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Agricultural Bulletin

OF THE

— STRAITS —

AND

FEDERATED MALAY STATES.

FOUNDED BY

H. N. RIDLEY, C.M.G., M.A., F.R.S., &c., in 1891, and edited by him up to 1911.

AND CONTINUED BY

The Botanic Gardens Department Singapore,

No. 1. JANUARY, 1912. Vol. I.

CONTENTS.

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THIRD SERIES.

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SINGAPORE:
THE STRAITS TIMES PRESS, LIMITED.

INTRODUCTION

AS the Bulletins contain much material of great interest to Planters and Horticulturalists in general, I have endeavoured to form as complete an index as possible by including each article under its special heading. This has been a matter of extreme difficulty as many articles had no title so that in many cases one article may be found under one of two or three headings.

Many of our readers may be interested in some special subject and may not want to purchase a complete volume to obtain the necessary literature, so that I have given the Volume, the Month and the page in nearly every case. Should they desire some particular article, it will now only be necessary to write to the Botanic Gardens giving Volume and Month *(by the way, enclosing the cost of same).*

As the Bulletin has been edited largely for the help of Planters in general, I have also endeavoured to keep all the articles on Para Rubber by themselves. This method should greatly facilitate the reference to articles required by Planters which have appeared in the Bulletins.

I trust this has not been a labour in vain and that it will supply a long felt want.

JAS. W. ANDERSON.
Assistant Curator.

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AGRICULTURAL BULLETIN

OF THE

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No. 2.] FEBRUARY, 1912. [Vol. 1

VITALITY OF RUBBER SEEDS.

By F. G. Spring, Superintendent, Government Plantations, F.M.S.

Seeds of Hevea braziliensis do not retain their vitality for a long period and the consequent difficulty of forwarding them successfully to distant countries is well known. This year several hundred thousand Para seeds from tapped trees were packed in Venesta chests with charcoal and forwarded to Trinidad. The results obtained were far from satisfactory although the seeds were most carefully selected and packed.

There is no doubt that seeds picked immediately on falling, and carefully packed, give the best results. If they are allowed to be on the ground, or if badly packed, a smaller percentage of germination will be obtained. It must be borne in mind however, that no matter how the packing has been done, the vitality of Para seeds cannot be retained for any length of time if they are not gathered immediately. The seeds must not be packed too many in a box, otherwise fermentation starts and the whole mass heats and loses its vitality; the packing material must be just sufficiently moist to prevent the seeds from drying out and not moist enough to encourage the growth of moulds and bacteria. For the same reason the packing must be fairly tight and yet not quite air-tight. Small boxes seem better than larger cases.

Experiments have been carried out as mentioned in a previous article* at the suggestion of the Director of Agriculture to compare the germinating power of seeds from tapped and untapped trees (Expt. I.) and to see if by coating the surfaces of the seeds with various substances (Expt. II.) the germinating power could be retained for a longer period. The tapped and untapped trees selected for the experiments are 12 years old; the first mentioned have been tapped for the past 2 years, the seeds were collected fresh each morning and treated as mentioned in the following list.

Experiment I.

The Vitality of Seeds from Tapped and Untapped Trees.

All seeds were packed with burnt padi husk in biscuit tins, each containing 200 seeds. The tins were wrapped in brown paper and sealed.

Boxes Nos. 1, 2, 3, 4, 5 and 6 were kept 3, 5, 7, 8, 9, and 10 weeks respectively then opened, and the seeds planted in well prepared nursery beds. It will be seen from the tables that seeds from untapped trees gave on an average 50 per cent. higher germination than those from tapped trees reckoned on the absolute percentage. In each test the former showed from two to three times as many germinations as the latter.

A record of similar experiments is published in the Circulars and Agricultural Journal of the Royal Botanic Gardens, Ceylon, Volume IV., No. 11, May 1908. This circular states that "seeds from tapped trees kept for five weeks did not germinate but those kept for four weeks showed 28 per cent. germination while seeds from untapped trees kept for four weeks did not germinate and those kept for three weeks showed only 3 per cent. germination. Both in percentage, germination, and time of germination the seeds from tapped trees are better throughout." No information is given regarding the manner in which the seeds were kept previous to planting.

It will be seen that the Ceylon figures are at variance with those obtained here, but it is difficult to say why this should be.

The Ceylon Circular also states that seeds from tapped trees are smaller, weigh less per 1000 seeds than those from untapped trees. This agrees with the figures obtained here, namely, seeds from untapped trees were found to be on an average 10.7 per cent. heavier than those from tapped trees of similar ages. The figures in Experiment I. are of interest not only as regards the suitability of exporting seeds from untapped trees but they also tend to show the effect tapping has on the vitality of the seed. Tapping lessens the weight and size of the seeds, and according to the present experiments reduces the germinating power.

* Agricultural Bulletin of the Straits and Federated Malay States Vol. X. No. 11, p. 345, November 1911.

It is evident that seeds which are to be exported are best selected from untapped trees.

Experiments are to be conducted to compare the growth of plants resulting from seeds of tapped and untapped trees.

Table I.

Percentage of Seed Germination obtained from Tapped and Untapped Trees.

No of box.	No. of seeds in box.	Length of time the seeds were in boxes.	No. of plants obtained.		Percentage of seed Germination.	
			Tapped.	Untapped.	Tapped.	Untapped.
1	200	3 weeks	67	156	33	78
2	200	5 ,,	46	133	23	66
3	200	7 ,,	48	100	24	50
4	200	8 ,,	40	167	20	83
5	200	9 ,,	40	164	20	82
6	200	10 ,,	49	165	24	82

Experiment II.

The Preserving of Rubber Seeds from Tapped Trees.

The seeds in these experiments were collected and packed in a similar way to those in the first experiment but they were coated respectively with bees wax, hard paraffin, and vaseline. The bees wax and hard paraffin were melted and the seeds dipped into their respective liquids, allowed to solidify and then packed. Previous to planting the seeds, the hard paraffin, bees wax, and vaseline were removed.

The percentage of germination of untreated seeds from tapped trees can be seen by referring to experiment I. On comparing this with the seeds coated with bees wax it will be seen that the latter showed an increased germination to the extent of approximately 30 per cent. The seeds coated with hard paraffin gave better results than untreated seeds from tapped trees but not as good as those coated with bees wax.

The seeds treated with vaseline did not germinate. The coating of rubber seeds with any substance is undoubtedly an expensive treatment but if seeds have to be sent to countries which take from 1½ to 2½ months to reach and seeds from untapped trees cannot be obtained, then, I think that the extra percentage of germination resulting from seeds being coated with bees wax would more than repay the extra expense entailed by this system of treatment.

Table II.

Percentage of Germination of Seeds from Tapped Trees coated with Bees Wax and Paraffin.

No of box.	No. of seeds in box.	Length of time the seeds were in boxes.	No. of plants obtained.		Percentage of seed germination.		
			Bees Wax.	Paraffin.	Bees Wax.	Paraf-fin.	Untrea-ted.*
1	180	3 weeks	107	62	59	34	33
2	180	5 „	108	71	60	40	23
3	180	7 „	94	74	52	41	24
4	180	8 „	82	66	45	37	20
5	180	9 „	100	61	55	34	20
6	180	10 „	86	58	47	32	24

* Untreated seeds from tapped trees (see Expt. I.)

In no case was there apparent a large falling off in germinating power from the third to the tenth week.

It is hoped to repeat both experiments in 1912.

GOGO VINE.

(*Entada scandens*, Benth).

In the "Board of Trade Journal," September 14th last, reference is made to samples of "soap bark," the prepared bark of the Gogo Vine recently received from H. M. Consul at Manila, with the information that the material is suitable for the manufacture of soap and hair-washes.

From small specimens of the stem and prepared bark obtained from the Board of Trade, it has been possible to determine the material as the produce of *Entada scandens*. This is an immense climber cosmopolitan in the tropics, and may be readily recognised by its spirally twisted stems and huge pods which are from two to four feet long, containing hard polished flat circular seeds of a chestnut colour. So long ago as May, 1855, the late Mr. T. C. Archer presented to the Museum a similarly prepared sample of the bark under the same vernacular name, with a note to the effect that it contains saponaceous properties, forms a lather with water, and is much used by Manila ladies for cleaning the hair. The following particulars as to the mode of preparing the bark and its local appliations are gathered from "The Medicinal Plants of the Philippines,"

by T. H. Pardo de Tavera, p.106:—"The use made of the mashed bark of this tree is well known throughout the Philippines. Cut in strips and beaten thoroughly between stones it is sold under the name of 'Gogo,' it is macerated in water to which it imparts a reddish colour, and forms a substitute for soap. The Filipinos use this preparation for bathing especially the hair, for which purpose there is no more useful or simple preparation. It cures pityriasis, and renders the hair very soft, without drying it too much as is usually the case with soap. The natives use it in treating the itch, washing the affected parts with the maceration and at the same time briskly rubbing them with the bark; in this way they remove the crusts that shield the acari. The treatment is successful in direct proportion to the energy of rubbing. . . The maceration of gogo is emetic and purgative; it is used in the treatment of asthma; it is exceedingly irritating, the slightest quantity that enters the eye causing severe smarting and a slight conjunctivitis for one or two days."

The seeds, which contain saponin, are stated to be used by the Nepalese in the preparation of a hairwash. According to Watt (Dict. Econ. Prod., India,) the most general use to which the seeds are applied in India is for crimping linen. The Dhobis cut one side of the seed and scoop out the kernel then they introduce two fingers into the cavity, and quickly stroke the damp linen forwards with its polished surface. This crimps it beautifully crossways. The seeds are made occasionally into snuff-boxes and other articles, and are often carried long distances by ocean currents.—(*Kew Bulletin*, page 474—No. 10 1911)

J. M. H.

The subject of the preceding note (*Entada scandens*) is a fairly common plant throughout the Malay Peninsula where it is known under the native name of "Akar Beluru." The flowers are borne on spikes 6-10 inches long but are not attractive. The pod which is said to be 1-3 feet long is spirally curved into a mass in the Malay plants, and has the appearance of being far too heavy for so slender a climber, which however, depends on its tendrils for support. There is a model of the fruit in the collection at Raffles Museum.

R. DERRY.

FACTORIES ON PLANTATIONS.

The Selection of a Site.

The selection of a suitable factory site requires, in some countries, considerable thought. On hilly estates, it is customary to select some area as low, while as central, as possible. This generally enables the manager to economise in transport and sometimes to use water power.

On such properties, sites which are swampy, liable to flood, or unhealthy, should be avoided. It is often much cheaper to select a site at some altitude, and pump water up to the factory, than to choose a place convenient only for water and transport. In considering the site in relation to transport, it should be borne in mind that carrying the latex—which may contain more than 50 per cent. of water—to the factory is more expensive than subsequent transport of dry rubber to the nearest cart road. The selection of a site is also partly determined by the accessibility of the area for passengers and cart traffic, proximity to a good, clean supply of water, exposure to wind, and the character of the subsoil.

One difficulty frequently experienced, especially when artificial heating apparatus is not employed, is that of getting a good supply of cool air through the building. This defect is often due to the site not being at a sufficient altitude and to the building being closely surrounded by forest trees of the Hevea type.

Types of Factories Required.

The type of factory to be erected depends upon many conditions, such as the amount of the crop and the methods of curing and washing.

In order to meet crop requirements, care should be taken to ensure that extensions can be easily and economically made from time to time. This is particularly the case where small and similar acreages come into bearing regularly each year for many years in succession. Where the whole of the area is in bearing, the building need not provide for extensions to the same degree, though an annual increase in yield per acre must be allowed for.

The method of curing also has a bearing on the type of factory required. If vacuum driers are used, the size of the factory can be reduced. If artificial heating apparatus is provided the rubber is dried more quickly, and less space is therefore required in the curing section. The installation of heating apparatus, fans, etc., generally necessitate the erection of a two-storey building. Smoking must also be considered, though in many cases a separate building is erected for this phase of the curing process. Frequently, however, the rubber is smoked, while being cured, in a part of the factory permanently set aside for this work.

The kind of washing machine and position of shafting must also be considered in the erection of the walls and floor of a factory. There are some washing machines which have double or treble the working capacity of others, and which demand comparatively less space. Shafting, if overhead, may require wall brackets, which frequently necessitate an entirely different construction. Floor shafting, on the other hand, may be erected more or less irrespective of the materials used in the construction of the building.

Type Now Used on Plantations.

Though in the types of factories now used on plantations there is considerable variation, there is some ground for hoping that standardisation will ultimately be recognised. If rubber plantation factories were standardised, the cost would be appreciably lessened, and additions more easily made. A width of forty feet, with bays ten feet, has been suggested (Davidson, Souvenir, I. R. J.) as the standard to adopt.

On Eastern estates the factories are either : (1) entirely on ground floor, (2) two-storeyed (or more) throughout, or (3) two-storeyed only in the curing section. They are provided with a space for the engines inside the factory, or a separate building adjoining the factory is reserved as the power station.

Materials Used in Construction.

Most factories are steel-framed and covered with galvanized corrugated-iron sheets. Where the roof is not provided with a timber ceiling, the air is apt to get very warm in the tropics. The sides, or walls, are usually made of corrugated-iron sheets, similar to those used for the roof. On some estates timber is sometimes favoured, in which case it is advisable to use wood which has been impregnated with creosote, in order to preserve it against the attacks of white ants. Brick walls, between the iron columns, are not often erected, though they are always cool, durable, and neat.

Ventilation of Factories.

Apart from health reasons, there are many others why rubber factories should be well ventilated. Rubber contains a proportion of putrescible matter, and if the air is not kept pure, bacteria may appear in large numbers and lead to deterioration of the rubber during curing. Furthermore, drying is, even in dry weather, expedited if a good draught of fresh air is maintained through the building. The majority of factories rely upon open windows and doors, together with a fan, for their supplies of fresh air; expanded metal, which is so constructed as to allow of air currents, is now used, near the eaves or floor level.

Floors of Factories.

The ground-floor is, for durability and cleanliness, usually made of cement. It is, however, not uncommon to find white ants boring their way through thin layers of cement, and it is therefore necessary to see that this work is properly executed. In order that water may be carried rapidly away from the washing machines and drip racks, channels should be freely provided. The floor requires washing at regular intervals (preferably with water containing some cheap disinfectant) and it is therefore necessary to construct it with a slope of, say, one in eighty, to hasten drying.

Where one-storey buildings are installed with artificial heating apparatus, a timbered floor is often necessary. This may be provided with spaces for the passage of air, and be raised above the level of the ground to enable steam or hot-air pipes to be laid and to create a hot-air chamber in this region.

Light and Windows in Factories.

The bad effect of light on rubber, and the necessity of having abundance of light in the machinery sections, necessitate the adoption of a different arrangement in various parts of the factory. There can hardly be too many windows near the engines and washing mills. These should therefore be provided and constructed so as to open inwards for draught purposes.

In the curing room, however, windows must either be supplied with red glass, or curtains, to stop the chemical rays from reaching the rubber, or with wooden or corrugated iron doors—which can be opened from the inside to allow light to enter during inspection of the rubber. It is necessary that the rubber in the curing room be frequently inspected in order that the development of moulds and tackiness may be arrested in the initial stages; hence the desirability of having even the curing room well supplied with light under control.

Doors and windows should, whenever possible, be made to close on the inside in order that draughts of fresh air can enter the building without check.—(*India Rubber Journal.*)

POTATOES AND JERUSALEM ARTICHOKES FOR PIGS.

"In his valuable work on "Pigs and their Management," Mr. H.W. Potts, Principal of the Hawkesbury College and Experiment Farm, Richmond, New South Wales, gives a chapter on "Crops for Pigs." Amongst the roots and tubers he considers Jerusalem artichokes as a most valuable food. Why this crop has been so much neglected by Queensland pigbreeders is hard to understand, seeing that its cultivation is simple and the yield of tubers considerable.

