D*) and the *Nut* (*F F*); and a third part the *Neutral Ring* (*I I*), so called from the fact that it is immaterial whether it revolves or not. Upon this *Ring* the wear and tear of the *Mill* are mainly thrown. The *Shoe* (*L*) acts against the *Nut (F F)* which causes it to vibrate, and this vibration hastens the supply of material fed to the *Plate* to the extent allowed by the *Slide* in the *Hopper O*. *J* is an *Oil Chamber*; *H, the bearing box of* the *Mill Shaft*; *G*, the *cast iron step*; *P*, the *steel lining* in a cast iron cup; *Q* with steel *button* on which the shaft revolves. The degree of fineness or coarseness is regulated by means of a screw and lever acting upon the *Step Q*. *E* is the *Adjusting Screw*. *A* the lever, with the fulcrum *K*, and connected by means of a connecting rod, represented by the dotted lines in the *Stand*, with a lever which acts directly upon the *Step*. The *weight B*, by means of these levers, would keep the plates in close contact, but their distance apart is regulated by the screw *E*. As will be immediately perceived, when iron or any kindred substance passes between the plates, or any substance harder than that which the plates are regulated to grind, the lower plate yields and allows it to pass out. In putting the cover on the Mill the word "ECCENTRIC" must come to the front (over the spout).

Figure 2 represents the plates used in this Mill; *a* is the upper, *c* the lower plate. The vertical view, in which are marked *c, d*, represents the position they occupy in reference to each other. From the position of the two centres it is named the Eccentric Mill. The circles which are cut in the plates act as revolving shears, cutting every way with a peculiar *cutting, wrenching, twisting,* and *sliding* motion, admirably adapted to every species of grinding. In order to meet every possible necessity, the faces of the plates are variously formed for different purposes, all, however, conforming to the general principle.

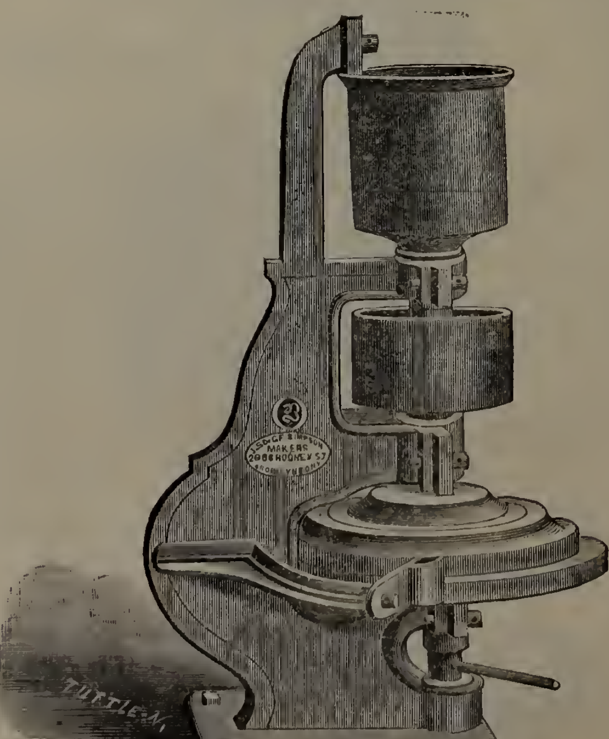
View of the No. 5 Improved Bogardus' Patent Universal Eccentric Mill.



Floor space, 34 inches square. Diameter of Pulley, 14 inches. Face of Pulley, 8 inches. Height from floor to centre of Pulley, 19 inches. Height from floor to top of Hopper, 54 inches. Height from floor to end of discharge spout, 28 inches. Opening in top of Mill, 6 inches diameter. Net Weight of Mill complete, 1200 lbs. Gross weight of Mill complete boxed, 1500 lbs.

Power to run about 8 to 10 horse. Price, $510.00, F. O. B., N. Y.

View of Nos. 3 and 4 Original Bogardus' Patent Universal Eccentric Mills.



For grinding wet substances. Will do the finest quality of work on almost any kind of paint and ink.

No. 3 Mill.—Floor space, 14″x20″. Diameter of pulley, 9¾″. Face of pulley, 6″. Height from floor to centre of pulley, 18″. Height from floor to top of mill, 39″. Hopper, 7″ diameter; 10″ deep. Capacity, 1 gallon. Net weight of No. 3 mill complete, 150 lbs. Gross weight of No. 3 mill complete, boxed, 265 lbs.

No. 4 Mill —Floor space, 22″x32″. Diameter of pulley, 14″. Face of pulley, 8″. Height from floor to centre of pulley, 22½″. Height from floor to top of mill, 48″. Hopper, 13″ diameter; 12 deep. Capacity, 4½ gallons. Net weight of No. 4 mill complete, 600 lbs. Gross weight of No. 4 mill complete, boxed, 790 lbs.

Power to run No. 3, one horse; No. 4, three horse.

The only difference between these Mills and those for grinding dry substances being in the arrangement of the frame, and the adaptation of its different parts to the particular use for which it is designed. The hopper revolves with the shaft, and acts as a mixer, the liquid being forced down by a stationary screw through the hollow shaft to the plate. The lower plate is smooth for about two inches from the outer edge. The ground material is taken off and delivered by means of the side scrapers as shown. The capacity of the mill will vary with the character of the material to be ground.

Price of No. 3 Mill, $156.00. No. 4 Mill, $360.00, F. O. B., N. Y.

Plans for Setting up the Bogardus' Eccentric Mills.

View showing the general way of setting up Nos. 2, 5 and 8 Bogardus' Eccentric Mills, for dry substance, with counter-shaft set on the floor.

The cut shows the general way of setting up Nos. 2, 5 and 8 Mills, for Dry substances, with tho Counter-shaft set on the floor.

Counter-shafts should be placed from 6 to 10 ft. from the Mill.

Belt to run with a quarter turn, as shown, and have au upward pull as it leaves the Mill as shown by arrows on cut.

The lower side of driving pulley on counter-shaft must be on a horizontal line with the centre of the pulley on Mill.

Mill must run to the right as shown by the arrows.

Tight and loose pulleys on the No. 2 counter-shaft, 10 inches diameter, 6 inch face each; average speed of counter-shaft required, 275. Use a 4 inch or 6 inch belt.

Tight and loose pulleys on the No. 5 counter-shaft, 14 inches diameter, 7 inch face each; average speed of counter-shaft required, 350. Use a 6 or 7 inch belt.

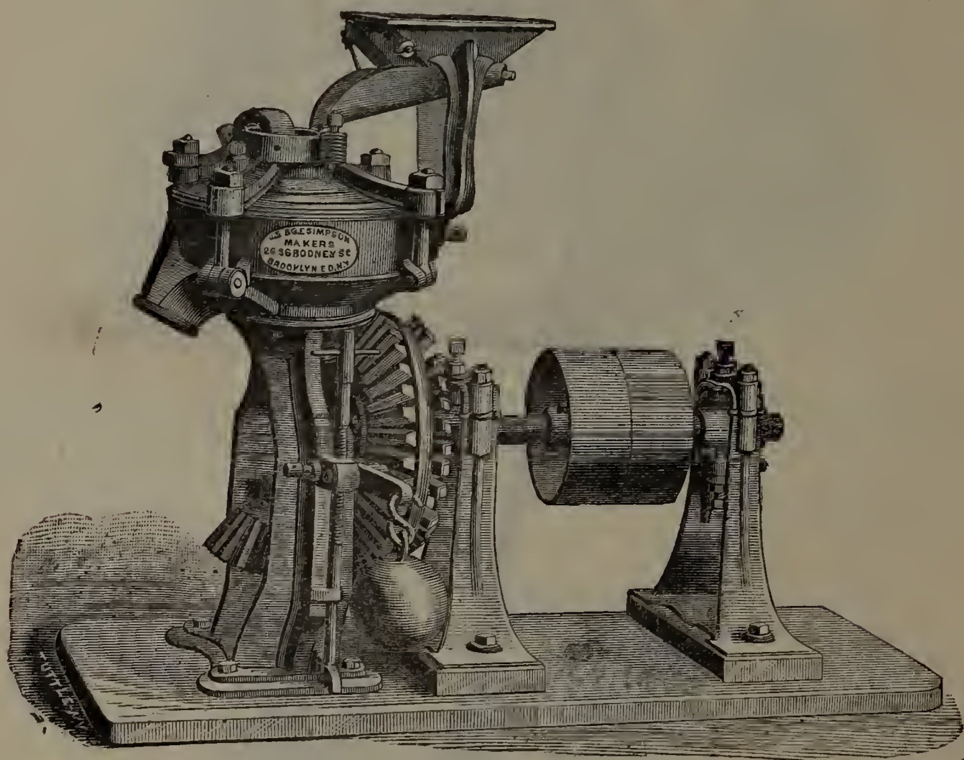
Price of Counter-shaft, complete, for No 2 Mill	...	$42 00
" " " " Nos. 5 and 8 Mill	..	60 00

Price of Pulley for main shaft will depend upon the size required.

In ordering Pulleys for main shaft diameter and speed of shaft should be given, also if regular balancod or split pulley is required.

Weight of	No. 2	Counter-shaft,	complete,	about	...	250 lbs.
"	"	"	"	boxed, about	...	425 lbs.
"	No. 5	"	"	about	...	460 lbs.
"	"	"	"	boxed, about	...	650 lbs.

View showing manner of setting up Nos. 2 and 5 Mills, for dry substances, with Bevel Gearing.



Bevel Gear, 1½ to 1. Floor space, 17 in. x 48 in.

By the use of Bevel Gearing, as shown above, the Mill can be set up to occupy less space than in the old way, with a counter-shaft on the floor, and being bolted on a bed-plate, are more portable and can be placed anywhore, whero grinding is required to be done. On the No. 2 Mill, one gear being iron and the other wood, no noise is made by their use. The Nos. 5 and 8 Mills can be run on the same principle as shown in abovo cut, but being heavier and larger Mills both gears are of iron.

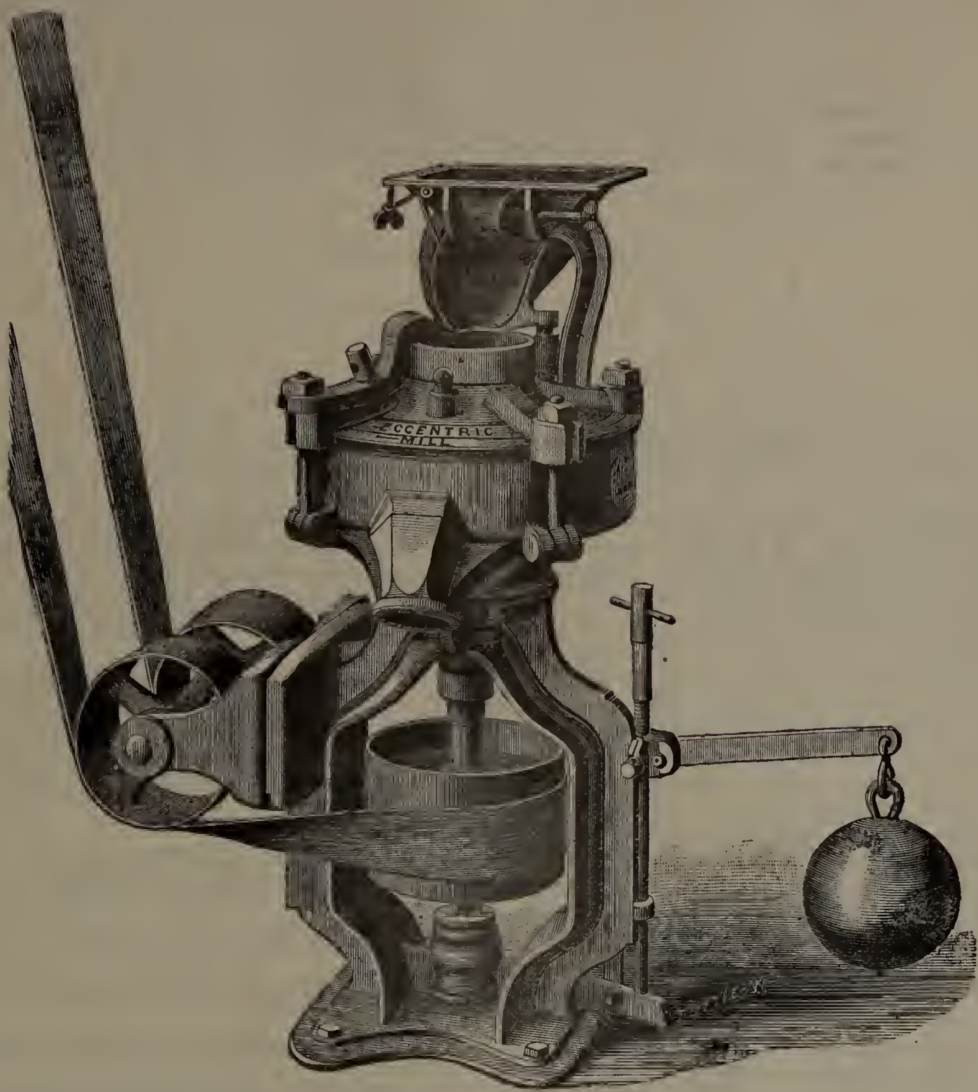
Extra price for Bevel Gearing, bed-plate, tight and looso pulley and shaft					
	for No. 2 Mill,	...	...	...	$150 00
do.	do.	do.	without bed-plate,	...	138 00
do.	No. 5 Mill,	do.	with bed-plate,	...	210 00
do.	do.	do.	without bed-plate,	...	192 00

Prices for Bovel Gearing for Nos. 5 and 8 Mills given on application.

Weight of No. 2 Original Mill with Bovel Gear, etc., complete, about ... 835 lbs.

"	"	"	"	"	"	"	boxed, about	1200 lbs.
"	No. 5	"	"	"	"	"	about ...	1750 lbs.
"	"	"	"	"	"	"	boxed, about	2200 lbs.

View showing manner of setting up the Mill, with Guide Pulley Attachment.



Patented August 24th, 1886.

The above attachment can be placed in the Nos. 2, 3, 4, 5 or 8 Mills.

By the use of the above attachment, as shown on the side of the Mill, the Mills can be run without the use of a counter shaft on the floor, which is a great objection to all Mills run in this manner where floor space is limited. By this invention the Mills can now be run direct from the main shaft on ceiling above or ceiling of floor below, if sufficient speed can be obtained, otherwise from a counter-shaft on the ceiling and at any angle to the shaft, no more room being required on the floor than what the mill occupies. Pulley on Mill, 10 in. diameter, 6 in. face; average speed required, 600.

Price for above attachment for Nos. 2, 3, and 4 Mills,	...	$30 00
" " " " Nos. 5 and 8 "	...	48 00

Directions for Using Nos. 2, 5 and 8 Mills for dry Substances.

The Mill should be run to the right as the arms in the pulley will direct, and make not less than 300 and may run 600 or even 800 revolutions per minute. The Mill may be fed as fast as desired; nearly any quantity can be ground by increasing the speed. The lever acts as a guard; it yields and delivers any obstruction which would take more power to crush than the material the Mill is grinding. The weight is (or should be) sufficient to keep the plates up when grinding. By screwing down the adjusting screw at the side of the Mill, it separates the plates and causes the Mill to grind coarsely. The adjusting screw must be turned in the opposite direction if wanted to grind finer. To separate the upper plate from the top of the Mill, place the end of the wrench in the hole in the ring which is on top of the Mill, and turn it to the right; this screws the ring off and separates the plate, being a back-handed screw, for the purpose of keeping the ring on the tube of the upper plate while the Mill is running.

There are three places to be well supplied with oil; the first is the step in which the end of the shaft revolves; the second is the bearing box, which holds the shaft in its upright position—this is done by pouring oil through a tube which leads to the box; the third place is the upper bearing of the Mill—in this is a large reservior for holding oil, and should be filled with at least a gill of oil before starting the Mill. It is poured in through a tube or just over the bearing of the Mill. After it is supplied with oil, a stopper should be placed in the opening of the tube, to keep the dust from getting in. The adjusting screw is held firmly in any position by a set screw against its side. The feeding is regulated by a shoe acting against the tube of the upper plate, which causes the shoe to vibrate; this, with the slide in the hopper, regulates the quantity fed into the Mill. Screw holes are made round the rim of the hopper, for the purpose of extending its size to any dimensions required. The Mill can be taken apart, cleaned and the plates changed (if necessary, in a few minutes). In putting the cover on the Mill, the word " Eccentric" on the cover must come to the front (over the spout.)

Directions for Using Nos. 3 and 4 Mills, for Grinding Paints and Liquid Substances.

The Mills should run to the right, and run from seventy-five to one hundred and twenty-five revolutions per minute. The belt passes from the back of the Mill, running over the front part of the pulley, leaving the front of the Mill clear; the scraper must be placed just where the plates coincide with each other, so as to scrape both plates at the same time. The reservoir, or step for the under plate, should be well supplied with oil; also, the cups around the tube, one just below the hopper, and the other below the pulley. Turning the screw to the left will bring the plates together, and cause the Mill to grind finer. The reverse must be done to grind coarser. After running a few hours the plates become faced, and the mill may then be set to grind as fine as desired.

GARDEN EGG.

The Garden Egg or Egg plant *(Solanum Melongena)* is supposed to be native of Asia. It can be readily grown in Jamaica, and at certain times of the year, it would be profitable to send it to the United States markets.

Soil and Situation.—A good rich soil is necessary, plenty of thoroughly rotted short stable or cattle manure should be dug in. A sheltered position should be chosen, where abundance of water can be given.

Sowing Seed.—The seed is sown in nursery beds, and when the seedlings are 2 to 3 inches high, they may be transplanted into the permanent beds. About one ounce of seed should give 100 plants.

Planting. The plants are set out at 3 feet apart in a row, the rows being 5 feet apart. About 3,000 plants go to the acre.

Cultivation.—If well grown, large fruits are desired, only a certain number should be allowed to each plant in proportion to its strength and the particular variety. The ends of the branches should be pinched when the fruits are ripening. The varieties differ in the length of time they take to ripen their fruit, from two to six months. In a tropical climate like Jamaica, it is preferable to grow those varieties which require the longest time, as the fruit is larger and better flavoured. In temperate climates, on the other hand, the "early" varieties are preferred.

Varieties.—The following are the chief varieties :—

(1). Long Purple.—The fruit is from 6 to 8 inches long, and 2 to 3 inches in diameter. It is best in quality before it is fully grown. Five or six months are necessary for its growth. There may be eight or 10 fruits on a large healthy plant.

(2). Early Long Purple.—This is only an early variety of the preceding, and the plant is not so strong nor so large.

(3). Round Purple—The fruits are large and somewhat pearshaped. Not more than 3 or 4 should be left to grow on a plant.

(4). New York Improved.—The fruit is like that of the Round Purple, but the plant is smaller. Not more than 2 fruits should be allowed to a single plant.

(5). Early Dwarf Purple.—This is an early variety. The plant is low-growing and branching, and may carry 10 or 12 fruits. The fruit is of a longer shape than the Round Purple, 3 or four inches long and about 2 inches in diameter at the thick end.

(6). White China.—This is a very distinct variety, with long slender white fruit.

(7). Landreth's Thornless Large Round Purple.—This is a variety recommended by Messrs. Landreth.

(8). Large Round White.—Similar to No. (7) but white in colour.

Nos. 1 to 6 can be obtained from Messrs. Vilmorin, Andrieux & Co., 4, Quai de la Mégisserie, Paris. Nos. (2) (4) (7) and (8) from Messrs. Landreth, 21 South Sixth St., Philadelphia, U. S. A.