Concerning roots and tubers generally as pig-food, Mr. Potts says that:—"All these, when fed continuously and exclusively to pigs, have a lowering tendency on the digestive functions, but that this is a matter which, in intelligent hands, can be controlled. The value and importance, he says, of root crops for pigs, particularly in our warm climate, are now widely recognised, in so far as they are used only as a succulent and relishable adjunct to other classes of food, richer in protein, and containing less moisture. A normal nutritive ratio must be maintained, and the success of feeding largely depends on the right interpretation of the balanced ration. We find that many root crops form excellent aids to the standard feeds.

"Amongst the domestic animals, none respond so readily to root crops as pigs. We have to admit that, under some conditions of climate, they are costly crops to raise, as they require large quantities of water. All things being equal, however, they provide a high percentage of digestible dry matter. Their value is chiefly emphasised in making available, during the hot, dry months of summer, and the cold months of winter, a succulent, relishable fodder, when our natural pastures and herbage are dry and scarce.

"Seeing they contain high percentages of water, starches, and sugars, it is essential, in the maintenance of a maximum growth in fattening swine, that they be combined judiciously with cereals, maize, flesh food, lucerne, pollard, skim milk, cowpeas, peas, beans, and other similar foods.

"A too wide nutritive value may create waste and check good growth by preventing the complete digestion of the protein, as well as permitting some of the starches to pass from the body as manure."

On the subject of

Potatoes

as pig food, the author says: "When fed to pigs, potatoes appear to agree with them better than other root crops, particularly when the ration is balanced with barley, maize, or oats and skim milk. The Danes secure very high returns with this class of food. The starchy matter of the potatoes is combined with the protein of the skim milk and cereals to formulate a well-arranged diet. The bacon made from pigs fed on these rations has a notable reputation.

"At the Wisconsin Experiment Station it was ascertained that 1 bushel of maize is equal in food value to 4½ bushels of cooked potatoes. In numerous experiments it was found that pigs always secured better flesh gains by being fed on cooked potatoes in comparison with those given raw.

"The use of potatoes as pig-feed can only be determined by the current market values. When potatoes are low in price, their use as a pig-food is justified; but, where potatoes are grown as a staple crop on the farm, there is always an unmarketable residue, and these can be fed to pigs with advantage. Pork raised solely from potatoes has a tendency to be very fat, and wasteful in cooking. In every instance they must be fed with other foods in which the percentage of protein is prominently high."

Artichokes.

"This is a flowering, perennial plant which has, in the past, been overlooked as a valuable food for pigs. It grows from 6 to 9 feet high, and when in bloom, seen from a distance, the crop looks like one of miniature sunflowers.

"The stalks are frequently used for feeding sheep or conversion into silage, and the tubers afford a palatable and succulent food for pigs. The plant is very persistent in growth, and, if raised, in suit-

able soil, is difficult to eradicate. Enough tubers, as a rule, are left each year to continue the crop; hence it is wise to set apart a permanent paddock for it, or the odd corners of a farm, or waste places of little value for other crops may be used for growing artichokes.

"The plant is extremely hardy; it resists frost and drought. Whilst the best crops are raised on good mellow loam, profitable yields are secured on stiff clay lands, light sandy or gravelly soils. The land is best suited where the drainage is good; in fact, any soil suitable for potatoes will answer for artichokes. It is a crop that requires little attention when it is established.

"The soil needs thorough cultivation. It should be deeply ploughed about May or June. During the winter it may be harrowed occasionally, lightly reploughed about September, and well manured as if for sweet potatoes. The tubers are then planted by dropping them into furrows 3 ft. apart, with a space of 2 ft. between the tubers. If the sets are small, plant whole, while large ones may be cut. Cover by turning a furrow over them. About 4 cwt. of tubers will plant an acre.

"The crop matures in five months. Should rain fall immediately after planting, the harrow may be run over the land to fine the surface. This should be repeated when the plants are about 4 in. high. It checks evaporation, destroys, weeds, and will not injure the crop. Later on, the cultivator should be kept moving between the rows about once a month.

"When the crop flowers and the tops droop and die, about April or May, it is ready for harvesting. The average yield will be from 7 to 8 tons per acre."

"Two varieties were tested at Hawkesbury College, and gave the following results :—

Jerusalem White	... ...	9 tons 1 cwt. per acre.
Jerusalem Pink	... .	6 tons 16 cwt. per acre.

"For feeding pigs it is best to turn them into the crop to root out the tubers. It must be remembered that, where it is desired to continue the crop, the pigs should be removed before all the tubers are eaten.

"Few foods are more relished by pigs. The tuber in the raw state is very nutritious, more especially for pregnant sows, and also sows reduced in weight and condition after suckling and weaning big litters.

"This class of food acts as a diuretic, or promotes a healthy action of the kidneys in secreting urine; it relieves constipation and stimulates liver function. One acre will support twenty sows from four to six months. Young growing pigs evidence considerable growth on being fed with them for a short period. The exercise obtained in harvesting or rooting up the tubers has a beneficial influence. It is especially notable that artichokes are very digestible.

"The outcome of a number of tests goes to show that, for fattening purposes, these tubers must be given with grain, and have a similar result to feeding with ordinary potatoes; 325 lbs. of wheat fed with 820 lbs. of artichokes gave 100 lbs. increase. The average composition of the artichokes is shown here in contrast with the potato":—

	Water.	Ash.	Protein.	Carbo hydrates.	Fat.	Nutritive Value.
Artichoke ...	79.5	1.0	2.4	16.7	0.2	1 : 7
Potato ..	78.9	1.0	2.1	17.9	0.1	1 : 8.6

JERUSALEM ARTICHOKE.

The culture of Jerusalem Artichokes (*Helianthus tuberosum*) has long been neglected in the Malay Peninsula. It is difficult to imagine why this should be so as their cultivation is of the easiest. Beyond deep changkoling of the soil and the keeping down of weeds, little further attention is required.

The tubers are used as a vegetable, sometimes as a dish but more usually for flavouring purposes. They are very popular with many Europeans, and as good vegetables are difficult to obtain, this plant ought to be more widely cultivated than it is at present. Plants will grow in almost any situation but the best results and largest tubers are obtained when they receive plenty of room and liberal treatment. Deeply changkol the soil and add to it a little well decayed cow manure about a fortnight before planting. Avoid using horse manure for various reasons.

The roots or tubers are planted in rows 2 feet apart and it is often as well to shade the plants when the leafshoots first appear. The stems do not grow to the height they do in Europe but they usually produce flowers, which is the exception in England. When the plants are about four feet high (usually their full height) the leaves wither and die. It is then that the tubers are in an edible condition.

When artichokes are grown as a vegetable for European consumption, it is not advisable to plant up a large area at once as the resultant tubers soon become discoloured and uneatable if lifted and stored, and if left in the ground for very long they would commence to sprout again. If a small bed is planted with tubers at the above mentioned distances and three weeks are allowed to elapse between each successive planting, a continuous supply of fresh tubers can be obtained. It usually takes from three months from the time the tubers are planted until the next crop is available.

The plant is really a Canadian sun flower.

J. W. A.

HORTICULTURAL NOTES.

Euphorbia pulcherrima or, as it is commonly called, Poinsettia pulcherrima is a plant frequently met with in the East. Its beauty does not so much reside in the flowers as in the bracts with which they are surrounded. It may be successfully grown in tubs or large pots, and small plants are admirably adapted for table decoration.

Owing to the amount of latex which exudes when a shoot is cut, the propagation of this plant is attended with considerable difficulty. It is practically useless to attempt to strike newly made cuttings, as the greater percentage will shrivel and die. Cuttings of Poinsettia, and this applies to many other lacticiferous plants, require to be slightly dried before they are inserted. Remove the shoots which can be spared from a plant and allow them to lie for about a fortnight in a shady, dry situation. The soft, sappy, useless shoots will immediately shrivel but the firmer wood at the base of the shoots remains sound. At the end of about a fortnight cuttings can be made and inserted in pots.

The size of the cuttings should be about four inches and it is essential that the base of the cutting be cut slightly below a node or bud, *i.e.*, where the stem is solid. The internodes or other parts of the stem are hollow and the shoot has generally to rot away until a solid piece of stem is reached. As may readily be imagined it is a matter of considerable difficulty to arrest the growth of this rot.

Insert the cuttings in six inch pots using a sandy compost. Cuttings root much more readily when placed round the side of a pot so that only four or five should be inserted round the side of the above mentioned size of pot. Until the cuttings are rooted, the soil requires to be kept slightly drier than is usually the case with other plants. Pot off singly into small pots and provide the same treatment afforded other plants of a like nature.

J. W. A.

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Do.	do.	London	35	10
Do.	do.	Liverpool	300	...
Do.	do.	U. K. &/or Continent	125	275
Cube Gambier	do.	United Kingdom	30	10
Black Pepper	do.	do.	10	...
Do.	Penang	do.	...	...
White Pepper	Singapore	do.	10	95
Do.	Penang	do.	...	...
Pearl Sago	Singapore	do.	5	15
Sago Flour	do.	London	150	175
Do.	do.	Liverpool	975	...
Do.	do.	Glasgow	...	50
Tapioca Flake	Singapore	United Kingdom	80	85
Tapioca Pearl & Bullet	do.	do.	190	75
Para Rubber	Straits & Malaya	do.	550	625
Gutta Percha	Singapore	do.	35	40
Buffalo hides	do.	do.	290	...
Pineapples	do.	do.	14,500	8,000
Gambier	do.	U. S. A.	225	85
Cube Gambier	do.	do.	30	80
Black Pepper	do.	do.	...	45
Do.	Penang	do.	...	20
White Pepper	Singapore	do.	35	70
Do.	Penang	do.	...	5
Tapioca Pearl	Singapore	do.	...	...
Nutmegs	Singapore & Penang	do.	9	22
Sago Flour	Singapore	do.	125	100
Pineapples	do.	do.	2,750	1,000
Do.	do.	Continent	2,750	2,500
Gambier	do.	South Continent	160	...
Do.	do.	North Continent	250	30
Cube Gambier	do.	Continent	45	30
Black Pepper	do.	South Continent	80	25
Do.	do.	North do.	15	25
Do.	Penang	South do.	10	20
Do	do.	North do.	...	...
White Pepper	Singapore	South do.	10	...
Do.	do.	North do.	50	20
Do.	Penang	South do.	10	5
Do.	do.	North do.	...	5

		STEAMERS.	Wired. Jan. 15 Tons.	Jan. 31 Tons.
Copra	Singapore & Penang	Marseilles	400	800
Do.	do.	Odessa	100	280
Do.	do.	Other South Continent	600	...
Do.	do	North Continent	880	1,275
Sago Flour	Singapore	Continent	1,500	825
Tapioca Flake	do.	do	95	55
Do. Pearl	do.	do.	35	15
Do. Flake	do.	U. S. A.	...	...
Do. do.	Penang	U. K.	...	50
Do. Pearl & Bullet	do.	do.	150	85
Do. Flake	do.	U. S. A.	...	...
Do. Pearl	do.	do.	25	350
Do. Flake	do.	Continent	10	...
Do. Pearl	do.	do.	75	270
Copra	Singapore & Penang	England	150	...
Gutta Percha	Singapore	Continent	75	50
Tons Gambier }	... ...	...	100	1,050
„ B. Pepper }			...	270
Para Rubber	Straits and Malaya	U. S. A.	25	30
Do.	do.	Continent	55	55

SINGAPORE MARKET REPORT.

January, 1912.

	Tons.	Highest	Lowest.
Copra	4,237	$10.85	$10.00
Gambier Bale	1,150	10.50	10.10
„ Cube No. 1 & 2 ...	398	16.00	13.50
Gutta Percha 1st quality ...	...	275.00	200.00
„ medium ...	...	140.00	90.00
„ lower ...	...	70.00	17.00
Gutta Jelotong	...	9.87½	8.25
Nutmegs 110s.	...	25.00	24.00
„ 80s.	...	27.00	26.00
Black Pepper	270	23.00	21.00
White „	149	34.00	30.50
Sago Pearl, small	181	5.40	5.30
„ Flour No. 1	5,173	4.30	4.25
„ „ No. 2	979	1.60	1.35
Tapioca Flake, small ...	578	9.10	8.90
„ Pearl „ ...	129	11.00	7.60
„ „ medium ...	267	9.10	8.50
Tin	2,410	95.45	92.00

PERAK.

Abstract of Meteorological Readings in the various Districts of the State of Perak for the month of November, 1911.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	Temperature. Mean Dry Bulb.	Temperature. Maximum.	Temperature. Minimum.	Temperature. Range.	Hygrometer. Mean Wet Bulb.	Hygrometer. Vapour Tension.	Hygrometer. Dew Point.	Hygrometer. Humidity.	Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
Taiping	...	105	79.35	91	70	21	76.09	856	...	87	...	23.24	2 56
Kuala Kangsar	...	...	78.45	93	69	24	75.08	826	...	86	...	10.03	4.71
Batu Gajah	...	95	79.81	90	71	19	76.46	867	...	87	...	13.43	2.33
Gopeng	...	...	78.88	90	68	22	74.71	807	...	82	...	15.38	4.19
Ipoh	...	...	80.29	91	70	21	75.78	830	...	80	...	8 52	1.62
Kampar	...	...	79.31	91	70	21	75 99	853	...	86	...	15.20	3.00
Telok Anson	...	...	79.64	93	71	22	76.47	869	...	87	...	14.08	3.20
Tapah	...	...	79.12	91	68	23	75.89	851	...	86	...	22.08	2.98
Parit Buntar	...	...	80.60	88	71	17	76.15	844	...	82	...	11.00	2.53
Bagan Serai	...	...	80.61	89	71	18	76.87	874	...	85	...	13.36	2 40
Selama	...	...	79.31	94	70	24	75.39	827	...	84	...	22.30	4.69
Lenggong	...	...	78.93	89	70	19	75.51	840	...	86	...	12.29	2.30
Tanjong Malim	...	...	80.17	92	69	23	77.24	897	...	89	...	9.93	1.77
Grit	...	...	77.34	91	67	24	73.55	779	...	84	...	9.01	1.84
Klian Intan	...	...	...	...	...	...	...	...	...	...	...	11.24	1.73
Pulau Bangkor Laut	...	...	...	...	...	...	...	...	...	...	...	9.14	1.78
Kuala Kurau	...	...	...	...	...	...	...	...	...	...	...	11.59	1.49
The Cottage	...	...	...	...	...	...	...	...	...	...	...	22.33	3.78
Maxwell's Hill	...	...	...	...	...	...	...	...	...	..	...	19.11	4.23

Office of the Senior Medical Officer,
Taiping, 14th December, 1911.

S. C. G. Fox,
Senior Medical Officer.

PERAK.

Abstract of Meteorological Readings in the various Districts of the State of Perak for the month of December, 1911.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
Taiping	...	105	80.11	91	70	21	76.43	863	...	85	...	18.97	3.48
Kuala Kangsar	...	...	78.89	91	69	22	75.42	837	...	86	...	9.97	2.62
Batu Gajah	...	96	81.08	91	71	20	76.30	845	...	80	...	12.79	2.40
Gopeng	...	...	78.98	90	69	21	74.59	799	...	82	...	13.22	2.02
Ipoh	...	...	80.98	93	71	22	76.57	856	...	82	...	10 62	1.93
Kampar	...	...	79.84	90	70	20	75.87	842	...	84	...	17.01	4.62
Telok Anson	...	...	80.50	93	70	23	76.77	875	...	85	...	16.57	3.55
Tapah	...	...	79.36	91	68	23	75.90	852	...	86	...	25.11	5.91
Parit Buntar	...	...	80.63	88	71	17	76.28	848	...	82	...	6.66	1.96
Bagan Serai	...	...	80.94	91	70	21	76.81	868	...	82	...	10.72	4.86
Selama	...	...	79.97	92	70	22	75.27	813	...	80	...	9.00	2.68
Lenggong	...	...	78.52	91	69	22	75.08	825	...	86	...	6.88	1.90
Tanjong Malim	...	...	79.72	92	69	23	76 82	885	...	89	...	12.09	2 67
Grit	...	...	76.69	92	66	26	72.78	756	...	84	...	11.80	3 37
Klian Intan	...	...	...	...	...	...	...	...	...	...	...	9.40	1.95
Pulau Pangkor Laut	...	...	...	...	...	...	...	...	...	...	...	11.46	1.87
Kuala Kurau	...	...	...	...	...	...	...	...	...	...	...	6.96	2.40
The Cottage	...	...	...	...	...	...	...	...	...	...	...	11.02	1.78
Maxwell's Hill	...	...	...	...	...	...	...	...	...	...	...	12.11	2 20

OFFICE OF THE SENIOR MEDICAL OFFICER,
TAIPING, 19th January, 1912.

S. C. G. FOX,
Senior Medical Officer.

SELANGOR.

Abstract of Meteorological Readings in the various Districts of the State of Selangor for the month of November, 1911.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
General Hospital, Kuala Lumpur ...	29.897	144.3	81.1	85.4	73.2	12.2	76.1	81.0	72.8	76	Calm.	12.25	2.46
Prisons " "	...	...	...	...	...	...	...	...	...	...	...	12.09	2.10
District Hospital "	...	...	...	...	...	...	...	...	...	...	...	9.59	2.38
" Klang	...	...	...	88.8	69.9	18.9	...	...	...	...	...	13.51	3.81
" Kuala Langat ...	...	...	...	85.9	73.7	12.2	...	...	...	...	...	9.98	2.95
" Kajang	...	...	...	85.1	74.9	10.2	...	...	...	...	...	11.56	2.18
" Kuala Selangor ...	...	...	...	86 9	71.6	15.3	...	...	...	...	...	4.80	1.05
" Kuala Kubu	...	...	...	89.8	70.5	19 3	...	...	...	...	...	17.94	3 90
" Serendah	...	...	...	92.1	70.3	21.8	...	...	...	...	...	14.68	2.06
" Rawang	...	...	...	90.9	72.4	18 5	...	...	...	...	...	13.43	2.08
Sabak Bernan	...	...	...	...	...	...	...	...	...	...	...	13.47	1.88

OFFICE OF THE SENIOR MEDICAL OFFICER,
KUALA LUMPUR, 3rd Jan., 1912.

G. D. FREER,
Senior Medical Officer,
Selangor, Negri Sembilan & Pahang.

KELANTAN.

Abstract of Meteorological Readings in Kelantan for the Month of November, 1911.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Mean Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 4 hours.
			Mean Dry Bulb.	Mean Maximum.	Mean Minimum.	Mean Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	%		Ins.	Ins.
Kota Bharu	...	142.0	78.4	81.88	74.03	7.85	76.2	.857	74.6	89.4	...	48.43	10.68
Kuala Lebir	...	...	75.8	83.9	72.4	11.5	74.5	.832	73.7	93.3	...	23.27	4.59
Kuala Kelantan	...	...	...	80.33	74.26	6.07	...	...	...	...	...	44.07	8.79
Kuala Pahi	...	...	...	80.76	72.53	8.23	...	...	...	...	...	23.54	3.55
Kuala Val Estate	...	...	...	80.53	72.70	7.83	...	...	...	...	...	31.71	6.12
Taku Plantation	...	...	...	...	...	...	...	...	...	...	...	26.79	4.10
Kenneth Estate	...	...	...	...	...	...	...	...	...	...	...	31.67	6.51
Pasir Jinggi ...	...	...	...	...	...	...	...	...	...	...	...	23.04	3.76
Chaning Estate	...	...	...	...	...	...	...	...	...	...	...	23.76	3.55
Pasir Gajah Estate	...	...	...	...	...	...	...	...	...	...	...	35.66	6.54
Pasir Besar	...	...	...	...	...	...	...	...	...	...	...	36.96	6.75
Pasir Puteh	...	...	...	...	...	...	...	...	...	...	...	39.37	8·37

RESIDENCY SURGEON'S OFFICE,
KOTA BHARU, 28th November, 1911.

JOHN. D. GIMLETTE.
Residency Surgeon, Kelantan.

KELANTAN.

Abstract of Meteorological Readings in Kelantan for the month of December, 1911.

DISTRICT.	Mean Barometrical Pressure at 32° F.	Mean Maximum in Sun.	Temperature.				Hygrometer.				Prevailing direction of winds.	Total rainfall.	Greatest rainfall during 24 hours.
			Mean Dry Bulb.	Mean Maximum.	Mean Minimum.	Mean Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	%		Ibs.	Ibs.
Kota Bharu	...	148.0	77.5	81.22	73.77	7.45	75.6	.829	73.6	89.4	...	50.72	11.05
Kuala Lebir	...	...	74.9	83.6	72.00	11.5	73.9	.810	72.9	93.4	...	23.55	4.30
Kuala Kelantan	...	...	...	79.93	74.16	5.77	...	...	...	...	...	47.95	11.39
Kuala Val	...	...	...	79.32	72.25	7.06	...	...	...	...	...	25.71	3.95
Kuala Pahi	...	...	...	80.00	71.83	8.17	...	...	...	...	...	23.49	2.86
Taku Plantation	...	...	...	...	...	...	...	...	...	...	...	24.64	3.57
Pasir Besar	...	...	...	...	...	...	...	...	...	...	...	28.16	6.80
Kenneth Estate	...	...	...	...	...	...	...	...	...	...	...	27.90	5.85
Chaning Estate	...	...	...	...	...	...	...	...	...	...	...	24.35	3.83
Pasir Jinggi	...	...	...	...	...	...	...	...	...	...	...	23.40	3.68

RESIDENCY SURGEON'S OFFICE,
KOTA BHARU, 20th January, 1912.

JOHN D. GIMLETTE,
Residency Surgeon, Kelantan.

NEGRI SEMBILAN.

Abstract of Meteorological Readings in the various Districts of the State of Negri Sembilan for the month of October, 1911.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
General Hospital, Kuala Lumpur	29.898	145.0	79.5	88.8	72.6	16.2	76.0	0.832	73.6	82	Calm	16.77	3.17
Pudoh Gaol ,, ,, ...	...	...	...	...	...	...	...	...	...	...	...	18.26	3.27
District Hospital ,, ...	...	...	...	...	...	...	...	...	...	...	...	13.20	4.09
,, ,, Klang	...	...	...	88.3	70.3	18.0	...	...	...	...	...	13.05	3.63
,, ,, Kuala Langat	...	...	...	85.9	73.4	12.5	...	...	...	...	...	9.56	1.95
,, ,, Kajang	...	...	...	84.4	74.9	9.5	...	...	...	...	...	15.34	2.88
,, ,, Kuala Selangor	...	...	...	86.2	72.2	14.0	...	...	...	...	...	13.35	2.90
,, ,, Kuala Kubu	...	...	...	89.4	70.5	18.9	...	...	...	...	...	19.63	2.78
,, ,, Serendah	...	...	...	91.4	70.5	20.9	...	...	...	...	...	19.72	2.54
,, ,, Rawang	...	...	...	90.7	72.8	17.9	...	...	...	...	...	14.77	1.89
Sabah Bernam	...	...	...	...	...	...	...	...	...	...	...	14.25	2.85

Office of the Senior Medical Officer,
Kuala Lumpur, 14th Dec., 1911.

A. J. McClosky,
Ag. Senior Medical Officer,
Selangor, Negri Sembilan & Pahang.

NEGRI SEMBILAN.

Abstract of Meteorological Readings in the various Districts of the State of Negri Sembilan for the month of November, 1911.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
District Hospital, Seremban	...	14.59	79.6	87.1	71.8	15.3	76.9	.874	75.1	85	N. W.	8.77	1.45
,, ,, Kuala Pilah	...	...	78 5	87.1	71.9	15.2	75.3	.819	73.2	84	...	10.90	3.14
,, ,, Mantin	...	...	...	...	...	...	...	...	...	...	...	11.05	1.65
,, ,, Jelebu	...	...	...	...	...	...	...	...	...	...	...	8.67	1.82
,, ,, Tampin	...	...	...	...	...	...	...	...	...	...	...	11.43	3.72
,, ,, Port Dickson	...	...	...	...	...	...	...	...	...	...	...	10.39	1.65
Beri-beri Hospital	...	...	...	...	...	...	...	...	...	...	...	11.83	2.56

Office of the Senior Medical Officer,
Kuala Lumpur, 3rd Jan., 1911.

G. D. Freer,
Selangor, Negri Sembilan & Pahang.

PAHANG.

Abstract of Meteorological Readings in the various Districts of the State of Pahang for the Month of November, 1911.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
District Hospital, Kuala Lipis	...	...	78.7	85.8	67.9	17.9	75.0	...	...	...	...	11.67	2.00
" " Raub	...	...	81.8	90.9	67.6	23.3	72.8	...	...	...	...	18.76	2.19
" " Bentong	...	...	80.2	88.3	71.2	17.1	75.0	...	...	...	...	19.64	3.80
" " Pekan	...	...	79.3	85.2	72.7	12 5	76.3	...	...	...	...	18.44	2.72
" " Kuantan	...	...	78.1	87.3	71.1	16.2	76.2	...	...	...	...	19.41	2.81
Dispensary, Temerloh	...	...	...	88.1	66.1	22.0	...	...	...	...	...	10.21	2.10
Sungei Lembeng	...	...	...	85.5	72.5	13.0	...	...	...	...	...	18.99	3.23
	...	...	...	...	...	...	...	...	...	...	...	...	...

OFFICE OF THE SENIOR MEDICAL OFFICER,
KUALA LUMPUR, 2nd January, 1912.

G. D. FREER,
Senior Medical Officer,
Selangor, Negri Sembilan & Pahang.

MINUTES OF A MEETING OF THE PLANTERS' ASSOCIATION OF MALAYA.

Held at 10.15 a.m. on January 7th, 1912, at the Selangor Club, Kuala Lumpur.

Present:

MR. E. B. SKINNER, Chairman.
MR. H. C. E. ZACHARIAS, Secretary.
MR. W. G. DOBSON, Legal Adviser.

and the following delegates:—

From Kuala Lumpur District Planters' Association:—Messrs. F. G. Harvey, H. F. Dupuis, A. J. Fox.

„ Klang District Planters' Association:—Messrs. J. Gibson, E. B. Prior, C. A. Buxton.

„ Kuala Langat District Planters' Association:—Messrs. E. Macfadyen, F. J. Dupuis.

„ Johore Planters' Association:—Mr. H. E. Burgess.

„ Taiping Planters' Association:—Mr. E. R. Salisbury.

„ Batu Tiga District Planters' Association:—Mr. H. L Jarvis.

„ Negri Sembilan Planters' Association:—Mr. A. Dupuis Brown.

„ Kapar District Planters' Association:—Mr. E. D. King Harman

and the following visitors:—

Messrs. L. Lewton-Brain, Director of Agriculture, J. Rea, C. K. Harrison, L. Morecambe.

1. The Notice convening the meeting having been read, the minutes of the previous meeting are taken as read, and on the motion of Mr. Gibson, seconded by Mr. Fox, confirmed.

2. Quarantine.

The Secretary reads the following letter:—

Kuala Lumpur, 23rd November, 1911.

Sir,—I have the honour to inform you that plans are being prepared for a quarantine station to supplement the accomodation at Pulau Jerejak which has been found to be quite inadequate. It is suggested that the site of the new Station should be at Port Swettenham but before coming to a final decision on the subject I should like to ascertain the views of the Planting Community who are directly interested in this matter, and I would suggest that a small Committee of the Planters' Association of Malaya should meet me in consultation with

the Principal Medical Officer and Director of Public Works with a view to discussing the plans and site.

I have, etc.,
(Sd.) E. L. BROOKMAN,
Chief Secretary, F.M.S.

The Secretary,
Planters' Association of Malaya,
Kuala Lumpur.

The Secretary reports that on December 3rd a deputation, consisting of Messrs. E. B. Skinner, E. B. Prior, F. G. Harvey, Dr. Watson, Macfadyen and H. C. E. Zacharias, met the Chief Secretary at Carcosa, Dr. Sansom, Mr. E. G. Broadrick and Mr. J. Trump being also present; that the site and plans of the prepared Quarantine Camp at Port Swettenham were discussed; and that a unanimous agreement on all points was arrived at.

Mr. E. B. Prior says the permanent quarantine camp, the Government had decided to construct at Port Swettenham, would be under the control of the Principal Medical Officer, Dr. Sansom, who had a large experience of quarantine camps in other parts of the world. He would therefore suggest that H. E. the High Commissioner be asked that the control of the quarantine camp at Pulau Jerejak be also under the control of the F.M.S.

The Chairman agrees with Mr. Prior regarding the quarantine camp at Penang, but said the great difficulty was that Pulau Jerejak belonged to the Colony, but he had already suggested that the F.M.S., should take a lease of the land, to get over the difficulty.

Mr. Macfadyen says the Port Swettenham camp was really the outcome of a sort of compromise; the Association asked that the Pulau Jerejak camp be placed under F.M.S. control; the Government could not see their way to do so and as an alternative consented to the Port Swettenham camp being built.

Mr. Prior: Hardly an alternative, Port Swettenham camp was an absolute necessity.

The Chairman's suggestion is embodied in Mr. Prior's motion, which is carried.

The Secretary reads the following correspondence, which is noted with satisfaction:

Kuala Lumpur, 6th December, 1911.

Principal Medical Officer,
Kuala Lumpur.

Sir,—I have the honour to enclose for your information copy of minutes of this Association, held on October 29th and would draw your attention to the last but two paragraphs on page 5.

I have etc.,
(Sd.) A. C. E. ZACHARIAS,
Secretary.

1251/1911 Kuala Lumpur, 7th December, 1911.

Sir,—I have the honour to acknowledge your letter of December 6th, 1911, enclosing copy of the minutes of a meeting of your Association held on October 29th, 1911. I have noted the suggestion made by the Chairman in the paragraph on page 5 and I shall have much pleasure in meeting with the wishes of your Association.

I have, etc.
(Sd.) C. L. SANSOM,
Principal Medical Officer, F.M.S.

The Secretary,
The Planters' Association of Malaya,
Kuala Lumpur.

3. Chinese Labour.

The Secretary reports that since the last meeting the Government had issued a notification that all Indentured Chinese Sinkeh labour would have to cease on July 1st, 1914. The Sub-Committee had not yet been convened and he was trying to arrange for them to meet the Protector of Labour and the Secr.tary of Chinese Affairs.

Mr. Jarvis would take this opportunity to bring to the notice of the meeting the exhorbitant wages paid at present to Chinese tappers, who in his district made as much as $1.20 a day, if he tapped 400 trees. He would propose—"That all Constituent Associations be circularized, to find out the rates paid to Chinese tappers with the object of endeavouring to standardize rates."

Mr. Gibson seconds the proposition.

Mr. Skinner considers the matter a purely local one and points out that conditions differ on different estates even in one and the same district.

Mr. Harvey thinks it more to the purpose if the employers of Chinese tappers were to meet and arrange these matters amongst themselves.

The motion is then put to the meeting and declared carried.

4. Javanese Labour.

The Secretary reads the following report, as received from Mr. H. J. Cooper on behalf of the Sub-Committee appointed.

The Secretary.
Planters' Association of Malaya.

Sir,—We, the members of the Sub-Committee appointed to enquire into the question of recruiting Javanese coolies have the honour to report:—

We were unable to arrange a meeting till the 3rd of December, when we met in Singapore and the same day had an interview with the Consul General for the Netherlands Indies and the Vice Consul.

We explained to the Consul at some length that our objects were to facilitate the importation of Javanese coolies, to reduce the cost by doing away with the middle-man's profit and also to secure a better class of labourer than many supplied by the present agents.

The Consul General received us very favourably and enquired from us the details of the present system for the recruiting of Indian labourers and the regulations of the Immigration Department. He advised us to see the authorities in Java as soon as possible and to take with us a detailed statement of the Indian Immigration system and copies of the enactments in force. It was possible that a similar system might be approved by the Dutch Government, but this could not be for some considerable time as it would mean the revision of all the existing enactments.