The following note is by Mr. William Harris :—

"When in charge of Castleton Gardens some years ago, I tried several times to raise Garden Eggs from seed, but without success, the plants either dwindling away and dying after a sickly existence, or, if they lived, failing to produce fruit.

I found that the settlers in the Castleton District grafted their plants on the Susumber (*Solanum mammosum*) a common Jamaica plant, which practice I adopted with great success. The grafted plants produce fruits of a very large size and fine flavour.

The mode of grafting which I adopted was that known as *wedge grafting.* The *stock* is cut to the depth of 1½ inches with a sharp knife, and the cleft kept open till the *scion* is inserted.

The *scion* (a piece of growing branch of Garden Egg, about twice as thick as an ordinary lead pencil and about 4 inches long) is cut wedge-shaped and inserted in the cleft, so that the inner barks may coincide.

It is then wrapped with soft string, or woollen yarn and covered with a handful of clay.

There should be no bark left upon the inserted part of the *scion* except that on the outside."

The following notes are taken from the Seed Catalogue of Messrs. Landreth :—

"*On Prices.*—Commission Merchants in Philadelphia pay the market gardener about on an average one-and-a-half cents per fruit. The highest prices are eight and ten cents per fruit.

Florida fruit arrives in Philadelphia the latter part of November, and commands $6 to $8 per barrel crate. Earlier in the Autumn the market is supplied by fruit from Jersey. Towards Christmas the price of Florida Egg plants rises to $10 per barrel crate, and then declines by April to $6 to $8, and by May to $5, after which they are likely to arrive in a damaged condition and be worthless.

On Cooking.—Fried. Peel the fruit and cut crosswise in slices of full diameter and of one-third of an inch in thickness, sprinkle salt between the slices and set aside for half an hour, when remove the water, dry and dip in butter and bread crumbs, and fry in hot lard until brown.

Baked. Peel the fruit and cut into small pieces. Place in a pan with butter and sweet oil over a fire for three minutes, add salt, pepper and a little sauce or gravy. Take it from the pan, and, put in a baking dish coat over with bread crumbs and Swiss cheese and bake in oven till quite brown."

LIMES.

Limes are the fruit of *Citrus Limetta*, a tree which grows wild in the West Indies and other tropical countries.

Situation—Limes grow best near the sea up to an elevation of 500 feet, where the atmosphere is moist. If the spot is liable to droughts, irrigation is necessary.

Soil—The soil should be light. It need not be as rich as for cocoa, so that those portions of a cocoa estate where the soil is too poor for cocoa, might be suitable for limes.

Planting—The seed should be sown in nursery beds, pricked out into other beds at about one foot apart, and finally transplanted into permanent spots. The trees should be planted about from 15 to 18 feet apart.

Cultivation—They require pruning, to prevent the centre becoming choked, and to remove suckers and superfluous and dead wood. Parasites must be carefully cleared off. Weeding should be attended to, and the soil occasionally stirred.

Yield—The trees begin to yield when about 3 years old, and are in full bearing at 7 years. The yield varies, but under favourable circumstances may be as much as from three quarters to a whole barrel from each tree.

Extraction of Juice—When manufactured on a small scale, the fruit is pressed between rollers. Cider presses or small sugar-mills answer the purpose. Dr. Nicholls recommends a form of mill "made with heavy horizontal wooden rollers covered with sheets of copper roughly perforated so as to *catch* the limes." From 7 to 8 gallons of juice can be obtained from one barrel of fruit if the mill is effective.

Preparation of the Juice—"When the juice is exported in its raw state, it is necessary to take particular care to exclude all dirt, fruit pulp, and seeds. If the limes be gathered in rainy weather, the mud must be washed off them before they are passed into the mill, and it is well to strain the juice through several copper sieves with meshes of decreasing size. Another good plan is to allow the juice to remain in puncheons or casks with a tap put in about 10 inches from the bottom. The juice will then "settle," the seeds and the heavier part of the pulp falling to the bottom, and the oil and other impurities rising to the top. The juice can be drawn off in three or four days, and it is allowed to run as long as it is clear. The cask in which the juice is exported must be completely filled, so as to exclude the air, and they should be bunged up as soon as possible. If this system be adopted the juice will remain in good condition for many months. When it is necessary to keep it for a long time, half an ounce of salicylic acid can be added to every fifty gallons of juice, the acid preventing the fermentation and consequent destruction of the product. The salicylic acid will not interfere in any way with the wholesomeness of the juice.

Concentration of the Juice.—"Concentrated lime juice is prepared very simply by evaporation in open copper pans until the required density is obtained. In Dominica, the juice is usually boiled down until it reaches one-tenth or one-twelfth of its original volume the resulting product being of very acid stuff about the colour and consistency of molasses. The concentration of the juice requires a great deal of fuel, about two cords being required to produce a hogshead at a density of 10 to 1. It is necessary for the planter therefore, to look to the available sources of supply of fuel before he commences to cultivate limes for concentration of the juice. If he have no forest land on or near to his property, fast growing trees should be planted at the same time as the limes, and the cultivation of trees for fuel should go hand in hand with the cultivation of the limes."—*Dr. Nicholls. Tropical Agriculture.*

Extraction on a large scale.—When the lime industry is maintained on a large scale as at Montserrat more elaborate methods are employed. "The fully ripe fallen fruit are collected in the morning, brought in and sorted. The sound fruit are treated by the écuelle for the oil in the rind; they are then put in a hopper with a sliding bottom, and supplied to two gun metal rollers having teeth of different lengths, which tear them to pieces; the torn fruit falls on a copper sieve below. After passing through this strainer, the juice is run into puncheons. The pulp is put in coir bags, and pressed in a screw-press to extract the remainder of the juice; the marc is used as manure." (Haldane).

The following information is taken from the "Gleaner" newspaper for 26th December, 1891, being a portion of an account given by the Editor, the late Mr. Gabriel de Cordova, of a visit paid to several of the West Indian Islands:—

The Lime Industry.—"A small area of land in Montserrat is occupied with the sugar-cane and there are still a few good estates, but the principal industry is the cultivation of the lime tree, which has made the island so well known throughout the civilized world. The prosecution of this industry lies in the hands of the Montserrat Company (of Birmingham,) and the prosperity which has followed to the island is largely due to their energy and enterprise. The lime plantations were started about twenty years ago by Mr. Joseph Sturge, and now the area under cultivation by the Company reaches 1,600 acres. The products exported are fresh and pickled limes, raw lime juice, concentrated lime-juice, essence of lime from the rind, and oil of limes prepared by distilation. The *modus operandi* pursued in the industry is interesting.

The cultivation is carried on by the company on scientific principles. The trees are planted in regular rows, eighteen feet apart and at the time of our visit we were fortunate in seeing them at the height of bearing, a most interesting sight. The crop was of the largest and the boughs actually lay on the ground, weighted down by the rich abundance of fruit.

Extracting the Essential Oil—The fruit is not picked from the trees, it is allowed to drop to the earth and then gathered by the labourers and piled up into heaps beneath the trees. The extraction of the essential oil from the rind is the first process and this is the accomplished in most simple but effective manner, by a special instrument the *écuelle*. The women who are employed for the purpose are each provided with a copper vessel made in the shape of an ordinary saucer, about eight inches in diameter and about one and a half inches deep, with a lip on one side for the convenience of pouring. The concave surface is studded with little copper spiggots constituting a kind of grater. The "handle" is fixed on the bottom and is hollow for it serves the purpose of a receptacle into which the essence falls from the vessel. The oil is obtained by simply rubbing the lime with the palm of the hand over the spiggots. When the "handle" is full, the contents are emptied into cans, and the work continued. The oil is filtered through blotting paper and shipped in gallon tins.

Obtaining Lime Juice—When the limes are thus relieved of the essential oil they are placed on the ground in heaps as before, and are afterwards conveyed in carts to the works. Here they are thrown into a machine which simply cuts the limes into two; the juice which flows as a result of this operation is considered to be the best, and is drawn off into puncheons, and shipped as "first quality." The halves then undergo a further process. They are passed through rollers which express all of the remaining juice and this is concentrated by a method of boiling similar to that adopted in sugar-works, the liquor being transferred from pan to pan as evaporation takes place. The product obtained about $\frac{1}{8}$ the original bulk is also shipped in puncheons. The skin and the trash of the fruit make excellent food for cattle, and we were informed that they eat them heartily and fatten on them. They also constitute a good manure.

Extent of the Industry—The average crop of the estates for the Montserrat Company is about 190,545 gallons of juice, this includes 78,588 gallons of "first quality," and 111,957 of concentrated; 44,600 fluid ounces of Essence of Lime is also produced. During crop time as many as 3,000 barrels of the fruit are gathered every week. In seasonable weather the average yield of a plantation is about 100 barrels to the acre but some portions of land have produced 250 barrels to the acre. The average life of a lime tree is estimated to be 35 years and we saw some which we were told were 16 years old in a most vigorous and healthy condition and bearing an abundant crop."

A Queensland journal makes the following remarks which may be of use to manufacturers here:—

"A good deal of lime-juice is at present imported here from Jamaica, and purchased by bottlers of lime-juice in this country; but much of the juice imported is dirty and full of impurities. Its value may be ascertained from time to time from our market report. The concentrated juice for citric-acid making which we import comes mostly from Sicily. It is there obtained as a by-product in the manufacture of essential oils of lemon and burgamot from the rind of the fruit. The peeled fruit is cut in half and pressed, and the juice is evaporated in a copper (care being taken to prevent burning). Sicilian juice has a strength of from 65 to 70 oz. of citric-acid per gallon, and that is the strength a manufacturer should aim at. The West Indian juice has a much higher strength (90 oz. or thereabouts), but this is generally obtained at the cost of burning the juice which is therefore liked less by manufacturers than the Italian. Another important factor is the packing. Italian juice comes over in huge oaken casks of about 130 gallons, sometimes, but rarely, in chestnut casks of the same capacity. The latter are more liable to leakage. The West Indian juice is packed in casks of from 30 to 50 gallons. In Sicily, essential oil and juice are made by small cultivators not owning expensive apparatus of any kind and the goods are collected all round the villages by merchants."