He then referred to the present system in Java by which certain firms were allowed to recruit coolies from the agricultural districts and said that he had no doubt that if we were to open an agency of our own in Java, in charge of approved persons, his Government would grant a licence, and we could then send out our own recruiters who would be registered at this agency and work under its supervision, more or less on the lines of the Madura Co. in India, but of course the coolies would be under the present system of indenture

The Consul General further advised that it would help us very much if we went to Java accredited by the Government of the Federated Malay States, in the same way as a similar mission under Mr. Carey some years ago.

We thanked the Consul General for his advice and suggestions, and on the 4th saw the Colonial Secretary who said that the High Commissioner would probably have no objection to giving us a letter to the Governor General if he first received an official letter from the Planters' Association of Malaya, appointing us as their delegates and mentioning the object of our mission, and we, therefore, suggest that this letter should be sent at once and that we should go over to Java at the beginning of February.

We need hardly point out that the establishment of some system of free recruiting in Java would be of incalculable benefit to the planters of Malaya, and now that we have received so much encouragement it behoves us to go ahead as quickly as possible and in connection with this the Consul General mentioned to us that the Sumatra planters were already moving in the matter and had sent a deputation.

We have the honour to be, Sir,
Your obedient servants,
H. J. COOPER and
(for Messrs. Maude and Pears,)
MEMBERS OF SUB-COMMITTEE.

The Chairman draws attention to the fact that no mention is made of the incidence of the expenses of the suggested visit to Java; and that the P.A.M. had no funds to meet this expenditure.

Mr. Gibson thinks every effort should be made to broaden the base of their labour force.

Mr. Macfadyen proposes that the letter referred to by Mr. Cooper be obtained from Government, provided the expenses of the Sub-Committee's visit to Java do not fall on this Association.

Mr. Fox seconds the proposal which is carried unanimously.

5. H. N. Ridley Fund.

The Secretary reports that $300 had been received to date.

The Chairman suggests that sufficient should be collected, enabling them to present a really valuable piece of plate to Mr. Ridley.

The Secretary is instructed to circularize again the various District Associations and to bring up the matter at the subsequent meeting.

6. London Exhibition, 1911.

The Secretary submits the following accounts received rom the Under Secretary:

MALAY STATES DEVELOPMENT AGENCY.

STATEMENT OF RECEIPTS AND DISBURSEMENTS ON ACCOUNT OF THE INTERNATIONAL RUBBER EXHIBITION.

RECEIPTS.	£	s	d	PAYMENTS.	£	s	d
Received from Crown Agents for the Colonies	138	16	0	Actual Disbursements as per Schedule B ...	984	3	6
Contributed by Rubber Companies	845	7	6				
	984	3	6		984	3	6

I certify that the above is a correct statement of actual Receipts and Disbursements.

(Sd.) W. T. TAYLOR,
18th August, 1911.

I certify this is a true copy.

(Sd.) H. VANE,
Treasurer, F. M. S.
28th December, 1911.

INTERNATIONAL RUBBER EXHIBITION EXPENSES FUND CONTRIBUTIONS.

Name of Contributors.	Amount. £	s	d
Bukit Rajah Rubber Company Ltd.	26	13	4
The Selangor Rubber Company Ltd.	50	0	0
Bukit Mertajam Rubber Company Ltd	10	10	0
The Rembia Rubber Estates Ltd.	10	10	0
Shelford Rubber Estate Ltd.	25	0	0
Straits Settlements (Bertam) Rubber Company Ltd. ...	25	0	0
Batu Caves Rubber Company Ltd.	25	0	0
The Klanang Produce Company Ltd.	25	0	0
The Sungei Salak Rubber Company Ltd.	20	0	0
The Johore Rubber Lands (Malaya) Ltd.	25	0	0
The Penang Sugar Estates Company Ltd.	20	0	0
The Rubana Sugar Estates Ltd.	10	0	0
The Straits Rubber Company Ltd.	20	0	0
Seafield Rubber Company Ltd.	50	0	0
The Carey United Rubber Estates Ltd.	25	0	0
The Damansara (Selangor) Rubber Company Ltd. ...	50	0	0
Harpenden (Selangor) Rubber Company Ltd. ...	25	0	0
Linggi Plantations Ltd.	117	14	2
The Kapar Para Estates Company Ltd.	25	0	0
The Ulu Rantau Rubber Estates Company Ltd. ...	10	0	0
The Federated (Selangor) Rubber Company Ltd. ...	25	0	0
The North Hummock (Selangor) Rubber Company Ltd...	25	0	0
The Kuala Selangor Rubber Company Ltd.	25	0	0
The Edinburgh Rubber Estates Selangor Ltd. ...	25	0	0
The Scottish Malay Rubber Company Ltd.	10	0	0
Riverside (Selangor) Rubber Company Ltd.	10	0	0
The Strathmore Rubber Company Ltd.	5	0	0
The Sungei Kapar Rubber Company Ltd.	25	0	0
The Tremelbye (Selangor) Rubber Company Ltd. ...	25	0	0
The Batu Tiga (Selangor) Rubber Company Ltd. ...	25	0	0
The Vallambrosa Rubber Company Ltd.	50	0	0
Total ...	845	7	6

I certify this is a true copy.

(Sd.) H. Vane,
Treasurer, F. M. S.

28th December, 1911.

B

Payments made by the Malay States Development Agency on account of the representation of British Malaya at the International Rubber Exhibition, Islington.

No.	Date.		Service.	Amount. £	s	d	Total. £	s	d
9	June	13.	L. H. Taylor, Petty Expenses	0	2	10			
10		15.	Do. do. ...	0	1	9½			
15		20.	Post Office—Postage ...	4	0	0			
15			L. H. Taylor—Tea for Special Typist	0	2	6			
16			L. Wray—Sundry Expenses	1	5	8			
17		21.	T. H. Reid—Postage ...	1	0	0			
17			Post Office do. ...	4	0	0			
18			C. S. S. A. Visitors' book for Exhibition	0	6	0			
19			M. R. Peacock—Postage ...	2	0	0			
20			Do. do. ...	1	0	0			
21			F. J. B. Dykes, Petty Expenses	0	2	0			
25		28.	L. H. Taylor do.	0	13	9			
26			Commissionaires employed at Exhibition June 19th to 25th	5	14	0			
27			Gratuity to Messrs. Pollitzer's men	0	15	0			
28		30.	Gratuities to Waiters at reception	1	12	0			
29			Refreshments provided at reception	21	5	11			
30			Payment on account to Cinematograph operator ...	2	2	0			
31			F. J. B. Dyke's Sundry expenses June	2	9	3			
							48	12	8½
8	July	1.	Puddicombe and Kay, cleaning stand June 24th to July 1st ...	1	10	0			
9		3.	Commissionaires employed at exhibition, June 26th to July 2nd	7	4	0			
11		6.	H. J. Badcock, mounting exhibits	1	18	6			
12			J. D. Hewett & Co., charges on railway frames ..	2	4	8			
13			Oliver Typewriter Co., Special Typists	5	0	0			
14			Raines & Co., enlarging photographs	35	5	0			
15			Townson and Mercer—Glass jars	1	8	0			
			Carried forward	54	10	2	48	12	8½

No.	Date.		Service.	Amount. £	s	d	Total. £	s	d
			Brought forward	54	10	2	48	12	8½
18	July	6.	Post Office rent of Telephone	4	0	0			
24		10.	L. H. Taylor, Petty Expenses	0	10	10			
26			Hill Siffken & Co., Invitation cards	7	10	0			
27			Piggott Bros. & Co. Ltd., on account	300	0	0			
32			Pathe Freres Cinematograph Film	18	6	4			
33			Commissionaires employed at exhibition, July 3rd to 9th...	7	4	0			
34			Puddicombe and Kay, cleaning stand to July 7th ...	1	10	0			
35			Lewis and Peat Transport ...	0	2	6			
38		15.	Commissionaires employed at exhibition to July 15th ...	7	4	0			
39			Cinematograph operator, balance of account ...	4	4	0			
40			Puddicombe and Kay, cleaning stand to July 14th ...	1	10	0			
43		17.	T. Cox & Son—Carpentering work	4	3	0			
44			International Rubber Exhibition Tickets	6	8	0			
45			Gratuities to Commissionaires and others	1	6	0			
46		19.	Union Bros., Printing ...	25	10	0			
47			Stroud and Co., Foliage plants	18	0	0			
48			Lanadron Rubber Estates Ltd. Refund insurance ...	1	0	0			
50			L. H. Taylor Petty Expenses	0	9	4			
53		21.	L. Wray do. ...	0	6	6			
54			F. J. B. Dykes do. ...	0	17	4			
56		26.	Agricultural Hall Coy. Electric power Cinematograph...	4	15	0			
57			L. Wray, Hotel Expenses, etc.	15	19	10			
							485	6	10
8	Aug.	12.	The Tella Camera Coy., photographs	1	1	0			
9		14.	International Rubber Exhibition, Banquet Guarantee ...	4	8	7			
10			Piggott Bros. & Co. Ltd., balance of account	182	17	6			
11			W. T. Taylor, Stamps ...	0	2	7			
13			Lanadron Rubber Estates Ltd. Mitchell's Expenses ...	72	0	0			
			Carried forward	260	9	8	533	19	6½

No.	Date.	Service.	Amount. £ s d	Total. £ s d
		Brought forward	260 9 8	534 4 6½
25	18.	Executor of Thomas Drew, rent of store	7 10 0	
26		Beck & Pollitzer, accounts ...	113 3 8	
				381 3 4
☞		Cost of Pamphlets and post-cards distributed by the F. M. S. Information Agency ...		69 0 7½
		Total ...		984 3 6

I certify this is a true copy

(Sd.) H. Vane,
Treasurer, F. M. S.
28th Dec. 1911.

The Secretary further reports that the total cost of this exhibition had been $14,501.66, as compared with $9,031.92, the cost of the 1909 Exhibition.

The following contributions had been made:

The Government of the Straits Settlements ...	$ 2,000.00
" F. M. S. ...	4,000.00
Rubber Companies: collected in London, £845 7s. 6d.	7,246.07
" " K. Lumpur ...	1,010.64
	$ 14,256.71

leaving a deficiency of $ 244.95, which had been defrayed by the P. A. M. This sum included $ 98.35 due by various exhibitors for duty; but the various amounts were so small that he considered it impracticable to recover same.

Mr. Gibson proposes, Mr. Harvey seconds, and it is resolved unanimously, to pass the accounts as above set out and to pay the deficiency of $244.95 out of the funds of the Association.

7. Standing Committee.

Mr. A Dupuis Brown proposes: "That in view of the rapid expansion of the rubber industry and the great importance of keeping the planting community informed of all legislative or other measures which may in any way affect its interests, the P. A. M. appoint a Standing Committee of five from amongst its members in addition to the Chairman and Secretary, to consider such measures and communicate its opinions to the district associations, also to act as a consultative body for dealing with the current work of the P. A. M." and submits the following elaboration of the scheme:

REASONS FOR ITS PROPOSED CREATION.

1. The Meetings of the P. A. M. are held at irregular intervals and in the interim the Secretary has no opportunity of consulting the representatives of the Association.

2. He is, therefore, unable to proceed with negotiations on a given subject until he has received fresh instructions from a subsequent meeting. For this reason such negotiations are likely to be unduly protracted.

3. Under present arrangements the delegates to the P. A. M. are expected to pass very important resolutions, affecting the entire planting community, without any opportunity for mature reflection or for consultation with their respective district associations.

CONSTITUTION.

1. I think the first and chief consideration is to get men who are willing and able to attend the meetings of the standing committee.

2. For this reason I should advocate the appointment of those who live within a fairly easy distance of Kuala Lumpur.

3. At the commencement the standing committee could be formed of 5 of the delegates with power to add to their number, the Chairman and the Secretary of the P. A. M. being *ex-officio* members.

4. The standing committee should meet at least once every month. Additional meetings to be convened on the requisitions of the Secretary of the P.A.M. or of two members of the standing committee.

FUNCTIONS.

1. To consider all draft enactments of the F.M.S. Government and to take steps to call the attention of the P.A.M. delegates to any proposed legislation which is likely to affect the interests of the planting community.

2. To authorise the Secretary of the P.A.M. to continue negotiations and correspondence if in accordance with the policy determined at the meeting of the P.A.M.

3. To sift and prepare the matter intended for discussion at the meetings of the P.A.M.

Mr. Macfadyen is afraid that the creation of this committee would emphasize still further the preponderance of Kuala Lumpur. He would therefore suggest that members from other States be eligible, and if that was agreed to, he had much pleasure in seconding the proposition

Mr. Burgess thinks that Johore would certainly like to be represented.

Mr. Skinner suggests one member for each State.

Mr. Gibson considers, that if the Association found the intervals between meetings too long, a better plan than appointing a committee, which would in a way usurp the rights of delegates, would be to hold meetings of the Association oftener.

Mr. Dupuis Brown says even if the Assoiation did meet twice every month he still thought a standing committee should be formed to boil everything down and prepare it for the Association meetings.

The motion is then put to the meeting and carried by 8—2.

Mr. Dupuis Brown proposes that the Committee be forthwith appointed.

Mr. Gibson is in favour of leaving this over until the Annual General Meeting.

The Meeting decides in favour of Mr. Gibson's suggestion by 9 votes to 5.

8. New York Exposition.

The Secretary submits the following correspondence:—

Malay States Information Agency,
London, E.C., 3rd November, 1911.

Dear Sir,—I beg to forward for the consideration of your Association copy of a letter received from Mr. A. Staines Manders, regarding a Rubber Exhibition to be held in New York in September and October, 1912.

Mr. Staines Manders calls attention to the fact that the charge for space will be 8/4*d.* a square foot as against 4/- a square foot which was charged at the Agricultural Hall, Islington. Other expenses also would probably be higher than in London.

Mr. Staines Manders is very insistent as to the benefits likely to result from Plantation Rubber being made better known in the U.S.A.

I have communicated Mr. Staines Manders' letter to the F.M.S. and to the Straits Governments.

The Secretary,

I am, Dear Sir,
Yours faithfully,
(Sd.) W. T. TAYLOR.

Planters' Association of Malaya,
Kuala Lumpur.

London, W. C., 2nd November, 1911.

The Secretary,
Malay States Development Agency,
88, Cannon Street, E.C.

Dear Sir,—I have recently returned from New York, U.S.A., which I visited by invitation of several gentlemen, for the purpose o

discussing the matter of a Rubber Exposition in New York. After numerous meetings and on the advice of Mr. Henry C. Pearson, Editor of the "India Rubber World," New York, it was decided to hold an Exhibition under the above title in Sept. of 1912, Mr. Pearson being the active Vice-President, and under the auspices of the International Exposition Company, an incorporate body of New York. All necessary finances for the organisation have been provided and the Exposition will comprise the following sections, and will be one of considerable importance.

1. Crude Rubber—indigenous and plantation.
2. Manufacturers, and Machinery Makers.
3. Kindred Trades.

Mr. Pearson is of opinion that it is a unique opportunity (see his remarks *re* Brazilian rubber) for the producers of plantation rubber to come forward and secure a much larger proportion of the trade of America.

From enquiries I made, and conversations I had with experts I found the one opinion general, *viz.*, that the manufacturers are eager for more knowledge than they now possess regarding plantation rubber. Further, my experience was that they were thirsting for information, and as the "India Rubber Journal" says, the opportunity will not occur again for a while. My advice is that planting countries should take part, though there will be no necessity to make the expensive display they did in London this year. What they require is a good, comprehensive exhibit of plantation rubber, plenty of literature, and above all, a good Representative able to give full information, and to be able to write up a report on the details he received as to the requirements of manufacturers, etc.

The Exposition will be open for ten days; Conferences will be held under the Presidency of Mr. Henry C. Pearson, but no Conference book will be published though full reports will appear in the "India Rubber World," New York.

Indigenous rubber countries will be well represented, and plantation should also. There is no doubt in my mind, and I should not say so unless I believed it, that the prospects for plantation rubber in the States are enormous if it is shown to the manufacturer in a proper way. We shall have the American manufacturers at the Exposition, and those who do not exhibit will be there to seek information regarding plantation rubber as they know all that is possible *re* Brazilian.