THE PEACH.

Peach trees require a good well-drained soil. Stiff clays, or soil of an adhesive nature are very unfavourable, and the peach should not be planted in such. Then, again, if the subsoil is of too wet or too dry a nature the trees will not thrive: in one case the roots will suffer from stagnant moisture, and in the other through an insufficiency of moisture. The first thing to be done, therefore, is to examine the subsoil and remedy the defects, if any.

If too wet the remedy is drainage; but if of a dry gravelly nature, it should be dug out to a depth of three or four feet, and replaced with good soil. With this depth of suitable soil, although the bottom may be dry the trees will not be as likely to suffer from drought.

Soil—A good calcareous loam, to which has been added a fair supply of rotten manure, will be found to suit this tree.

If not of a calcareous nature, lime should be added to the soil pretty freely and thoroughly incorporated with it.

Extremes of drought, and moisture at the roots should, above all, be guarded against as far as practicable.

Various means to ensure an equable supply of moisture at the roots will suggest themselves to those who take an interest in their trees.

During very heavy rains a few pieces of old boards might be placed on the top of the soil in such a way as to throw off the superfluous water; then during very dry weather the surface might be lightly forked over, and watered till the soil contained in the holes is thoroughly moistened at the bottom, then a good mulching of stable litter might be given to each tree, which will assist in keeping the ground longer moist as well as afford nourishment to the trees.

Peaches here, like all other trees from temperate climates, are in a constant growing state, that is they are never at rest as in colder climates. To check this, to some extent, the plan has been adopted at Cinchona of digging a trench round each tree and exposing the roots during the cool months, and filling in the trenches again when the trees should start into growth.

We cannot yet name the exact time when the roots should be uncovered and when the trenches should be again filled in. The roots are now (beginning of September) being uncovered, and will be covered again about January, filling in the trenches with soil, rotten manure, and lime thoroughly mixed.

Pruning—This is a very necessary operation in the cultivation of the Peach.

The trees should be carefully watched, and as soon as the old leaves have fallen pruning should be done, in such a way as to maintain an equality of vigour amongst all the branches, as far as possible. All superfluous, and weakly shoots should be removed. After getting rid of useless wood, attention should be directed to the remaining shoots; they should be shortened if necessary, taking care always to cut back to a wood bud, which is of a conical, pointed form, consisting of scales surrounding a growing point, whilst the fruit bud is ovate, becoming globose, assuming then a hoary appearance, and consists of scales enclosing the rudiments of petals, stamens, &c. It is also much more plump than the wood bud.

If the branch is cut immediately above a fruit bud, it will not produce a shoot from that point, but will die back to the nearest wood bud.

There may be only two wood buds on a shoot, one the growing point, or apex situated amongst several flower buds, the other near the base of the shoot: in this case the shoot must be left its full length, or else cut above the wood bud at the base. The latter is the preferable mode, for a succession shoot would be obtained, whereas, if not so cut back the whole would be naked the following year.

A shoot that has borne fruit will do so no more, and must, therefore be cut off close to the wood bud at its base which will produce a succession shoot, which must, like its predecessor, be shortened in order that, whilst it produces fruit during the ensuing season, it may in its turn produce a succession shoot. In general every bearing shoot should have a young shoot for succession, and the nearer the young shoot springs from the base of the bearing shoot the better.

If the succession shoot shows a sign of becoming too vigorous, its top should be pinched off when it is about 15 or 18 inches long. The length to which the bearing shoot ought to be shortened will depend on its vigour, and in order to cut it immediately above one of the wood buds it may have to be left at greater length, or cut shorter than would be otherwise advisable, this depending on the position of the wood buds.

The distance between the bearing shoots on a branch may be 15 to 18 inches.

Pruning may, therefore, be reduced to the following:—

1. Removal of all superfluous and weakly wood.
2. Shortening the bearing shoot to encourage the growth of a succession shoot at its base.
3. Removal of shoots that have borne fruit, cutting them off close above the succession shoot at the base of each.

Disbudding.—This consists in the removal of buds in a young state. If all the young shoots formed were allowed to grow, they would soon become excessively crowded, therefore only those should be allowed to remain for which there is sufficient space. This operation, however, must be performed by degrees, for if too many buds are removed at once, those that are allowed to remain will not be able to at once receive all the extra sap, stagnation will ensue and prove injurious to the health of the tree.

Thinning the fruit.—If the tree is in a healthy state there will generally be more fruit than can properly be matured, and it must be thinned. Weak trees should only be allowed to carry light crops, and on weak branches fewer fruit than on more vigourous ones. If the trees are allowed to carry too many fruits, the latter will be small and thin-fleshed. In removing the fruit, care should be taken not to tear the bark off the shoots, and the smallest, of course, should be dispensed with.

W. Harris.

GENERAL HINTS ON THE PRUNING OF DECIDUOUS FRUIT-TREES IN NEW SOUTH WALES.

(Re-printed from the "Agricultural Gazette of New South Wales.")

The objects to be obtained by pruning in New South Wales will be practically confined to a proper shaping of the tree. Pruning to produce fruit which is so necessary in England will seldom be required here, as our trees are naturally so prone to produce fruit that it should be more the object of the fruit-grower to reduce bearing wood, and thus decrease the burden of the tree.

This would take the place in part of thinning out the fruit, a very necessary operation where quality is desired, and one that it pays well to give thorough attention to, as it greatly improves the size and appearance of the fruits ensuring a ready sale at good prices, even when the market is glutted with ordinary fruit. There is always a market for anything really first-class.

Pruning to restore vigour to the tree is only applicable to old trees in which the root is still sound and vigorous, and able to carry another top.

The form of pruning best adapted to New South Wales conditions is a modification of what is known as the "vase" system on a low head.

This form of pruning properly carried out gives a tree strong branches, having a general upright tendency, that is able to carry its fruit without assistance, and that is effectually shaded in the centre from sunburn or scald. This latter consideration is of great importance, and, if neglected, it leads to serious loss in a hot climate.

The height at which the tree is to be headed will be influenced by location, as it has been found by experience in Califonia that the higher the prevailing summer temperature, and the greater the aridity, the lower the tree should be headed, and what applies there should apply here.

The advantages of low heading are accessibility of fruit, ease of pruning, symmetry, solidity, decrease of danger from winds, and greater facility to approach the tree with the horse in cultivation. Where the trees are properly trained with low heads and obliquely-rising branches, one can get much nearer to them than in the case of trees headed high, with horizontal or drooping branches. These are, however, not all the advantages of low heading. Another very important thing in a hot climate is the shading of the trunk and prevention thereby of sunburn, as well as shading the ground around the roots. It is also found that branches starting from near the ground make a more vigourous growth than when the tree is headed higher.

In order to get trees into the shape most desirable, it is necessary to commence on the young tree as soon as it is planted out. In choosing trees from the nursery, always select healthy, clean-grown trees—those with a stem free from laterals for the first 2 feet being preferable. Do not attempt any pruning before planting out, nor is it necessary to do any pruning in the nursery except it is to remove superfluous laterals in order to faciliate cultivation whilst in the nursery and packing the trees when dug.

Having thus secured good trees and planted them out, the first and most important step in the formation of your tree is taken. Whatever idea the grower may have as to shaping his tree, it must be cut back when planted. Lifting from the nursery has destroyed a part of the root system of the tree, and the top must be reduced accordingly. The grower who dislikes to sacrifice the fine top, will sacrifice future growth and vigour by retaining it. The tree may struggle through and regain vigour, but it will be for years smaller and less vigorous than if it had been properly cut back at first. I cannot emphasise this point too strongly, as on it depends, to a very large extent, the future vigour of a tree and its capacity to bear fruit.

The height at which the head should be formed will vary, as I have previously mentioned, with climatic conditions; but, as a general rule, I prefer to head at a height of from 15 to 18 inches.

Having decided on the height, the next thing is to remove the whole of the top, taking care to cut just above a strong bud, pointing in the direction of the prevailing wind, as this will tend to brace the tree against it, and keep an upright growth. The cut by which the top is removed should be as clean as possible, and if possible, it is an advantage for it to slope from rather than to the sun.

Having cut the tree to the desired height, allow the top three, four, or five buds to grow to their full extent, taking care that they come out at even distances along the stem, so as to get a properly balanced head; and it is better for them not all to start from the same height, but for each succeeding branch to be 2 to 3 inches lower than the preceding one, as this will tend to make a much stronger tree, and one less liable to split apart.

Having selected the necessary branches to form the future trees, the rest of the buds on the main stem should all be pinched back after they have made a growth of a couple of inches or so, so as to produce a tuft of leaves which will tend to protect the stem of the tree against sunburn till the top has made sufficient growth to do so. Should, however, your tree, when purchased from the nursery, have laterals along its whole length, it will be necessary to remove them all after cutting away the top, care being taken not to cut them too close and thus destroy the strong bud at their base, which will have to produce the future limb.

In forming the head be sure to have the main limbs well balanced; and, as a general rule, I may say, three branches are preferable to four, and four to five.

Generally speaking, it will not be necessary to do anything in the way of pruning during the first year's growth unless it is excessive and in danger of splitting the tree, when it may be necessary to shorten in; but, ordinarily, it is better to leave on the whole as a good root system will thus be developed, and the main stems strengthened. At the end of the year the tree should be cut back to within from 6 to 12 inches of the original height at which it was cut, the object being to produce a thoroughly strong foundation on which to build the future tree; as, should the young wood be left on and go to fruit, though an earlier return would be obtained, the tree would break, and at three to four years would be straggling and ill-formed, requiring to be propped all round to carry its fruit, which will also be of inferior quality. And in addition, it will be impossible to do anything with horse cultivation in such an orchard, as it would be impossible to get near the trees, thus requiring a large amount of costly and otherwise unnecessary hand labour. There is no economy in getting men to do labour at high rates which can be better and more thoroughly performed by a horse and at a vast saving of time and money.