The rates for space will be slightly higher than in London but this is counterbalanced by the fact that we lay down the platforms and cover them for exhibitors, so that they only have the fitting up of the stands to do.

I shall be glad if you will kindly take up the matter with your Colony and hoping they will exhibit,

I am, etc.,
(Sd.) A. STAINES MANDERS.
Organising Manager.

Rate for space = $2 (8/4d) per square foot which includes covered platform specially laid for each exhibitor.

H. C. E. Zacharias Esq., New York, November 6th, 1911.
Secy., Planters' Assn. of Malaya,
Kuala Lumpur, F.M.S.

Third International Rubber and Allied Trades Exposition.

Dear Sir,—I take pleasure in informing you that the Third International Rubber and Allied Trades Exposition will be held at the New Grand Central Palace, 46th to 47th Street and Lexington Avenue, New York City, from the 23rd day of September, 1912, to October 3rd, 1912. You will probably remember my name as the organizer of the successful rubber expositions in London in 1908 and 1911. Further particulars will be sent you in due course, and I trust that you will give the exposition your kind support.

Yours very truly,
(Sd.) A. STAINES MANDERS,
Organising Manager.

P. S.—My friend, Mr. Henry C. Pearson, Editor of the "India Rubber World" has very kindly consented to become the Vice-President of the exposition.

No. 3 in 7950/1911. Kuala Lumpur, 12th December, 1911.

Sir,—I am directed to inform you that a Rubber Exhibition will be held in New York in October next and that the Government has under consideration the advisability of arranging for the Federated Malay States to be officially represented. I enclose a copy of a letter which has been received from Mr. A Staines Manders, Organizing Secretary, and I am to enquire what prospect there is of Planters in the Federated Malay States taking part in the Exhibition and what financial support may be expected from them towards defraying the necessary expenses.

2. A letter has been received from Sir. W. Taylor stating that he has been making enquiries as to how the proposal is regarded by the Rubber Growers' Association and others in Great Britain connected with the industry, and he is informed that the proposal has been received with favour generally and that the impression appears to be that Plantation Rubber interests might be benefited.

3. The expenses are likely to be greater than the expense incurred in connection with the recent exhibition in London.

4. If it is decided to take part it is hoped that a good display of exhibits from the Federated Malay States will be guaranteed.

The Secretary,
Planters' Association of Malaya,
Kuala Lumpur.

I have etc.,
(Sd.) F. E. TAYLOR,
Ag. Under-Secretary, F.M.S.
13th December, 1911.

Under-Secretary, F.M.S.
Kuala Lumpur.

Sir,—I have the honour to acknowledge receipt of your letter 3/7950 dated yesterday, contents of which I will place on the agenda of our next meeting to be held on the 7th proximo.

I have etc.,
H. C. E. ZACHARIAS,
Secretary.

Mr Harvey: May I suggest the Association be not represented in New York.

Mr. Macfadyen: seconds.

Mr. Gibson: I think the New York Exposition will be fruitful of good results and it will be foolish indeed not to be represented. We know perfectly well that America is a big consumer and is likely to increase, and I think if we made a good show in America it would be to our own benefit. I feel confident of the fact that we have only to get the Yankee to take to using our rubber in real earnest, to see another rubber boom. We have only to show him we can produce goods as good as are produced in other parts of the world. It would be wanting in energy and enterprise if we were not represented.

Mr. Dupuis Brown supports Mr. Gibson's contention.

The Chairman thinks it would be a great pity to decide that the Association be not represented and suggests circularizing the various Planting Companies, to get their views on the subject.

Mr. Macfadyen explains that he had seconded the proposition, not because he thought it undesirable that the Malay Peninsula should be represented, but because he had misgivings that it would be well represented. The last Exhibition in London had strained their resources and he was afraid that contributions might not come forward as readily as was necessary, to get their industry adequately represented.

Mr. Harvey's motion is put to the Meeting and declared lost by by 8—4.

Mr. Gibson then proposes and Mr. Fox seconds that the Secretary communicate with the Government of the F.M.S and S.S. and with the Rubber Growers' Association and solicit their co-operation in the matter.

The motion is carried by 10—2.

9. The Labour Enactment, 1911.

The Secretary informs the meeting that at a meeting of the Taiping Planters Association held on the 8th ultimo the following resolution was passed: "That the Labour Enactment, 1911, be cancelled or at least considerably modified."

He explains that previous to this he had received notice of a motion from Mr. Macfadyen on the same subject and had consequently placed Mr. Macfadyen's motion on the Agenda

Mr. E. Macfadyen, proposing "that this Association strongly deprecates the precipitancy with which the Labourer,s Enactment, 1911, was passed through the Federal Council, said that for a law conferring such wide and far reaching powers upon the executive, the Labour Enactment, 1911, appears to have been passed after only the most perfunctory deliberation. No one would suggest that Government resorted to secrecy in order to faciliate its passage. We are under no delusion as to the real powers of Government in regard to legislation whatever fictions may be maintained about their sharing such powers with Councils or Committees. There may be limits to the powers of Government in administering some of their laws; but in the making of them they are absolute. The burden of my complaint is that Government has no moral right to pass a law such as this, whatever its actual power, without giving members of Council an opportunity to consider its nature and probable effects.

The official apology for a degree of haste admitted to require apology was that the law would only be applied in one instance. Surely this is an aggravation rather than an extenuation of the circumstances. If Government may take an employer into court when they see their way to a conviction; and when they did not, may make a new law to meet his special case, it must be patent that there ceases to be any guarantee for commercial enterprise at all. The whole proceeding appears to be against any right principle. This very instance might be so handled as to do infinite damage to the reputation of our government for fair play; which is one of the chief commercial assets of this country.

I am not concerned to argue that the powers conferred should not, in the peculiar conditions of the labour situtation here, be in existence. My contention is that such powers ought not to be exercised by government officers on the advice of other government officers alone. To remove the labour force from an estate, by a stroke of the pen, is to annihilate that estate as a profit-earning concern; and I urge upon the members of Council to secure the provision of adequate safeguards against the possible misuse of such extreme powers. Whether the necessary safeguard should take the form of a reference to the council itself or to a Committee of the council or to somebody appointed *ad hoc*—is not for me to say: but I do say emphatically that without such a reference, the perpetuation of this enactment would be highly dangerous. If unofficial opinion

had to be consulted in some form or other the position of government would be strengthened; the public would be given the security it has a right to demand and it is more than probable that in most cases a resort to extreme measures would be rendered unnecessary by the pressure which might in this way be brought to bear. Some such machinery would have been elaborated, I feel sure, had even 48 hours been allowed on deliberation: and that this could not have been granted, it is impossible to believe, seeing that eight days were allowed to elapse before the powers conferred were made use of I move "that this Association strongly deprecates the precipitancy with which the Labour Enactment, 1911, was passed through Federal Council."

The Chairman thinks every member of that Association would have voted for the Bill after having heard the guarantee of the Government, who were about to redraft the Bill. The conditions of the Tamil labour force on the estate referred to were an absolute disgrace. All the unofficial members of the council objected to the procedure, but it was felt it was not right to vote against the measure after receiving the Government's guarantee that the enactment would only be applied to one group of estates, and that a fresh Bill would be submitted to them at the next Federal Council. He felt confident from what Sir Arthur Young and the Chief Secretary to Government had said that they had every intention of consulting the planting community on the steps they proposed to take in this direction in future.

Mr. Gibson regarded the Government's actions from another standpoint. If this Enactment went home, the man in the street, who had invested his money and did not know exactly the position or conditions of the country where his investmen was, but got to know the Government of that country could turn round and take away the labour of the estates he had invested his money in, it might be the means of bringing about a panic and doing tremendous harm to the rubber industry. Those were the far reaching effects of such an action on the part of the Government and it was the bounden duty of the Association to impress on the Government that such high-handed legislation was intolerable.

He had great pleasure in seconding Mr. Macfadyen's motion.

Mr. Macfadyen's motion is then put to the meeting and carried unanimously.

10. Honorary Members.

The Secretary reports that Mr. A. C. Corbetta has applied for Honorary Membership and explains that the present rules do not provide for this.

Mr. F. G. Harvey proposes, Mr. A. J. Fox seconds, and it is agreed to, that a new rule to that effect be drafted and submitted to the forthcoming Annual General Meeting.

11. Medical Staff on Estates.

The Chairman informs the Meeting that the Government had under consideration a scheme, whereby they would provide all the necessary staff and second same for service on the various estates, as required. This would do away with all the present difficulties the planters were labouring under. The Secretary might write in and find out, how far this matter had progressed.

The Secretary is instructed accordingly.

Mr. Burgess asks for details of the Bailey Memorial Fund.

The Secretary, being unable to give these particulars without reference to his books, is instructed to submit these at the next meeting.

12. Absconding.

Mr. Jarvis asks whether the Enactment making absconding a criminal offence has yet come in force.

The Chairman understands that the Enactment, as originally gazetted, did not meet the views of the Secretary of State for the Colonies, and that another Bill is in preparation.

13. Indian Labour.

Mr. Harvey enquires whether it is legal for the Indian Immigration Department to demand the discharge of a coolie on tendering themselves a month's wages in lieu of notice.

The Legal Adviser is requested to look into this point and to give his opinion thereon.

Mr. Gibson enquires whether a coolie recruited for an estate from India, but who has worked previously on another estate, is considered to belong to the former or to the latter estate.

The Chairman says that undoubtedly the coolie belonged to the estate who recruited him.

14. Recruiting Commission.

Mr. Gibson suggests that something be done to remove the discrepancy between the amounts paid to kanganies by the various estates for recruiting purposes. Some estates paid their kanganies as much as three and four times as much as others, and it was found these well-paid kanganies stayed at the depôts in India and waited the arrival of other kanganies bringing coolies forward from up country. An equal rate should be authorized by the Immigration Committee and thus prevent this anomaly.

The Chairman recommends that the amount be stated on the licence, and that the Indian Immigration Committee be asked to fix a maximum commission.

15. Sitiawan and Dindings Planters' Association.

The Secretary places on the table the first Annual Report of this Association and is instructed to inform the said Association, in response to private enquiries, that the P.A.M. will greatly welcome the application of this new body.

16. Brussels Exhibition.

The Secretary submits account from Messrs. Lewis and Peat, showing balance still due of $499.37.

17. General.

The Secretary lays on the table copy of By-laws and Regulations of the Selangor Chamber of Commerce Rubber Association.

The Meeting terminates at 12-30 p. m.

H. C. E. ZACHARIAS,
Secretary.

The Planters' Association of Malaya.
In Account with
The Planters' Stores & Agency Co., Ltd.

		Dr.		*Cr.*	
1910.		$	cts.	$	cts.
Aug. 19	To samples of Rubber for Brussels Exhibition (by our London Office)	703	39	..	...
Dec. 31	Antwerp charges	75	17	...	...
1911.					
Jan. 31	By Proceeds of Rubber sent to Exhibition			279	19
„ „	By Balance			499	37
		778	56	778	56
	To balance	499	37		

NOTE OF SALE.

PER s/s "CORMORANT" FROM ANTWERP,

49 lbs.	Block	
15 „	Sheet	
10 „	Sheet	
20 „	Crêpe	
20 „	Crêpe	
9 „	Crêpe	
123 lbs.		at 5/7¾ 14 Dec. 11. Exhibition Samples from Brussels.

THE PLANTERS' STORES & AGENCY CO., LTD.

Agricultural Bulletin

OF THE

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AND

FEDERATED MALAY STATES.

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Botanic Gardens Department, Singapore.

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OF THE

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AND

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AGRICULTURAL BULLETIN

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No. 3.] MARCH, 1912. [Vol. 1

THE THIRD INTERNATIONAL RUBBER EXHIBITION.

There is much to commend the proposal of holding the Third International Rubber Exhibition in New York during the current year and it is gratifying to learn that what appeared to be lukewarm interest in London and the East is being replaced by active support. The India Rubber Journal of February 17 states that "at a special meeting of the Rubber Growers' Association held at the London Chamber of Commerce this week, it was resolved to present to the New York Rubber Exposition, which opens in September next, a series of gold, silver and bronze medals for free competition open at all the rubber plantation countries in the world exhibiting at the exposition."

"The condition of the competition is that at least one hundredweight of rubber—to be a commercial, not an exhibition, sample—mustbe shown for each entry made, and planters are to have the privilege of making more than one entry if they wish."

Every one will be aware that of all industries those pertaining to agriculture are the slowest to mature, although the rapid development of plantation rubber has been amazing, and where events have moved so quickly it cannot be complained that the industry is suffering from a plethora of exhibitions; while the stimulus of the preceding exhibitions have materially assisted development.

Writing on the scope and utility of the proposed exhibition Mr. Pearson, Editor of The India Rubber World, says :—

"Steps have been taken to secure exhibits of crude rubber from every rubber producing country in the world.

There is also in process of formation an advisory committee, made up of the most influential manufacturers, chemists, importers, and scientists in every way connected with the trade.

There will be notable loan exhibits, European and American, exhibits of laboratory and factory appliances, etc., etc.

There will be a series of conferences at which essays on various subjects of interest to the trade will be read.

When one considers that the United States not only uses one half of the world's crude rubber, but manufactures much more than one half of the world's rubber goods; when one further considers the very general interest that the press and the people of the country are to-day evincing in rubber, it would appear that the exhibition was timely. That it can be made broadly informing to every trade and profession, to business organizations and to schools, goes without saying, and Mr. Manders' past record furnishes no reason to doubt his complete grasp of the possibilities as well as his ability to carry his plans through to a successful finish."

A Rubber Exhibition in New York offers an opportunity to planters to emphasise the real position of the present and prospective magnitude of plantation rubber in the East, which financial statements showing the area under cultivation and the output of rubber fail to convey, as is evidenced by the American manufacturers, and delegates from Brazil, who have visited Singapore and the Federated Malay States during the past few months.

Hitherto manufacturers (the real masters of the rubber market) held large stocks of crude rubber, and this policy is slowly changing in favour of forward contracts with estates. It only remains to convince all manufacturers that the plantation industry is an established one, and that the output of over 10,000 tons for Malaya during 1911 will be largely exceeded year by year. It would therefore be of direct advantage to estates to earn a good name on the market.

Another advantage is offered, which should not be lost sight of, by displaying plantation rubber in bulk, it furnishes an opportunity of conveying to all concerned the improbability of synthetic rubber replacing raw rubber. Synthetic rubber is a scientific fact so far as the laboratory is concerned, and it may not be long before the commercial proposition is before the world. Rubber displayed in bulk would be more convincing than figures. It could be seen what the substitute would have to replace in both wild and cultivated raw rubber, and also, what is usually forgotten, reclaimed rubber. Both, governments and financiers, might pause to think that rubber trees can be brought into bearing in a few years, while turpentine, the base of synthetic rubber and the product of fir trees, approach a century. Two results are apparent, the gradual destruction of forests which could not be replaced; the consequent increased price of turpentine, and the improbability of producing synthetic cheaper than raw rubber.

The converse of synthetic rubber is overproduction of plantation rubber—also a possibility. Outside Malaya there is more real activity in planting rubbers at the present time than at any previous

period; Brazil is both planting and fostering natural reproduction; the West Indies have embarked on a strong rubber planting policy; all tropical Africa is actively engaged in planting Para and Ceara; from India Ceara is expected to be largely exported; Mexico expects to increase her output in the near future.

Where so many countries are engaged different systems of cultivation and methods of preparation naturally follow, and the opportunity presents itself at the forthcoming exhibition of studying the real position in all its latest developments.

"Entries for the competition close on August 1, and are to be made direct to Mr. A. Staines Manders, c/o the Grand Central Palace, 46th to 47th Streets, Lexington Avenue, New York city."

It is inferred that exhibits not intended for competition would be received later, as the exhibition opens during the last week in September 1912.