The following spring, each of the tree, four, or five branches that have been left will throw out branches all along their length, and, of these, only the two upper ones on each branch, on opposite sides of the branch, and having an upward tendency, should be left. All the others, after making a growth of 2 or 3 inches, should be pinched back so as to produce a tuft of leaves, as was done on the main stem the first year, to shade the branches, and throw out fruit spurs, which will produce fruit the following year. At the end of the second year you will thus have a stocky, well-shaped, evenly-balanced tree, having six, eight, or ten well-developed branches, which will have to be shortened into a length of 15 to 18 inches from the previous year's cut. In the following spring, each of the six, eight, or ten branches are treated in the same manner as the three, four, or five branches were the previous year.

The result of these operations will be a strong, upright tree, of about 4 feet in height, ready to begin bearing, and one that will stand up under a fair crop of fruit evenly distributed over its branches. By this method of pruning, the orchardist will get his first fruit thirty months after setting out his orchard; but in many, if not most instances, it is advisable to delay a year longer, as, when cropping is commenced too soon, before the trees are able to stand their fruit, there is a risk of breaking them down, and also of materially injuring their future health and productiveness. It is like hitching up a raw colt and expecting to get the work of an old horse out of him, the result being he is broken down and useless just at the time when, had he been properly treated, he would have been of most value.

The following winter top growth should be again cut back, the amount to be cut depending on the strength of the tree and kind of fruit. Generally speaking, a good rule to go by is, the less the growth, the more in proportion should be cut back.

Under favorable circumstances, we shall now have a tree from 6 to 7 feet high when pruned, more if the growth has been extra, the branches of which have a general upright tendency, which will enable them to carry much more fruit than if left to struggle all over the place, and, moreover, cultivation may be carried right up to the trees. From this stage onwards the trees will only require a yearly shortening in, cutting out any branches that interfere with others, also, of course, all dead or dying branches. When it is found that the tree is of a spreading habit naturally, always, in pruning, cut to an inner bud, which will tend to confine it; and, if the tree is inclined to grow too upright, as is the case with some plums and pears, always cut to an outer bud; and, if it is desirable to continue the limb in a given direction, cut to an inner bud one year and an outer bud the next.

I have mentioned nothing about summer pruning, which, except in especial cases, is not applicable to fruit-growing for commercial purposes as, in order to be successfully carried out, it requires far more time and attention than the ordinary fruit-grower can give his trees, and to leave it to an ordinary hired hand would do for more harm than good.

Before I conclude, I will say a few words about general pruning, as applicable to existing orchards. In the first place, all branches crossing or in any way interfering with any other branch, should be removed; and, if the cut is a large one, it should be made with the saw, and the edges of the cut carefully trimmed with a knife, and the whole covered with grafting wax, or a dressing of shellac dissolved in alcohol to the consistency of paint, and applied with a brush. This entirely prevents the wounds souring, and when the edges of the cut have been well trimmed, a new growth of bark will soon cover the cut. All dead, broken, or dying branches should be removed, and also all branches growing from the under side of the limbs which tend to trail on the ground, or, at any rate, open up the top of the tree, letting the sun directly on the branches, thus scalding them, and causing much dead wood. The trees should also be gone over carefully, and thinned out, or shortened in where necessary; but, at the best, if the tree has been improperly started, it is a hard job trying to pull it into anything like a decent shape.

The tools required in pruning are a good knife, a pair of 9 inch shears, and a saw, of which the Hatch pattern of the California pruning saw, made by the Pacific Saw Company of San Francisco, is decidedly the best. This saw somewhat resembles that used by butchers, except that the blade is much narrower, $\frac{5}{8}$ of an inch in width being about the best size for general work. The blade revolves on a swivel, so that it can be used in any position required, and, as the teeth are fine, it makes a very clean cut. Another advantage of this saw is that, should you break a blade, you can fit in another in a minute or two.

The time to prune deciduous trees is when the sap is down, and leaves off the trees. Plums are generally the first ready, and are followed by pears, apricots, peaches, and lastly apples.

The general effects of pruning may be summarised as follows:—

1. Close pruning, when the tree is dormant, induces tree growth. Hence, if tree is a feeble, or has not grown as could be wished, it should be closely trimmed in the winter season, always cutting just above healthy buds.

2. A severe shock to the tree, whilst the sap is flowing freely, causes the tree to throw out fruit buds and spurs for the next season, and pruning whilst the tree is in blossom will cause that crop to set.

3. When tree growth is desired, prune whilst the tree is dormant; but if fruit is desired, prune either root or top whilst the sap is flowing.

4. For plums, prunes, and apricots, leave all the small spurs growing along the branches no matter whether the tree is young or old, for on them the bulk of the fruit is grown. Head in well from the outside, which tends to develop these spurs, and also strengthens the tree, and the fruit is grown where the tree is best able to bear it.

5. Apples, peaches, and pears are inclined to bear nearer the tips, and young trees should be well headed in during the winter season, both to give the tree symmetry and strength, and also to induce a more vigorous wood growth, and prevent a premature bearing of fruit—a fault that New South Wales fruit growers do not seem to appreciate, but which is, nevertheless, a very serious one.

PLANTS IN FLOWER AT CASTLETON GARDENS.—II.

Colvillea racemosa is a near relation of *Poinciana regia*, and, like it, is a native of Madagascar. It is a beautiful tree attaining a height of 40 or 50 feet. The leaves are about 3 feet long, deeply divided like a fern. The flowers are scarlet and the pods about 6 inches long. This tree bears the name of Sir Charles Colville, Governor of Mauritius, when Bojer discovered it in Madagascar.

Gloriosa superba is a very pretty climbing plant with strange-looking flowers of a deep rich orange and red colour. It is a native of tropical Asia and Africa, and was introduced into England about 200 years ago. It belongs to the same family as the Lily, but in outward habit and appearance, is very different. The recurved, erect petals were likened by Linnæus to flames. The leaves are remarkable in having their tips modified into tendrils.

Tectona grandis, the Teak Tree, flowers in November. It is a native of the moister districts of India. As a timber its commercial value ranks next to Mahogany.

Bignonia magnifica has large flowers, $3\frac{1}{2}$ inches across, varying in colour from delicate mauve to rich purplish-crimson, with a light primrose-colour throat. It is a native of Columbia, and was first introduced into English hothouses in 1879.

Randia Stanleyana is nearly allied to Gardenia, and is of a purple and white colour. It is a native of Sierra Leone.

DONATIONS TO THE DEPARTMENT.

Library.

From Secretary for Agriculture, Nova Scotia:—

Report Provincial Govt. Crop, August, 1892.

The Agricultural Act and amendments thereto.

Annual Report of the Secy. of Agriculture for the year 1890.

Proceedings and Journal of the Agri. and Hort. Soc. of India, April-June, 1892.—From the Society.

Proceedings of the Agri.-Hort. Soc. of Madras, April-June, 1892.—From the Society.

Bulletin Torrey Botanical Club. September, 1892. No. 9.—From Editor.

Sugar Cane. September 1, 1892. No. 278.—From Editor.

Chemist and Druggist, Nos. 646, 647. September, 1892.—From Editor.

West Indian and Commercial Advertiser, September, 1892.—From Publisher.

Times of Ceylon, Nos. 33 and 34. August, 1892.—From Editor.

Farmer and Fruit Grower, Nos. 36 and 37. September, 1892.—From Editor.

Supplement to the Leeward Islands Gazette. 15th Sept., 1892.—From Supt. of Agriculture.

Revue Agricole, &c. No. 5. May, 1892.—From Editor.

British Museum. Return 1891-92.—From Trustees of Brit. Mus.

Bulletin No. 69.—September, 1892.—From Royal Gardens, Kew.

No. 38. December, 1892.

BULLETIN

OF THE

BOTANICAL DEPARTMENT,

JAMAICA.

CONTENTS:

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JAMAICA:
GOVERNMENT PRINTING OFFICE, 79 DUKE STREET, KINGSTON.
1892.

EXPERIMENTS IN THE CULTIVATION OF VEGETABLES.—VI.

PEAS.

The following Tables are a continuation of those published in Bulletin No. 34.