The following suggestions are made from experience and to avoid errors and save delay:

1. All cases of exhibits should be fastened by screws and not nails. Nailed cases frequently split and are spoiled for returning.
2. The name of the estates, settlement or state, should be stencilled or printed on 2 or 3 faces of the case. Consignee's address on top of case.
3. Cases to be returned should have the addresses printed on a board and screwed face downwards on top of the case when consigned to New York.
4. Full instructions; if for competition: description of contents; number of cases; weight of rubber; whether offered for sale or to be returned; address for returning; should be communicated to the local secretary, or direct to the Commissioner.
5. Instructions should not be enclosed in the cases of rubber.
6. Instructions, part to local secretary or Commissioner, and part to agent or friend, should be avoided.
7. Cases should be numbered and contents described on case, as well as mentioned with instructions.

The matter is receiving the attention of Government, and it only remains for plantations to come forward with rubber in bulk to place Malaya in the front of rubber producing countries.

R. DERRY.

IPECACUANHA.

(Cephaelis Ipecacuanha.)

The superior claims of rubber have so absorbed the attention of planters during recent years that only occasional enquiry is made of other plants. With many economic plants, particularly drugs, the demand is temporary only and a fascinating price is best measured

by the possible demand for the product and the probable extent of its cultivation.

At the present time enquiry is again being made respecting Ipecacuanha, and considering the consumption and consequent demand for the drug, the limited sources of supply, its slow reproduction and cultivation, there does appear a prospect for further development. In most instances, however, enquiry is based on the suitability of the plant for a Catch-crop, and the object of this note is to indicate its inadaptability for cultivation under such conditions.

Cephaelis Ipecacuanha is a dwarf, half shrubby, shade loving plant indigenous to many parts of Brazil, and sparsely in New Granada and probably Bolivia. It was first introduced to Europe about 1830 and to India 30-40 years later. Ipecacuanha is prepared from the dried roots of the plant which are exported from Brazil, Cartagena, Selangor and Johore, and India *(an analysis showing the relative value of the commercial drug from the first three countries mentioned is published in the Agricultural Bulletin p. 364, Vol. 8.)* Its cultivation—owing to its special requirements—is still limited while the demand for the drug is increasing.

Bentley and Trimen describe the process of collection in Brazil as follows:—"The roots of the Ipecacuanha plant are collected more or less all the year round, but less during the rainy season from the difficulty then experienced in drying them properly. The collectors are called Poayeros from the Brazilian name Poaya by which this plant is known. A Poayero collects the roots by grasping in one hand as many stems as he is able, and with the other he pushes a pointed stick obliquely with a see-saw motion in the ground beneath the plants, by which he is able to pull up a lump of earth with the inclosed roots in an almost unbroken state. The earth is then shaken from the roots which are placed in a bag brought for that purpose, and the same process is repeated with other plants. When the Poayera pulls up the roots, he breaks them at certain points, and from these broken parts of the roots which are left in the soil, young plants are subsequently produced, and thus the total destruction of the plant is avoided."

In the East the plant is reproduced by root cuttings (so far as I know it does not seed locally, but where well matured plants are available old enough to flower, seeds could be produced by artificial fertilization) but such cuttings are not easy to establish, and if the root is subdivided into numerous cuttings due protection to prevent loss from excessive damp is necessary. On virgin soils, or where there is a depth of vegetable humus and the situation is moist and shady, the plant grows well when established but the properties of the root deteriorate with continued cultivation. Such deterioration might be minimised, if not avoided, by mulching with leaf-soil and burnt-earth, especially burnt-humus, as the lime contained in burnt-earth and applied in this form, although the proportion is small, is easy of absorption. Careful cultivation is necessary as the alkaloid or active principal of the drug, only amounts to about 1 per cent. of the root.

The Brazilian plant is variable in habit, and the Cartagena or Colombian variety is distinct and of less commercial value.

R. DERRY.

Mr. R. H. True (Bureau of Plant Industry of the U. S. Department of Agriculture) has been supplied with the following information from the American Consul at Cartagena regarding the cultivation of Ipecacuanha, and this we publish from the "Oil Paint and Drug Reporter" Ipecac, a trailing plant thrives best in clay soil along the banks of rivers. While it requires a great deal of moisture, it cannot live under water, and consequently in Colombia it is found in its best development in regions where the rainfall is abundant, but where the rivers do not overflow.

The Sinu River is the ideal region for ipecac. The plant is found in abundance from near the head-waters of this river . . . The growth extends to a distance of several miles on each side of the river and also to the more important tributaries of the Sinu, the Esmeralds, Verde and Manso rivers. In regions where the water is excessive, such as the valleys of the Atrato, the plant though found, has a poor growth and is of an inferior quality. In gathering ipecac the whole plant is up-rooted and the thin and soft rootlets are thrown away, and these discarded rootlets serve as a means of reproduction, becoming in a year well-developed plants having valuable roots of their own. The present demand for ipecac is good, for the average price in Cartagena is about $1.80 per lb. and $2.20 per lb. can be obtained in some of the foreign markets for the dry roots. The European demand is especially strong. France paying from 10c. to 20c. more than can be obtained in the United States. The total shipment of ipecac from this port during the calendar year 1910 amounted to 14,181 kilos. The area from which Cartagena ipecac is derived is very extensive and somewhat scattered, though by far the most important region is that of the Sinu River and its tributaries. It is thought that the land actually covered by the plant must embrace several hundred square miles, though any attempt at an accurate estimate would be useless. A relatively small amount of Cartagena ipecac comes from the Atrato, and it is of inferior quality. In addition to the two regions mentioned, there is still another, nearer than either of them to Cartagena, called San Onafre. Ipecac is not an object of cultivation in Columbia, though there is no reason why it should not be, except the fact that it is found wild in such abundance."

(*The Chemist and Druggist*, Feb. 24, 1912, p. 78).

CALABAR BEAN.

(Physostigma Venenosum).

A plant allied to the runner-beans (Phaseolus) and native of Nigeria and the Congo where it is used as an ordeal, but owing to its poisonous properties the production has been discouraged.

The drug, which is obtained from the ripe seed, has been recognized in different Pharmacopæias for many years as a valuable poison and for external use in cases of Myopia. Quite recently a further chemical examination by the Wellcome Chemical Research Laboratories has resulted in the isolation of a new alkaloid which will doubtless add to the value of the plant although the demand may be limited.

R. D.

COCAINE.

(Erythroxylon Coca.)

In the Agricultural Bulletin of the Straits Settlements and Federated Malay States page 336 vol. VII. there is an account of this plant as grown in the Botanic Gardens Singapore and a report from the Imperial Institute on a sample of dried leaves submitted by the late Mr. Machado for analysis and valuation. The colour of the leaves was not quite good but "the percentage of alkaloids present was equal to the average amount found in commercial supplies of Coca leaves from other sources." Planters are also cautioned that the demand is small and that leaves would be over-produced if extensively cultivated.

At the present time the price is high and leaves from the East appear to be exported from Java only. The plant is exceptionally hardy and is grown as a hedge-plant in the Singapore Gardens. There would be a great saving in handling and freight if anyone cared to try the production of Cocaine instead of exporting leaves.

R. D.

The Production of Cocaine in Peru.

This subject receives attention in a recent number of *The Engineer*, in an article which is reproduced in *Peru To-day* for September 1911: In introducing the article, the latter publication points out the importance of the cocaine industry in Peru; this is shown by the circumstance that the value of the annual production of the drug is £2,500,000. A great part of this is exported, while most of the rest is consumed by the native Indians.

The account in *The Engineer* states that the processes employed in Peru for the extraction of cocaine from the leaves of the coca plant *(Erythroxylum Coca)* are crude, owing to the fact that the treatment takes place in the interior, on account of the expense of transport of the leaves; the extent of this expense is illustrated by the fact that 200lb. of coca leaves are required for the manufacture of 1lb. of cocaine. Doubtless, improved means of communication will bring the manufacture nearer the coast, and then better methods will be employed.

For the extraction of the drug from the leaves, three operations are employed: (1) maceration, (2) intermediate precipitation, and (3) final precipitation. For maceration, the leaves are placed in four tanks, in the first of which they are treated with a 0.5 per cent. solution of sulphuric acid. After twenty-four hours, the liquid is allowed to flow into the second tank and the first is again filled with new leaves and the acid solution. After another interval of 24 hours, the contents of the second tank are run off into the third while the former is filled from the first as before, the first again receiving a new charge. The fourth tank, after another period of twenty-four hours, is filled from the third, and the preceding processes with the other tanks are repeated. In this way, leaves in a state for further treatment, namely, those originally put into the first tank, are obtained at the end of four days. The tincture thus obtained is next placed in a strainer, for the purpose of filtration, after which the processes of maceration is complete.

For the intermediate precipitation, the tincture is subjected to the action of sodium carbonate in cylindrical vessels. At this stage, in order to test if precipitation is complete, a small quantity of the tincture is removed, filtered from the cocaine, and the filtrate tested with ammonia, when there should be no precipitate formed. The obtaining of a precipitate indicates the necessity for the addition of sodium carbonate to the tincture in the cylindrical vessels.

The first operation for the final precipitation is the addition of petroleum, the mixture being stirred carefully for three to four hours at a very slow rate. At the end of this period the oil, which now contains the cocaine, is washed with acid-free water, and then treated with acidulated water, the proper amount being determined by the testing for precipitation of an aliquot part. During this process, the mixture is stirred vigorously for half an hour to forty minutes, with the result that the cocaine is transferred from the oil to the acidulate water, which can be separated from the former after the mixture has been allowed to stand for about a quarter of an hour.

At this stage, the extract is ready for final precipitation, which as before is effected with sodium carbonate, the amount required being determined by a test with an aliquot part of the solution. The mixture is then allowed to settle for twelve hours and, filtered while being washed with distilled water, to remove any excess of sodium carbonate. The wet residue of cocaine is finally subjected to pressure, when the drug is obtained as a white paste containing 87 to 93 per cent. The usual yield is about 2¼lb. of cocaine per day of twenty-four hours.

When inferior leaves are used, the product is brownish in colour and has to be subjected to further treatment, similar to the above; this results, however, in the loss of some of the cocaine. A last matter of interest is that the approximate cost of producing 1 lb. of cocaine is about £5—an amount which naturally varies with the price that has to be given for the leaves.—*Agricultural News, West Indies.*

INDIGO.

(Indigofera tinctoria.)

The following paper read before the Ceylon Agricultural Society on the possibility of producing natural Indigo to compete with the synthetic dye is of especial interest for its latent possibilities.

Synthetic Indigo is a bye-product of coal-tar and although extensively used it has not entirely replaced the natural indigo.

For silks and high class textile goods the natural dye is still preferred for its durability as a fast dye.

As the indigotine, or blue colouring matter, varies with cultivation and preparation from 20 to 90% there does appear an opportunity for producing an improved standard dye. It is very probable too, that in preparing the Indigo in the form of paste there is considerable saving over solid or cube Indigo which is the result of sterilizing. (Singularly, some years ago, great efforts were made in Singapore to produce solid or stick Indigo which failed).

Locally, the plant is grown from cuttings and not seeds, so that it may improve the cultivated product if seeds were tried instead of cuttings.

Formerly the cultivation was extensive but has gradually dwindled to almost nil, possibly due to a combination of causes.

When Indigo was extensively cultivated in Java and Sumatra it was known that its cultivation improved the soil for tobacco, sugar and other crops.

It certainly deserves careful experimental trials for green soiling with rubber, but if intended as a Catch-crop, a good water supply is essential and prospective crops assured before embarking on the apparatus necessary for its preparations.

R. D.

Ceylon as an Indigo Country.

Interesting Paper.

Baron Schrottky—then read an excellent paper entitled, "The cultivation of Indigo in Ceylon," in which he said:—

The object of the paper on Indigo, which you have permitted me to read to you to-day, is to arouse interest in an industry which, for some time past, has been considered moribund, if not dead.

The natutal indigo industry, at one time one of the most prosperous industries in the East, has been practically ruined by the competition of a synthetic dye.

Adolf von Bayer discovered in 1880 a method of producing from coal tar products a substance identical in every respect with indigotine, the chief dyeing principle in the indigo of commerce, in which it is found to the extent of about 60 per cent.

The Badische Soda and aniline Fabrick acquired Bayer's patents, and in 1897 brought into the market a synthetic indigotine at a price

low enough to compete with the natural dye. The Badische Company was able to sell their product at a profit at the cost price of natural indigo, which was then about Rs. 120 to Rs. 150 per maund of 74 lb.

This competition naturally resulted in the closing of most indigo factories in Bengal and Northern India which were dependent for financial assistance on Calcutta houses and only those planters who had land of their own, on which they could very profitably utilize the excellent manure which indigo refuse yields, were able to keep their heads above water.

The export of indigo, which in 1896 was 187,337 cwt, valued at nearly 4 million pounds sterling, had fallen in 1910 to 18,061 cwt. valued at a little over 200,000 pounds sterling.

Indigo continued to be grown in Behar and elsewhere in India, but chiefly for the sake of manure it yields, the dye coming to be looked upon almost as a by-product. It was at the darkest period of the Indian indigo industry that Sir Edward Law, Finance Member of the Indian Council, in his Budget speech, March, 1904, spoke hopefully of a possible revival of the industry, if planters would only put their factories on a sounder financial basis, practise economy in the management of their estates, select the best yielding variety of the indigo plant, and adopt more scientific methods of manufacture. It is due to a few of the more enterprising planters of Behar that progress has been made in these directions.

The great increase in the yield of dye obtained by the latest developments of the industry will be more fully realised by comparing a maximum outturn of ¼ lb. of dry from 100 lb. green plant in 1887, which was then spoken of as "marvellous," with the ¾ lb. of dry dye which 100 lb. of green plant can be made to yield now, an increased outturn which, 20 years ago, would have been regarded as impossible. But quite as important has been the advance in the marketing of the dye in the more convenient form of a paste of such qualities and of such an atomically fine division of the dye that—speaking from practical experience—as much yarn can be dyed a certain shade with one pound of Indigotine in the Standard Natural Indigo paste than can be dyed with 1½ lb. of Indigotine in the synthetic dye.

We arrive now at the question of how this development of the indigo industry affects Ceylon, where it has never been considered profitable to grow the plant, even at the flood tide of prosperity in that industry. In those days the yearly outlay of an indigo factory—for supervision, rent of land, cultivation, manufacture, and the marketing of the dye—used to be in Behar about Rs. 36 per acre, and the outturn was 24 lb. of the dye per acre, selling at Rs. 3 per lb. This gave a cent. per cent. profit.

Cheapness of labour and cheapness of land were then the essential elements in the profitable cultivation of indigo, and on this basis Ceylon could not hope to compete with India. But now these items are not of such importance, since the industry has developed on lines

which make it necessary to treble the outlay, so that the cost of labour and land is now proportionately much smaller. It is this change which enables Ceylon planters to take up indigo cultivation with every chance of success and profit. The increased outlay is chiefly due to the cost of scientific methods of manufacture, and the very large additional outturn of dye obtained thereby has reduced the cost of natural indigo of average quality (60 per cent. indigotine) to 1s. per lb. whereas the synthetic dye costs 1s. 6d. to manufacture, and is sold at present at 8d. per lb. of 20 per cent paste equal to 2s. per lb. of 60 per cent. indigotine.

The way is, therefore, open for a revival of the natural indigo industry on a better basis than ever before, for it is well-known that the cost of the synthetic dye cannot be further reduced. It is generally acknowledged that natural indigo has better dyeing properties than the synthetic product, and dyers will give preference to the natural dye if they can get it at the same price of a standard quality and in the more convenient form of a paste. Such a standard natural indigo paste of keeping qualities has now been produced; it has been tested by practical dyers, it has met with the approval of Mincing Lane brokers, and it finds a ready demand and sale at a remunerative price.

It will, of course, take some time before an indigo industry on these up-to-date lines is established even in Behar. But a beginning has been made there and it is to be hoped Ceylon will follow suit, for here there is no lack of enterprising men with a command of credit and ready money, which is essential. The climate is favourable, the soil is suitable, and, in short, we have here all the elements that should ensure success.