Names of Peas grown at Cinchona.	Date of Planting in December, 1891.	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 Seeds Ripe.	Days from Planting.	Last Seeds Ripe.	Days from Planting.	Number of Pods on Plant—Average.	Number of Peas in a Pod—Average of 100.	Mean Average Temperature while Plants were growing.	Minimum Temperature.	Maximum Temperature.	Average Maximum.	Average Minimum.	Rainfall.	Number of Days on which rain fell.	Height in feet.	Time of Cooking in Minutes.	Quality.
Carter's Little Wonder ...	12th	24th	12	Dead.		.	.	.	.	.	.	.	.	.	63.0	54.2	71.9	68.5	58.3	2.93	13	.	.	.
" Stratagem ...	"	"	12	5.2.92	55	1.3.92	80	14	16.3.92	95	29.4.92	139	4	4	62–0	51.2	72.9	67.5	56.3	15.57	65	3	20	1
" Pride of the Market	"	"	12	2.2.92	52	7.3.92	86	14	20.3 92	99	30.4.92	140	4	3	62.0	51.2	72.9	67.5	56.3	15.57	65	2½	18	2
" Blue Express ...	"	"	12	17.1.92	36	5.2.92	55	18	6.3.92	85	29.4.92	139	3	5	62.0	51.2	72.9	67.5	56.3	15.57	65	3	15	1
" Anticipation ...	"	"	12	4.2.92	54	7.3.92	86	14	20.3.92	99	30.4.92	140	4	5	62.0	51.2	72.9	67.5	56.3	15.57	65	3½	20	2
" Wonder of the World	"	"	12	Dead.		.	.	.	.	.	.	.	.	.	63.0	54.2	71.9	68.5	58.3	2.93	13	.	.	.
" Balmoral Castle ...	"	"	12	2.2.92	52	1.3.92	80	15	26.3.92	105	28.4.92	138	7	5	62.0	51.2	72.9	67.5	56.3	15.57	65	5	20	1
" First Crop ...	"	"	12	17.1.92	36	12.2.92	62	12	8.3.92	87	30.4.92	140	5	5	62.0	51.2	72.9	67.5	56.3	15.57	65	3½	20	2
Laxton's Fillbasket ...	"	"	12	5.2.92	55	7.3.92	86	10	24.3 92	103	28.4.92	138	4	3	62.0	51.2	72.9	67.5	56.3	15.57	65	4	20	2
" William the First ...	"	"	12	18.1.92	37	1.3.92	80	14	27.3.92	106	30.4.92	140	6	4	62.0	51.2	72.9	67 5	56.3	15.57	65	5	20	3
McLean's Little Gem ...	"	"	12	31.1.92	50	24.2.92	74	12	20.3.92	99	10.4.92	120	5	3	61.5	51.2	71.9	67.6	56.1	14.11	53	2	18	2
" Blue Peter ...	"	"	12	Dead.		.	.	.	.	.	.	.	.	.	63.0	54.2	71.9	68.5	58.3	2.93	13	½	.	.
Advancer ...	"	"	12	18.1.92	37	22.2.92	72	18	20.3.92	99	30.4.92	140	7	4	62.0	51.2	72.9	67.5	56.3	15.57	65	4	20	3
American Wonder or Emerald	"	"	12	16.1.92	35	22.2.92	72	12	8.3.92	87	30.4.92	140	4	3	62.0	51.2	72.9	67.5	56.3	15.57	65	1	18	3
Bishop's Long Podded ...	"	"	12	31.1.92	50	11.3.92	90	12	30 3.92	109	28.4.92	138	6	8	62.0	51.2	72.9	67.5	56.3	15.57	65	2½	20	4
Sharpe's Invincible ...	"	"	12	5.2.92	55	3.3.92	82	14	1.4.92	110	30.4.92	140	5	4	62.0	51.2	72.9	67.5	56.3	15.57	65	4	20	3
Princess Royal ...	"	"	12	5.2.92	55	11.3.92	90	18	1.4.92	110	10.4.92	120	12	4	61 5	51.2	71.9	67.6	56.1	14.11	53	6½	20	1
Omega ...	"	"	12	Dead.		.	.	.	.	.	.	.	.	.	63.0	54.2	71.9	68.5	58.3	2.93	13	.	.	.
Kentish Invicta ...	"	"	12	17.1.92	36	5.2.92	55	18	9.3.92	88	29.4.92	139	9	5	62.0	51.2	72.9	67.5	56.3	15.57	65	5	15	2

Abundance ...	"	"	"	31.1.92	50	1.3.92	80	15	6.4.92	115	30.4.92	140	8	4	62.0	51.2	72.9	67.5	56.3	15.87	65	2	20	1
Carter's Dignity ...	19th	30th	11	12.2 92	55	15.3.92	87	12	1.4.92	103	1.5.92	134	5	5	62.0	51.2	72.9	67.5	56.3	14.38	61	6	15	1
" Progress ...	"	"	"	Dead.		.	.	.	.	.	.	.	.	.	63.7	55.2	72.2	67.0	56.1	6.11	21	.	.	.
" Empress ...	"	"	"	10.3.92	82	31.3.92	103	16	15 4.92	118	11.5.92	144	4	3	63.8	55.2	72.4	68.2	56.4	14.85	64	6	18	1
" Telephone ...	"	"	"	10.2.92	53	13.3.92	85	14	3.4.92	105	1.5.92	134	4	6	61.0	51.2	72.9	67.5	56.3	14.38	61	6	15	1
" Telegraph ...	"	"	"	10.2.92	53	12.3.92	84	18	6.4.92	108	11.5.92	144	6	5	63.8	55.2	72.4	68.2	56.4	14.85	64	7	18	1
" G. F. Wilson ...	"	"	"	12.2.92	55	14.3.92	86	14	6.4.92	108	11.5.92	144	5	5	63.8	55.2	72.4	68.2	56.4	14.85	64	5	18	3
" Elephant ...	"	"	"	Dead.		.	.	.	.	.	.	.	.	.	63.7	55.2	72.2	67.0	56.1	6.11	21	7	.	.
Laxton's Alpha ...	"	"	"	7.2.92	50	10.3.92	82	14	1.4.92	103	1.5.92	134	12	4	61.0	51.2	72 9	67.5	56.3	14.38	61	4	18	3
" Supreme ...	"	"	"	12.2.92	55	10.3.92	82	16	6.4.92	108	1.5.92	134	6	4	61.0	51.2	72.9	67.5	56.3	14.38	61	5	20	1
" Prolific ...	"	"	"	7.2.92	50	8.2.92	80	18	6.4 92	108	27.4.92	130	10	4	61.0	51.2	72.9	67.5	56.3	14.34	60	5	20	3
Sturdy ...	"	"	"	Dead.		.	.	.	.	.	.	.	.	.	63.7	51.2	72.2	67.0	56.1	6.11	21	.	.	.
Dickson's Favourite ...	"	"	"	Dead.		.	.	.	.	.	.	.	.	.	63.7	55.2	72.2	67.0	56.1	6.11	21	.	.	.
Sugar " Dwarf" ...	"	"	"	12.2.92	55	13.3.92	85	16	15.4.92	118	27.4.92	130	7	4	61.0	55.2	72.9	67.5	56.3	14.34	60	7	20	3
Early Sunrise ...	"	"	"	7.2.92	50	15.3.92	87	18	14.4.92	117	2.5.92	135	7	5	61.0	51.2	72 9	67.5	56.3	14.38	61	3	20	3
James' Prolific ...	"	"	"	Dead.		.	.	.	.	.	.	.	.	.	63.7	51.2	72.2	67.0	56.1	6.11	21	.	.	.
" Marvel" ...	"	"	"	12.2.92	55	8.3.92	80	18	13.4.92	116	11.5.92	144	3	2	63.8	55.2	72.4	68.2	56.4	14.85	64	6	20	1
Hundredfold, or Cook's Favourite ...	"	"	"	4.2.92	47	8.3.92	80	12	1.4.92	103	27.4.92	130	4	2	61.0	55.2	72.9	67.5	56.3	14.34	60	1	18	3
Duke of Albany ...	"	"	"	12.2.92	55	7.3.92	79	16	6.4.92	108	27.4.92	130	8	8	61.0	51.2	72.9	67.5	56.3	14.34	60	6	20	1
Champion of England ...	"	"	"	10.2.92	53	15 3.92	87	18	17.4.92	120	1.5.92	134	6	4	61.0	51.2	72.9	67.5	56 3	14.38	61	6½	18	1
British Queen ...	"	"	"	11.2.92	54	14.3.92	86	20	1.4.92	103	11.5.92	144	7	3	63.8	55.2	72.4	68.2	56.4	14.85	64	8	18	1
Tall Sugar ...	"	"	"	Dead.		.	.	.	.	.	.	.	.	.	63.7	55.2	72.2	67.0	56.1	5.57	19	.	.	.
Ne Plus Ultra ...	"	"	"	Dead.		.	.	.	.	.	.	.	.	.	63.7	55 2	72.2	67.0	56.1	6.11	21	.	.	.
Emperor of the Marrows ...	"	"	"	12.2.92	55	18.3.92	90	21	14.4.92	117	11.5.92	144	6	4	63.8	55.2	72.4	68.2	56.4	14.85	64	7½	20	2

W. H.

THE CULTIVATION OF PEAS.

Soil.—A good friable loam, in which there is plenty of lime, is the best for peas. The soil should be dug to a good depth so that the roots may easily penetrate downwards in time of drought, and the surface should be kept rather rough so that the rain water may not run off it, but pass through the soil.

Manure.—Well-rotted stable manure should be applied in greater or less quantity according as the soil is more or less poor, and it should be dug in about a foot below the surface.

The ground having been prepared, the first thing to be done is to mark the distances for the rows, and this will depend on the heights of the varieties selected. In previous numbers of the Bulletin, varieties growing from 3 to 5 feet in height, were recommended as being the most suitable for general cultivation. Tall growing varieties require to be planted not less than 7 or 8 feet apart, and in England they are often planted at twice or thrice that distance apart, and other low growing crops, such as turnips, &c., planted between the rows, it having been abundantly proved that the further the rows are placed apart, the better the yield and produce. As a rule, however, the distance between the rows may be about the same as the height to which the varieties usually grow. The rows should run from North to South.

Sowing the Seeds.—Having decided on the distances apart for the rows, and marked them with pieces of stick, a line should be stretched and drills made with a garden hoe, about 3 or 3½ inches deep, and about 6 inches wide, then the seeds should be sown, not too thickly, but allowing room enough for them to grow, without robbing each other of nourishment and moisture. A pint of good seed should sow a row 60 to 70 feet in length, or several rows equal in total length. When the seeds have been sown, the soil taken out of the drills should be broken fine with a rake if lumpy, and the peas covered with it, and lightly trodden.

As soon as the plants have grown a few inches, a little earth should be drawn by a hoe towards them, and this should be repeated as they advance. They should then be at once sticked, and as soon as the tendrils appear the sticks will be in readiness for them to lay hold of. Small sticks may be used at first, but as the plants advance in growth, taller, twiggy branches will be necessary. Two rows of sticks are needed for each row of peas, one on each side of the plants. In sticking, begin at one end of the row, put the sticks firmly in the ground, and slant those on one side slightly in the same direction, and if those on the other side of the peas are equally slanted in an opposite direction, a kind of lattice work will be formed and will be a good support for the plants.