The indigo plant grows better in Ceylon than in Behar. It grows wild in the low-country and at high altitudes, it is found up to 5,000 feet, it grows in the dry districts and in the wet districts, and there are some sixteen varieties of *Indigofera* indigenous to the Island. The plant grows in Ceylon for the greater part of the year (excepting the very dry districts), and will yield three to four cuttings in the twelve months; whereas in Northern India, where there are four months of cold weather and three months of drought, only one good cutting can be obtained, the second cutting depending much on the season, and, at the best, yielding only a half crop.

Mr. Teixeira de Mottos, General Secretary of the Midden Java Planters' Association, has given me the crop outturn of *Indigofera arrecta* in Java as amounting per acre to 32,000 lb. per year for three cuttings, the yearly outlay being Rs. 100 per acre. This crop outturn of green could, I feel certain, be reached here also in Ceylon, wherever the rainfall is over 60 inches for the year, and where the fall is well divided between the south-west and north-east monsoons.

In the dry districts of the Island, with only one monsoon, and a rainfall of only about 40 inches spread over four to five months of the year, we can only expect two cuttings, which might be estimated to yield about 20,000 lb. of crop per acre, for in Behar I have the

statistics of a crop of *Indigofera arrecta* sown on March 20, and yielding before the middle of September, within a period of six months two cuttings amounting to 21,600 lb. per acre.

If we take for Ceylon a rather higher outlay per acre than in Java, say Rs. 120 per acre, and add to this the expenditure in working according to scientific methods of manufacture (say Re. 1 for every 400 lb. of crop treated) we arrive at a total outlay, for a yield of 32,000 lb. per acre of Rs. 200 per acre, and for a yield of 20,000 lb. crop Rs. 170 per acre. The outturn of dye for Ceylon may be safely estimated at about the same as that obtained in Behar by scientific methods of manufacture, *i.e.*, 2½ lb. of standard indigo paste per 100 lb. of green plant, though actual manufacture from plants grown in Ceylon has shown that the yield of dye is higher than in Behar. Arrangements have been made with a Mincing Lane firm to take over this standard paste at the rate of 50 cents per lb. c.i.f. Colombo.

The outturn of standard paste per acre yielding 32,000 lb. green plant may therefore be estimated at 800 lb. of paste, value Rs. 400, plus Rs. 148, the estimated value of the residual manure which the decomposed plant yields after the dye has been extracted, making a total of Rs. 548 against an expenditure of Rs. 200. In the districts where only 20,000 lb. of green plant can be cut per acre, the outturn of standard paste will be 500 lb., value Rs. 250, plus Rs. 100, the value of the manure, or a total of Rs. 350, against an expenditure of Rs. 170.

There must further be deducted rent of the land (or interest on the capital represented by it) and also the interest on the capital invested in the building of a factory and depreciation.

With the assistance of a few enterprising men in Colombo, this question of the possibility of successfully pioneering in Ceylon an indigo industry on up-to-date lines has been brought nearer torealisation. *Indigofera arrecta* and *Indigofera sumatrana* have been experimentally cultivaed during the last six months in gardens within Colombo city, as well as at higher elevations on coconut and rubber estates. The plants have grown satisfactorily, as could not otherwise have been expected, for indigo is a weed which will flourish well with ordinary cultivation in all tropical and semi-tropical countries. Even where it was sown broadcast on totally unprepared hard laterite soil a crop has been obtained, though the growth is irregular.

What was sown in Colombo in July last has already yielded two cuttings (the second cutting at the rate of 14,500 lb. per acre), and the plants are shooting out well for a third cutting.

Plant grown in the Kalatara district has been manufactured in a miniature factory according to scientific methods and has yielded well, the outturn of dye being much greater than the Behar plant yields, and was equal to 3¾ lb. of standard paste for 100 lb. of green leaf.

You will have noted that I have added to the value of the dye the estimated value of the manure, which is a by-product of indigo manufacture. This is a most valuable asset, especially for Ceylon, where the soil cries out for manure more and more every year. The

fact that indigo cultivation and manufacture will yield as a by-product one of the most valuable of natural manures is one pregnant with the greatest possibility for this Colony.

We know from the experience gained in India and Java that this manurial matter trebles the outurn of tobacco; that it doubles the outurn of paddy, in grain as well as in straw; and it will also be found very suitable for coconut cultivation, for cacao, and for tea.

The manure, consisting of the fermented green leaves and stalks, is put into heaps and kept in pits, and can be further improved in value by running the waste liquid after fermentation over it. The bacterial life, set going by the fermentation, helps to decompose the plant, and turns the whole mass into a brown friable mould. Sir George Watt, in his *Dictionary of the Economic Products of India,* specially refers to the great value of this manure, and you will find the fact mentioned there that experience has shown that land cutltivated in indigo is greatly benefited thereby.

Indigo is one of the few plants which enrich the soil on which it is grown, (1) by the exudation into the soil of nitrogenous matter from peculiar root-nodules in which through bacterial action the inert nitrogen of the air is worked up into assimilable nitrogenous products; (2) by the fall of leaf; and (3) by the droppings of the millions of insect life which an Indigo field harbours, while the long tap roots of the plant draw nourishment from strata of soil not reached by ordinary crops.

This Indigo refuse is called "seet," and closely approximates in its general composition good English Farmyard manure, though it is decidedly richer in its chief constituent—nitrogen. From 100 maunds of green plant about 80 maunds, or about 3 tons, of well-rotted "seet" are obtained. Mr. Pawson, from whose report to the Behar Planters' Association, pages 9-12, I quote, says that without taking into consideration the very valuable manurial qualities of the decomposed organic matter in the "seet," its principal plant food constituents per ton would be equivalent to 103 lb. sulphate of ammonia, 36 lb., sulphate of potash and 13 lbs., tribasic phosphate of lime.

Compared with oil cake, which contains only 14 per cent. of moisture, while "seet" contains 70 per cent., one ton of "seet" is equivalent in manurial value to about 5 cwt, of castor cake. The actual results are, however, even greater in the case of "seet," as the plant food there is in a more assimilable and subdivided form than in either farmyard manure or oil cake. Composition of Indigo refuse or "seet":—

		Per cent
Water	...	72·56
Organic matter	...	22·88
Mineral matter	...	4·56†
		100·00

Containing nitrogen	...	0·98
Equal to ammonia	...	1·19
*Containing—		
Silica	...	1·04
Lime	...	1·09
Magnesia	...	0·21
Potash	...	0·89
Phosphoric acid	...	0·27
Phosphoric acid equal to tri-basic phosphate of lime		0·58 (Rawson)

Rawson gives the actual money value of the "seet" from 100 maunds (=8,000 lb.) of green plant as amounting to Rs. 37.

Fron an outurn of 32,000 lb. of green plant per acre we may therefore expect, in addition to the dye, a residual manure worth Rs. 148. The amelioration of the soil, as a concomitant of indigo cultivation, has been recognised as one of the most important elements of the industry in India, and should receive the same recognition in Ceylon.

I trust that the data I have given will draw the attention of Ceylon planters to the cultivation of a product which, even grown as a subsidiary crop, opens such large possibilities for the more successful cultivation of the present stable products of the Island.—*Ceylon Observer*, March 7, 1912.

PRUNING.

Pruning consists in removing any part of a tree, either stem, branches or root with a view to repressing its growth in one direction, and directing the course of sap towards other parts of the tree or shrub, etc, which are better situated and constituted for performing the natural functions.

In this country, trees and shrubs generally, produce an over-abundance of branches, half of which are sufficient for all purposes required, decorative or otherwise. It is therefore essential that pruning be resorted to. By pruning I do not mean to infer that in the case of such trees as Cassia fistula, etc., wholesale, ruthless cutting out of branches is required, far from it, but if a few of the weaker branches were removed, the sap which would have been utilised by the removed branches, is directed into the remaining branches, strengthening and enlarging them so that they are better able to continue the satisfactory growth of the tree.

In fruit trees generally, pruning has a most beneficial effect on the yield of crop, enlargement of the fruit, general productiveness of branches hitherto barren, and admission of more light and air to the remaining branches are some of the immediate results attained.

Pruning may be performed with a pruning knife, secateurs, parang, or small hand-saw, but in all cases the branch should be removed as close to its base as possible leaving a clean, slightly sloping cut. Cover the scar completely over with coaltar, taking care that no tar is allowed to trickle down the bark of the tree. As any unprotected wound or scar is liable to introduce fungi to the tree, it is better to apply the tar two times, i.e., once immediately the branch has been removed and again about a fortnight later. Never leave scars or cuts unprotected for any length of time.

If it is decided to remove some of the branches say of a Mangosteen tree, then immediately the fruit has been gathered is the best time to do so. This allows the remaining branches to enjoy, during the whole of the following growing period, the additional supply of sap thus caused, and consequently the tree produces larger and better fruits the ensuing season. When one sees the numerous inferior Mangosteens placed on the market, it is surprising that some such method of thinning out of the branches has not been practised. Neglecting to thin out the weaker branches is one of the causes by which we get an enormous crop of medium-sized fruits one season followed by a more or less dearth during the next season. Even in this country where growth is extremely rapid, a tree cannot be expected to yield large crops of first class fruits regularly each season, unless some such method of thinning out of branches is adopted. The Chiku (Achras sapota) is another fruit which would be immensely improved by the judicious removal of many of the weak branches

The first thing to be done when pruning trees, shrubs or any sort of plant is commenced is the removal of all dead and dying branches (even if nothing else is done, all such branches should be removed as soon as they appear.) All the weak and useless shoots should then be removed. In pruning ornamental trees or shrubs one must endeavour to preserve the natural symmetry of the plant, but if as is often the case, one branch has a tendency to outgrow its neighbours, then it may be pruned about two feet lower than the tips of the others. If, however, on branching again it still has the same tendency, it should be removed altogether as this excess of growth is probably due to its being in direct contact with a large and strong root.

Shade trees and roadside trees in particular require frequent prunings to obtain the necessary amount of shade with the minimum amount of waste branches. To do this, one must commence pruning shortly after they are removed to their permanent quarters. In many instances, young trees are lifted from the nursery beds and planted without the least care and forethought. Preparations should be made some time beforehand so that the roots are exposed to as few drying influences as possible.

Seedling trees have usually one main shoot which varies in length according to the vigour of each particular variety. If such a tree as this be lifted and planted, in all probability the leaves shrivel and die, causing the death of the shoot two three feet from the tip. It takes some considerable time for the tree to recover from such a check and also produces an unnecessary amount of lateral

branches. If, however, the tip of such a tree be removed until firm wood is obtained (usually about 6 inches) some ten days before planting, the axillary buds will have become plump and active. Planting may then be carried out with much less danger of checking the growth of the tree and almost immediately continue its growth.

The subsequent lateral branches must be pruned or removed according to the purposes the tree is desired to fulfil, but in order that there be as little waste of sap as possible, they should be removed when quite young.

Ornamental and flowering shrubs require frequent pruning. In the case of the former, sufficient only should be removed to preserve the shape of the shrub unless it has become scraggy, when severe pruning is necessary. For the latter the secateurs may be used frequently and more drastic treatment may be given them.

The pruning of flowering shrubs can be done immediately the flowers have faded but the best and most favourable time to do so is is at the commencement of the rainy season. They may then receive a severe pruning without causing so great a check as when done at any other time of the year.

When a shrub or tree has been pruned, it should immediately receive a liberal dressing of manure, either by mulching or by digging it lightly into the soil. Well decayed leaves and old cow-manure mixed together is the most suitable manure for this purpose.

The following list comprises a few Ornamental and flowering plants which require such pruning:—*Acalyphas; Angelonia salicaraefolia: Aristolochias* (a few)*; Beloperone oblongata; Bougainvilleas*; *Brunfelsia; Clerodendrons; Congeas; Crossandra; Daedalacanthus; Duranta; Eranthemum* (except *E. Malaccensis*)*; Cryptostegia; Excaecaria bicolor; Galphimia glauca; Graptophyllum* (Caricature plant)*; Hibiscus* (all)*; Holmskioldia; Ipomoea carnea; Ixoras; Jasminum* (slight); *Jatropha; Lantanas; Murraya* (slight)*; Mussaendas; Quisqualis indiga* (Drunken sailor)*; Nerium; Palicourea gardenioides; Petraea volubilis; Plumbago rosea* (frequently); *Rondoletia odorata* (slight) *Russelias; Sanchezia nobilis; Panax fruticosus*(all vars.)*; Strobilanthes Dyerianus; Tecoma stans; Thunbergia erecta;*and *Wormias.*

J. W. ANDERSON.

IN UNKNOWN PAPUA.

Mr. Staniforth Smith's Tour.

London, Feb. 16.

Mr. Staniforth Smith, Administrator of the Territory of Papua, lectured this week before the Royal Geographical Society on his recent adventurous journey through the Western District of Papua. Here are some notable results of his adventures which prove that the terra incognita consisting of huge up-raised coral beds has a larger area of elevated land than any other discovered in the territory.

The Natives.

The description of the country given postulates a somewhat sparse population over this elevated portion of the Western Division. At Sambregi, immediately to the north-west of Mount Murray, are a cluster of villages with an aggregate population of about 1,000 people. Throughout our trip we saw only one other village of any size, which we reached on December 27th. This was on a large tributary of the Kikor flowing south of east. In every other instance the tribe or clan lived in one communal dwelling, varying in dimensions according to the size of the community, and capable of housing from ten to seventy people. These dwellings, especially the smaller ones, are generally hidden away or perched on steep ridges, that are not easy of access, probably from motives of defence. The population of this area of elevated land is estimated at 15,000 inhabitants, or about one and a quarter persons to every square mile.

The native inhabitants of the interior do not appear to be a homogeneous people; racial distinctions are apparent that seem to indicate a mingling of Papuans and Papuo-Melanesians, to use the terminology of Dr. Seligmann. Some of the inhabitants of a village were dark-skinned, dolichocephalic men, with wiry frames and somewhat slender limbs, and, in disposition, rather morose and unemotional. In not a few instances the somewhat prominent nose was arched, presenting the appearance of the so-called Semitic type. Other villagers again were unusually light skinned—more the colour of a Samoan. The high altitude might accentuate this. I was unable to obtain the cephalic indices of any of the natives, as they were very shy, and we could not afford to make a long stay anywhere. The faces of the light-skinned men were broader and shorter than their darker neighbours, their limbs stouter, and they appear to be more vivacious and intelligent, and also to be fonder of ostentation in the shape of ornaments and paint. The Melanesian migration into New Guinea is believed to have advanced along the north-east coast as far as Cape Nelson, where their progress was stopped by the warlike Binandili tribes; and along the southern coast till they reached the populous villages of the Gulf country. It is, however, not yet known how far the immigrant race penetrated inland. Certain of the inhabitants of the main range near the Gap, at Mount Albert Edward, and on the Chirima, as well as in the neighbourhood of Mount Yule, are lighter skinned and broader headed than the Papuan, and it is possibible that the Melanesians have gradually diffused themselves inland along the southern slopes of the main range, where the original inhabitants were few in number, and therefore less able to successfully resist the advance. The greatest obstacle would be the natural features of the country, which would necesitate very slow progress. This might account for the marked distinction in physical characteristics which have not yet been obliterated by miscegenation. The light skinned people were nearly always in a minority. Mr. J. P. Thompson, in his book, 'British New Guinea,' speaks of the

"remarkably light bronze colour," of some of the natives of the upper Fly river.

I obtained a small vobabulary—principally substantive nouns—from the Sambregi tribes, immediately to the northwest of Mount Murray, in the hope that it would contain sufficient information to enable philologists to determine if the language was Papuan or Melanesian; unfortunately, this was lost with all other papers in the Kikor river.

By exercising great forbearance and patience, we were fortunately successful in making friends with these bushmen everywhere. As they had never seen white men before, our arrival caused great excitement. At the first small communal dwellings we reached they all turned out with their bows and arrows, and stood shouting their war cries. They naturally thought we were a marauding party, and naturally, and rightly they were prepared to defend their wives and children and homes. While they were in this condition of extreme excitement our party sat down, and, although our arms were ready for any emergency, appeared to take no notice of them, except to hold up some red cloth. They then retired, and, when some presents were sent up to the house, we found that they had all fled, the hostile demonstration being probably to allow the women and children time to get away into the jungle. Great care was taken that nothing was touched, and a tomahawk, a knife, and some red cloth were left in the house. Not seeing them return, we started on our march next morning, and in the afternoon were overtaken by the natives, who, when they found that we had no desire to hurt them, evinced the greatest joy, and made us presents of food. After that for some days we experienced little trouble in establishing friendly relations with the natives we met. Possibly, by some bush telegraphy they had notified the other tribes that we had no desire of injuring them. In many instances the friendship of the natives was of great service to us. Not only were we able to buy food, but they showed us native tracks, and, in one instance, took the whole party over a wide river in their canoes.