If the weather be hot and dry, a thick layer of litter spread between the rows will be advantageous, by keeping the ground moist, and comparatively cool.

W. Harris.

INSTRUCTION IN THE CULTIVATION OF THE GRAPE VINE.

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

By permission of His Excellency the Governor it has been arranged that Mr. Thompson, the Superintendent of King's House Garden, shall give a series of brief practical demonstrations on living vines, giving hints on the care of the vine from the time of first putting in a cutting, the proper method of pruning, thinning the bunches, etc.

A large number of cuttings of vines of the best kinds were obtained some time ago through the Kew Gardens from the Royal Horticultural Society's Garden at Chiswick, and these have been planted in a portion of King's House grounds adjoining the East Lodge. When the vines are sufficiently old, the demonstrations will take place in this experimental vinery. Meantime permission was given by S. L. Schloss, Esq., for the work to be begun in the vinery at his pen, Collins Green, on the Halfway-Tree road. The first demonstration took place there on Saturday 12th November, at 4 o'clock.

The last demonstration there was given on 3rd December. This concludes the series on mature vines considered at this time of the year. During the two following weeks, Mr. Thompson gives demonstrations on the young vines received from Kew and planted near the East Lodge.

Present Treatment of Grape Vines.

In connection with his demonstrations at Mr. Schloss' Pen on the cultivation of the Grape Vine, Mr. Thompson has been requested to put down a few notes on the subject for the benefit of those unable to attend, and his remarks are given below. As regard the rest required by the vines at this time of the year in order that the wood may ripen, the practice in India is to uncover the roots in October when the rains are over, and allow them to remain bare for a month or two. At this time the leaves will have fallen, and the vines are then pruned. In the beginning of February, rich manure is dug in to help in the production of new shoots, leaves and blossoms. Sir E. Tennent in his work on "Ceylon" says that in that country, the roots of the vines are stripped "once a year, about the time of pruning, in July."

Mr. Thompson writes :—

"If by neglect the vines have got into an over-grown state, they should be gone over carefully and all the very small and thin shoots taken out. All laterals should be taken off the fruiting wood, at the same time great care must be taken not to rub or knock any of the foliage off the fruiting wood, for the leaves in this wood are needed to protect and develop the buds for fruiting next year. The leading growths of the vine must not be cut back at all until the pruning for fruit takes place about February.

"All lateral growths are a waste to the plant, if allowed to grow too long, and they should be pinched or cut back to their first leaf as soon as they have made about 4 inches of growth. When the next laterals make their appearance and are in the same stage of growth, they should be treated like those before. By so doing all the energy of the vine goes into the main growth, fruiting wood or fruit, instead of forming a number of small and useless shoots.

"The late rains are not good for vines, for they give them a tendency to shoot now, whereas at this time of the year, vines should be kept at rest as much as possible, and this can only be done by keeping the roots of the vines as dry as possible, so as to get the wood of the vine well ripened, for without well ripened wood, we cannot expect fruit next year. Vines in a proper state, with regard to pruning, and vines that have just done fruiting, will not need more attention of any kind before January. In the meantime the leaves should change colour and fall off the vine, and then the wood will eventually be in a ripe condition to prune for fruit."

PLANTS IN FLOWER IN CASTLETON GARDEN.—III.

Cinnamomum zeylanicum.—The Cinnamon Tree though small is singularly beautiful, being one mass of shining foliage. It is a native of Ceylon, where one variety grows in the forests even up to an elevation of 8,000 feet.

Cinnamon and Cassia are species which were known in the most remote times and were regarded as among the most costly of aromatics. The *Pharmacographia* quotes the offering much by Seleucus II. King of Syria, to the temple of Apollo at Miletus, B.C. 243 as consisting chiefly of vessels of gold and silver and olibanum, myrrh, costus, including also two pounds of Cassia and the same quantity of Cinnamon. After the Portugese had discovered the new route to India, by the Cape of Good Hope, they permanently occupied Ceylon in 1536, chiefly for the sake of the Cinnamon. Even twenty years later it was rare, if we may judge from the fact that it figures among the New Year's gifts to Philip and Mary (1556-57), and to Queen Elizabeth (1561-62).

Under cultivation, the Cinnamon tree is cut low down and only 4 or 5 shoots allowed to spring up. When these are about 2 years old and begin to turn brown, they are cut and the peel carefully separated into "quills." The outer bark is scraped off; and the quills, placed one inside the other, form the Cinnamon of commerce. (See Bulletin 26).

Cananga odorata.—The Ilang-Ilang Tree of Burma and Java, is a large tree with sweet-scented flowers. An otto prepared from the flowers is worth from 18s. to 22s. per ounce. Maccassar Hair Oil is said to be a solution of Ilang in Coco-nut oil.

A tree planted in Hope Gardens in 1886, attained in 6 years a height of 46 feet, with a girth of 38 inches at 3 feet above the ground.

Gordonia anomala is a handsome shrub with large white flowers, nearly related to the cultivated Camellia and to the Tea Plant. It is a native of Hong Kong, and flowers also at the Hill Garden at an elevation of 5,000 ft.

FERNS: SYNOPTICAL LIST.—XIV.

Synoptical List, with descriptions, of the Ferns and Fern Allies of Jamaica, by G. S. Jenman, Superintendent Botanical Gardens, Demerara, (continued from Bulletin No. 36.)

Genus XIII. *Cheilanthes*, Swartz.

Sori marginal, terminal on the veins, dot-like in form, more or less apart and remaining permanently isolated, with similarly isolated, scale-like, involucres covering a single sorus, or close together and eventually confluent, with more or less continuous involucres covering few or several sori; fronds usually small, veins free.

A small genus, widely dispersed over the island, and extending from sea level up to 5,000 or 6,000 ft. alt., occupying both open and shady situations but chiefly the former. In the separation or contiguity of the sori, and consequent form of the involucre, the members of the genus fall into two natural divisions.

a. Sori apart, permanently isolated, each possessing a separate scale-like, subreniform involucre.—*Adiantopsis*, Fée.

1. *C. radiata*, R. Br.
2. *C. pauperctua*, Mett.
3. *C. pedata*, A. Br.
4. *C. Reesii*, Jenm.

aa. Sori close, confluent at length, few or several together covered by the inflexed involucres.—*Eucheilanthes.*

5. *C. micromera*, Link.
6. *C. microphylla*, Swartz.
7. *C. marginata*, Hook.
8. *C. tomentosa*, Link.

1. *C. radiata*, R. Br.—Rootstock small, fibrous, upright. the crown scaly; stipites tufted, erect, slender, stiff, polished chestnut or blackish, often flexuose, $\frac{3}{4}$–$1\frac{1}{4}$ ft. l.; fronds bipinnate, firm, dark green, naked, pedatiform, composed of 7-9 tapering pinnæ, horizontally radiating like out-spread fingers from the summit of the stipites, varying in size. the central which is $\frac{1}{2}$–$\frac{3}{4}$ ft. l. and $\frac{3}{4}$–1 in. w. rather the longest, those on either hand gradually smaller. the inner pair very much reduced, costæ slender, channelled and scariose margined; segments very numerous even—or slightly serrulate—margined, horizontal, close, linear—oblong, 3–5 li. l. $1\frac{1}{2}$–2 li. w. apex rounded or acute, base truncate sessile, and slightly auricled on the superior side inferior reduced, the basal ones $\frac{1}{4}$–$\frac{1}{2}$ in. distant, and situated in the axils, forming a frill to the top of the stipites; veins oblique, pinnate, branches simple, forked in the basal auricle; sori contiguous, serial, forming a bead-like line around both the base and lateral margins; involucres thin, subreniform—Plum. Fil. pl. 100. *Adiantum*, Linn. *Hypolepis*, Hook. Sp. Fil. Vol. 2. t. 91. a.

Infrequent in distribution, but common where found, through most of the island, under the shade of forest, on stony ground or rocks, up to 1,500 ft. alt. The segments are eventually deciduous, the fronds consisting only of the naked costulæ, radiating from an excentric axis at the top of the stipites. It was first gathered by Sloane in "woods in the north side of the Island by the Old Town of Sevilla."

2. *C. paupercula*, Mett.—Rootstock small, erect, fibrous, the crown scaly; stipites tufted, slender, erect, polished chestnut or black, naked, fronds bi-tri-pinnate, 5–9 in. l. 3–5 in. w. firm, dark green, naked, ovate—or deltoid-lanceolate, broadest or not at the base, rachis and costæ channelled, very slender, polished and coloured like the stipites; pinnæ apart or subdistant, few or several, alternate, spreading, the lowest one or two pair sometimes branched at the base on the inferior side, those above these simply pinnate, and gradually reduced passing into the similar, pinnate terminal part, segments apart or contiguous, articulate, on minute black pedicels, ovate-oblong, 2–3 li. l. $1\frac{1}{2}$–2 li. b. both ends rounded, even— or the fertile distantly crenulate-edged; veins pinnate, branches few, simple, very oblique, sori small, distant, 1–5 to a segment, in slight hollows caused by the veins not reaching the edge; involucres thinly membranous, reniform.—*Adiantum pauperculum, Kunze. Hypolepis*, Hook. Fil. Vol. 2. t. 88. C.

Rare; St. Ann's parish, gathered near Ocho Rios by Mrs. Chisholm from whose specimens this description is taken; previously only known from Cuba. As in the preceding, the leaflets drop away in old fronds leaving the naked framework standing mixed with the younger fronds. At first sight it has the appearance of a finely divided species of *Adiantum*, to which genus it was originally ascribed.

3. *C. pedata*, A. Br.—Rootstock erect or oblique, the crown clothed with subulate brown scales; stipites tufted, $\frac{3}{4}$-$1\frac{1}{4}$ ft. l. strong, erect, polished, naked, fronds deltoid-acuminate, the larger tri-partite, naked, dark green, subcoriaceous, 5-9 in. l. and as much w. quadri-pinnate by one or two pair of the lower pinnæ being branched, the basal branch on the lower pair being deflexed and much elongated, rachis and costæ channelled, polished and coloured like the stipites; final segments pedicelate, even, or crenulate-edged 2-4 li. l. $1\frac{1}{2}$ li. w. acutely pointed or rounded, the base auricled on the upper side; veins pinnate, branches sinple, oblique, forked in the auricle, not reaching the margin; sori along both the upper and lower margins, 2-3 or 4 to each not reaching the base on the inferior side; involucres membranous, roundish or subreniform.—*Hypolepis*, Hook. Sp. Fil. vol. 2. t. 92. A.

Rare; gathered by Purdie in 1844 in the western part of the island. The habit is peculiar and characteristic. The pair of basal pinnæ are more or less distinctly alternate, and generally so much developed that the fronds present the form of three erecto-spreading divisions of which the centre is least branched; while in the largest fronds, by the great extension of the lowest under branch of the lateral pinnæ, the form is assumed of five nearly equal primary radiating divisions. It has been gathered in Cuba also by Wright.

4. *C. Reesii*, Jenm.—Rootstock fibrous, erect clothed with minute scales; stipites tufted, wiry slender, polished dark chestnut or blackish channelled in the upper half, 2-6 in. l; fronds multifid, lanceolate or ovate lanceolate, tripinnate, naked, dull dark green, membrano-chartaceous, 4-8 in. l. 2-4 in. w. rachis and costæ channelled, coloured and polished like the stipes; pinnæ numerous, contiguous, spreading uniform, alternate, lanceolate, the lower rather larger or not, $1\frac{1}{2}$-3 in. l. $\frac{1}{2}$-1 in. w. nearly sessile, tapering, terminating in a subentire serrulate bluntish point; pinnulæ merely lobed at the base, or $\frac{1}{2}$-$\frac{3}{4}$ in. l. 2-3 li. w. and fully pinnate at the base, with 2-6 somewhat spathulate segments on each side $1\frac{1}{2}$ li. l. $\frac{1}{2}$-1 l. w. the terminal larger and lobate at the base, all crenulate on the outer margin; veins pinnate, branches oblique, not entering the margin; sori contiguous 1-4 to the side of a segment; involucres delicate, subreniform, eventually concealed by the bright brown sori.

Rare, gathered at Oxford, St. Elizabeth's parish by the Rev. T. L. Rees. This has somewhat similar final segments to *pedata*, but with the habit though more compact of *microphylla*, from which the character of the sori and involucres and other characters readily distinguish it. This and the two preceding would appear to be local in distribution as they have each only been collected once.

5. *C. micromera*, Link.—Stipites tufted, terete, 4-8 in. l. dark coloured, naked or rusty-ciliate, the base tomentose; fronds oblong-lanceolate, stiffly erect, subcoriaceous, dark green, 4-8 in. l. $1\frac{1}{2}$-2 in. w. not or hardly narrowed at the base, bi-tripinnate, rachis and costæ like stipites, naked or viscose and dark tomentose, other surfaces glabrous; pinnæ generally approximate, spreading stiffly $\frac{3}{4}$-1 in. l. 2-4 li. w. sessile terminating in an entire acute lobe; pinnulæ close oblong or ovate-oblong, blunt acute, entire or auricled at the base or lobed or fully pinnate, $1\frac{1}{2}$-$2\frac{1}{2}$ li. l. $\frac{3}{4}$-1 li. w. the lobes very minute, veins pinnate, obscure; sori copious, confluent quite surrounding the segments; involucres firm rather broadly inflexed, continuous. Plum. Fil. t. 58. *C. microphylla*, Swartz, var *aspidoides*, Fée.

Plentiful on exposed rocks and stony banks at 5,000 ft. alt. in the same locality with *C. tomentosa* near the Government Cinchona Plantation. Distinguished from microphylla by its narrower, more compact and stiffer habit, broader firmer and more continuous invoulcres and absence of fragrance. There are two forms, in one of which the pinnæ are fully pinnate to the point, and in the other the outer part is only pinnatifid, the former having naked rachises, those of the latter being viscid and tomentose. The substance is opaque when dry.

6. *C. microphylla*, Swartz.—Rootstock shortly repent; stipites tufted, 6-9in. l. terete, flexuose, wiry, blackish, naked, or slightly ciliate; fronds lanceolate, $\frac{1}{2}$–1 ft. l. $1\frac{1}{2}$-4 in. w. tripinnate, broadest at the base, thin dull grayish-green, rachis and costæ wiry, black and polished, the former slightly flexuose, naked or viscose ciliate; pinnæ distant, spreading or erect-spreading, 1-2 in. l. $\frac{1}{2}$-1 in. w.; pinnulæ subdistant or approximate, only lobed or fully pinnate, nearly sessile, those on the inferior side of the lower pinnæ, the larger, 2-8 li. l. 1-3 li. w., the terminal segment largest, subovate, acute-bluntish. the lateral 1-2 li. l. $\frac{1}{2}$-1 li. w., ovate or oblong; veins pinnate, oblique, forked in the outer segments; sori confluent; involucres narrow, membranous, continuous or interrupted by the lobes.–Hook. Sp. Fil. Vol. 2. t. 98. A. Eat. Fer. N. Am. pl. 57., Sloane t. 13, f. 2.

Generally distributed all through the country on open banks and rocks from sea level up to 5,000 ft. alt; variable in width but uniformly of lax habit. Fresh fronds crushed in the hand emit a strong almond smell hence its local name of "Almond Fern."

7. *C. marginata*, H. B. K.—Rootstock upright or oblique, fibrous, clothed with dark subulate scales; stipites tufted, terete, stiff, wiry, dark polished, naked; fronds deltoid, or nearly so, tri-quadripinnate, 3-7 in. l. and about the same w., coriaceous, dark green, glabrous or the underside slightly lanate, rachis and costæ channelled, polished and coloured like the stipes; pinnæ spreading, the lower sub-opposite, the lowest pair, which are $1\frac{1}{2}$-3 in. l. 1-$2\frac{1}{2}$ in. w., being much the largest and most developed on the lower side, those above these gradually reduced passing into mere lobes at the top of the fronds; terminal segments linear-oblong, 2-3 li. l. $\frac{3}{4}$-1 li. w. final lateral lobes usually less than a line deep, the tips recurved when dry; veins pinnate, obscure sori confluent; permanently covered by the flat, coriaceous, undulate, involucres, which nearly meet from the opposite sides.—*Allosorus* Presl., and Mart. et Gall. *Pellæa*, Baker.

Plentiful on stony disintegrated banks, exposed or more or less shaded, near Old England, below the Government Cinchona Plantation, at 4,000 ft. alt. A widely spread tropical American species, first gathered in Jamaica by Purdie, varying much in size and consequently in the shape of the fronds, small fronds appearing almost tripartite, while larger ones are as nearly uniformly pinnatiform. In the former the under surface is naked and dark, but in the latter it is pruinose from a very slight lanate film that covers it. The texture is so elastico-coriaceous that the lateral lobes curl in drying, claw-like.

8. *C. tomentosa*, Link.—Rootstock shortly elongated, finely scaly; stipites tufted, 4-8 in. l. wiry, flexuose, silky with appressed pale tomentum; fronds oblong-lanceolate, tri-quadripinnate, 4-8 in. l. $1\frac{1}{2}$-3 in. w. not reduced below, pale light green, soft, rachis and other surfaces more or less freely clothed with wool-coloured tomentum; pinnæ spreading, or erecto-spreading nearly sessile, bluntish, generally distant, 1-2 in. l. $\frac{1}{4}$-$\frac{1}{2}$ in. w.; pinnulæ oblong, contiguous or more apart, 2-4 li. l. 1-$1\frac{1}{2}$ li. w.; final segments minute, concave, pod-like, $\frac{1}{2}$ li. or less deep and broad, ovate or subspathulate, rounded, terminal larger; sori confluent, at length filling the disk of the segment; involucres continuous, at first connivent.—Eat. Fer. N. Am. pl. 45. *C. Bradburii*, Hook. Sp. Fil. vol. 2. t. 109. B. *Physapteris*, Presl. *Myriopteris*, Fée.

Plentiful on exposed rocks at 5,000 ft. alt. near the Government Cinchona Plantation, growing in spreading tufts on the surface and in crevices of rocks which are well exposed; first gathered in Jamaica by Lambert. The sporangia are few and rather large. It seems to be local in distribution, and is the only species of the section known in the West Indies.

CONTRIBUTIONS TO THE DEPARTMENT.

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Seeds.

From Royal Botanic Gardens, Trinidad—
Livistona altissima.
From Botanic Station, Antigua—
Thrinax Morrisii (n. sp. from Anguilla).
From Botanic Gardens, Mysore—
Celastrus paniculata.
From Sir F. Von Mueller, Govt. Botanist, Melbourne—
Albizzia (Pithecolobium) canescens.
Atriplex halimoides.
Eucalyptus microtheca.
" citriodora.
Casuarina Cunninghamiana.
Pittosporum Ralphii.
Glycyrrhiza psoraloides.
From Botanic Gardens, Melbourne—
Cordyline superbiens.
Telopea speciosisima.
Nuytsia floribunda.
Pittosporum Colensoi.
Prunus pseudo-cerasus.
Eucalyptus drepanophylla.
Marsilea Drummondii.
R. B. Nunes & Co., Falmouth—
Artabotrys odoratissima.
Messrs. Machado, Kingston.
Havana Tobacco.
Messrs. Leonte Quesada, Kingston—
Havanna Tobacco.

Plants.

From Dr. Henderson, Kingston—
(Orchids) Cypripedium caudatum roseum.
Odontoglossum Harryanum.
Lycaste candido-rubra.
Miltonia vexillaria.

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