The inhabitants of the Sambregi villages were particularly interesting as they live at an elevation of 6,000 feet above the sea-level, the highest elevation, I believe, of any Papuans so far visited. The physique of some of the young men was magnificent, the Kagi men of the main range approaching most closely to them in this respect. While the tracks between the villages of Sambregi were in wretched repair, and the houses below the standard of native dwellings in Papua, these people excelled in drainage schemes. The gardens in the rich low-lying portions of the valley are drained into the Sambregi creek by water channels varying in depth with the contour of land. In some cases the drains are as much as 8 feet in depth; no water lodges in them, and they are kept in excellent repair. With the exception of the native irrigation channels near Dogura in the Eastern Division, in no other part of the territory do the natives show such knowledge of channel construction. Although it is most

improbable that any of these bushmen have ever seen the sea, it is evident that they are able to carry on some trade with the coastal men, probably through many intermediate tribes, as we found them wearing sea-shell ornaments, and possessed, in some instances, of iron implements, such as a much used axe blade and plane irons. They also knew the names of the Kikor, Turama, and Bamu rivers, but their ideas as to the directions of same were sometimes far from correct.

While these far-inland bushmen are probably cannibals, we were unable to find any direct evidence. At Sambregi, one youth had a skull hung round his neck, and one man a pair of human jawbones; these, however, many have been the remains of relatives. In their dubus, or communal dwellings we saw no skulls or other human bones, although the jaws of pigs and other trophies of the chase were in evidence.

It appears that the natives bury their dead, and, at any rate in some instances, dig up the bones at a later period and put them on platforms. In one instance we saw a tiny house like a small dove-cot built on piles about 6 feet from the ground. In this was a skull painted with red ochre, and some bones. We also saw a platform recently erected, and the natives indicated that it was for human bones. In a rock shelter we saw two skulls and bones placed side by side in a circle of stones; close by were evidences of a grave having been opened and bodies exhumed.

For clothing the natives wear a piece of netted cloth hung down from the waist in front from a wide girdle of bark; at the back dried grass or the bright coloured leaves of a plant. In other instances, tapa cloth was hung from the waistband. As a head-dress they wore the black plumes of the cassowary, or the feathers of the white cockatoo; very occasionally we saw the plumes of the raggiana bird of Paradise. Their hair was usually worn short in front and long behind, clotted into tags and rolls, either with oil or honey and wax of the little black stingless bees. The hair is not bleached with the lime as in other parts of the territory. They wore cane armlets, anklets, and waistbands. These canes were used for fire making. The septem of the nose is pierced and the lobes of the ear, and various things hung thereon from a pencil of bone to circular pieces of cane and the claws of birds. It is remarkable that during our whole trip we saw no evidence of tattooing nor any cicatrices or mutilation of the body. Skin disease was exceedingly rare, and only seen in one or two instances in the adults, and rather more frequently amongst the children. In fact, the natives generally were a remarkably healthy lot of people. In time of war, and probably on festive occasions, they paint themselves either wholly or in part with yellow or red clay, or with ground charcoal and oil. The women wore a tapa cloth rami from waist to knee. They also have tapa cloth cloaks which cover the head and reach to the ground; this I have seen nowhere else in the territory. In their dubus or communal dwellings they keep rolls of tapa cloth blankets as the nights are cold on the great plateau.

They have no pots or cooking vessels and consequently all their food is roasted over the fire; the only exception I saw was in the case of the leaves of an oleaginous plant which they boil as a vegetable in bamboos. We saw no evidence of polygamy, and the probability is that it is not largely practised. From the inhabitants we saw, the women folk seemed less numerous than the men but this may have been owing to the warriors keeping them in the background. Children seemed fairly plentiful. The time of the men is principally occupied in clearing ground for gardens, hunting the pig, cassowary, and flying fox, building houses, making weapons, and cutting down sago trees. The women make all the sago—a continuous and exacting occupation—look after the gardens, do the cooking, and carry water required for household purposes in bamboos. They also hammer out the tapa cloth from the bark of a tree, and look after the rising generation.

These bushmen are certainly not a nomadic people. Their buildings are substantial, and, in every instance, they had a considerable garden and a number of village pigs. Their weapons consist of the bow and arrow, a heavy pig spear which is not used for throwing, and a man-killing club. Very rarely we saw stone clubs; these had probably been introduced from the coastal districts. The bow and arrow men wore plaited gauntlets from wrist to elbow on the right arm. The stone axe and adze are largely used. The natives do little carving except on their arrows (which are made of bamboos often tipped with bone or a cassowary's claw), spears, and wooden clubs. They also carve out wooden bowls to hold water; these have no ornamentation. The tribes on the western portion of the plateau seemed to be at war with each other during our visit; they were frequently met in full war paint; with bundles of arrows and killing clubs; in one instance they informed us by signs that they were on their way to fight a neighbouring tribe. Possibly, constant internecine strife keeps their numbers down, and accounts for the comparatively sparse population, as the climate is bracing and healthy and the natives singularly free from disease and full of vigour.

Their method of making fire is superior to the usual Papuan system. They get a piece of dry soft wood, split one end and insert a piece of tapa cloth, then taking a piece of cane, which they carry twisted round their waists, they place it under the wood on which they stand. Grasping each end of the cane, they pull it backwards vigorously; when it has eaten halfway through the wood to the tapa cloth the heat generated is so great that the cloth smoulders and is blown into flame. The whole process is accomplished in ten or fifteen seconds. I am informed that certain natives on the main range about Kagi adopt this system also; if so, it is interesting as possibly shewing some connection between them.

With the exception of two large villages, all the natives we saw were split up into small tribes, and each community has one communal dwelling, varying in size, according to their numbers, which would probably range from ten or fifteen up to seventy or eighty.

The dwelling is erected on a forest of piles composed of thin but durable wood, and is elevated from 10 to 12 feet above the ground. The sides of the great living room are only about 4 feet high, and the pitch of the roof is low. The roof is made of the fronds of the sago palm, each separate leaf being doubled round the rafters (which are only about 6 inches apart), and sown with native fibre to keep it in its place. At one side of the entrance is a partition, which does not reach as high as the roof; this divides the house lengthways into the men's quarters on the one side, and the women's and children's on the other. In each subdivision there is a gangway the whole length, and on one side of each a raised floor which is sub-divided alternately into sleeping platforms and fireplaces, each about a yard in width: above the fireplace is a platform filled with wood, and above each sleeping place another platform on which the men keep their weapons and other effects, and the women their tapa cloth, bamboo drinking vessels, and food supply. The dogs share the buildings with the natives. The house is generally surrounded by a garden. Variations of the above were seen. Near Mount Murray there were two additional rows of sleeping platforms and fireplaces on the ground level, one on each side with a separate entrance for each. Again, about 300 miles up the Kikor at the largest dubu we had seen (which we estimated was 70 yards in length) the partition, instead of running lengthways, was across the centre of the building dividing the men's and women's quarters. We have travelled down the Kikor about 116 miles to this point before we came upon the first coconut trees we had seen on our journey, nor did we see any more until we reached the mouth of the Kikor. We found that the language or dialect of the people was continually changing as we advanced. At the Sambregi a vocabulary of the most useful words, principally substantive nouns, was compiled; this, besides being of philological interest, we hoped would be of use to us in communicating with the natives we subsequently met; we found, however, that after advancing about 20 miles, the dialect changed, and very few of the words could be understood. Further on the language was quite different.

While the many tribes of natives we met on our exploration showed no suspicion and absolute confidence in us, after we had succeeded in establishing friendly relations, frequently coming to our camp and sitting round the fire at night, and bringing their women and children to see the "pale faces" during the daytime, they all without exception, refused even to taste any food we offered them, although they would take it and wrap it up in leaves, probably as a curiosity. This refusal may indicate that they possessed a knowledge of poison (we saw a fish-poison tree in one of their gardens), it may, on the other hand, have risen from a fear of "pouri-pouri" or witchcraft, or again, it may be that they were conservative in their commissariat and did not care to eat new foods they were not accustomed to.

Climate.

The climate of the plateau was cool and bracing, the nights being sharp and cold. This doubtless accounts for the healthy appearance of the people who also gave evidence of greater activity than the coastal races. The rainfall on the eastern portion of the plateau was heavy and of almost daily occurrence, generally commencing about four o'clock in the afternoon. As we advanced west the rainfall became less frequent and torrential, only falling on an average about three or four times a week. This might be accounted for by the great distance we were from the sea.

Coal.

There is every probability of beds of good coal being found on the borders of the great plateau, although I do not think that any minerals of value will be found in the elevated region caused by the upheaval of the coral beds. Coal has been found on the upper waters of the Purari by the Mackay expedition, and it was found by us both on the lower and upper waters of the Kikor river. On the upper waters of the Kikor there is undoubtedly a very extensive field of excellent coal. Unfortunately, the large number of specimens we were bringing down were lost when the rafts capsized. We followed down a creek for some days that brought us to the Kikor. Everywhere the beds were strewn with lumps of good-looking, bright, hard coal, and for about 15 miles down the Kikor coal was seen in almost every little creek and waterway, as well as on the banks of the river. The attempt to develop this field by the Kikor waterway is evidently impossible, as for 120 miles the river is one succession of rapids, whirlpools, and gorges. There is no reason why this coalfield should not extend further west, in fact a seam of coal was seen on the western side of the river, and, if so, it might be worked from the Strickland river, which it was estimated could not be more than 20 miles distant.

The coal we found on the lower Kikor was one isolated lump considerably weathered. However, as the creek was a very small one, running northward for only a few miles, it is evident that the seam from which it came could not be far off, and, when a magisterial station is established on that river, a fuller investigation might be made. If a large bed of good coal could be found here, I believe barges might be brought up the river to within 6 or 7 miles of it, although two very small rapids occur on the route. These run swiftly when the river is high, but are barely noticeable when the river is not in flood.

Flora.

The whole of the country traversed was covered by dense jungle and scrub, and we literally had to cut our way through the 374 miles traversed on foot, except where we occasionally met a native track going in the desired direction. It was surprising that over rough coral ranges and valleys, trees of considerable size and dense scrub could find a roothold and sufficient nourishment. The roots spread all over the surface of the rocks, constituting steps and ladders up

the steep mountain-sides, without which their ascent would have been most difficult. A remarkable fact was that we saw no grass whatever, except a little reedy grass near the rivers during our whole trip.

Of the economic flora, by far the most important was sago (Sagus Rumphii). We found these useful storehouses of nourishing food growing as far north as we penetrated, and up to an elevation of 3,500 feet. It had previously been considered that sago only grew along the coast and in the alluvial mud of riverbanks near the sea-level. This constitutes the staple food of all the inland natives we met, except the inhabitants of the Sambregi villages, who live principally on sweet potatoes, the elevation (6000 feet) being too great for sago. Wild breadfruit trees are fairly numerous. The fruit, unlike the Samoan breadfruit, is full of large seeds nearly the size of walnuts. These, when roasted, are palatable and make a good substitute for potatoes. The natives when hungry eat the pith of a small palm that grows plentifully over a large area of the country traversed by us. In time of scarcity our police and carriers consumed a good deal of this. To our palates it had a watery and woody taste that was far from agreeable; in fact, when hungry I tried to eat it, but in each instance it made me sick. I collected the seeds of several indigenous fruits, which, while not palatable, might have been improved by cultivation, but these were lost with other things.

Cultivated in the native gardens we found sweet potatoes, taro, yams, sugarcane, bananas, betel-nuts and ginger, the last-named cultivated as a medicine. Maize is unknown. No coconut trees were seen on the whole trip until we reached the lower waters of the Kikor river, nor are there any mango trees or tapioca. The natives grow a green vegetable, the leaves of which they boil in bamboos. It makes a very good substitute for cabbage and appears to contain a lot of vegetable oil.

Tobacco is cultivated in every native garden, which might lead one to suppose it was indigenous; the name, however, tends to show that it is an introduced plant. It is universally called "Saku" by the bushmen, which is evidently derived from "Kuku," the coastal name. In one of the gardens on the headwaters of the Kikor I found a Kava plane (Macro-piper methysticum) although I saw no evidence of the manufacture of the beverage.

Fauna.

The wild pig, judging by the amount of ground that is rooted up, is plentiful everywhere. It is the chief source of meat-supply for the natives, and is continually being hunted with dogs, the killing weapons being bow and arrow and spear. The only animals domesticated are the pig and the dog. The wallaby is very scarce, owing to the absence of grass. Cassowaries are fairly plentiful, their back plumes forming a favourite head-dress. Flying foxes are very numerous. Their flesh is much relished by the bushmen. Tree-rats were occasionally seen, and the streams abound in fish of excellent quality. Two or three were shot with a rifle, but as we had neither fishing lines

nor nets, this luxury was usually denied us. The natives catch the fish by spearing them and by fish-traps composed of stones or pickets across the streams. The little black stingless bee is common everywhere, and the honey and comb is much prized for food and as a dressing for the hair.

Cockatoos, both black and white, and pigeons were plentiful. Those wonders of avian architecture, the play grounds of the bower bird (Amblyornis subalaris), were seen on Mount Murray, at an elevation of 7000 feet. Of insect pests, the land leeches were very troublesome. The feet of the police and carriers were often red with blood from their bites. We tried painting their feet with sulphur ointment, but it proved quite useless. Scrub itch was very bad, except in the valley of the upper Kikor. The scrub itch is caused by a minute red insect that buries itself under the skin. Mosquitoes did not trouble us while on the highlands, but both they and sand-flies were very troublesome on the Kikor river.

The "leaf" or "stick" insects were fairly plentiful, and in some instances their resemblance to the plant life in their immediate environment was wonderfully accurate. One insect resembled a stick covered with green moss; the green colouring appeared so exactly like moss, that a member of our party refused to believe it was not actually moss until he had examined it with a magnifying glass.

On the map accompanying this report the course of that portion of the Kikor river lying to the west of the 114th meridian of east longitude is only approximate, as, while descending this river, most of our instruments were lost, and the compass-bearings and estimated speed could not be checked by observations for latitude. In addition to which the great difficulties that beset us on our return journey did not permit of the careful mapping previously undertaken.

The most important results of the exploration were:—

(1) We went practically right across the centre of the unexplored portion of the territory of Papua, travelling approximately 524 miles through totally unexplored country (374 miles on foot and 150 by river.)

(2) We ascertained that instead of the Western Division of Papua being low-lying recent alluvial country, as previously supposed, it is (except along the coast and in the vicinity of its navigable rivers) an upraised plateau having an area of approximately 12,000 square miles, the lowest valley being over 2,000 feet above sea-level.

(3) The upper waters and watersheds of the great rivers emptying into the Papuan Gulf are now roughly defined, thus completing our knowledge of the river system of the territory.

(4) We have now data for estimating the population of the whole territory with some accuracy, the hinterland of the Western Division being formerly an unknown quantity.

(5) We found coal deposits in two places along the watershed of the Kikor river, the coal country along its upper waters being very extensive.

(6) We found sago growing inland as far as we penetrated and at an elevation up to 3,500 feet.

(7) We established friendly relations with the natives everywhere, and were successful in avoiding all fighting. *Singapore Free Press,* 15th and 16th March, 1912.

Before proceeding to Papua as Administrator Mr. Staniforth Smith spent some time in Ceylon and Singapore, studying the agriculture and Economic Botany. From Singapore many cases of useful plants were taken for introduction to Papua and seeds are periodically communicated.

LEWIS AND PEAT'S RUBBER REPORT.

February 15th, 1912.

The market since our last report has been very steady and a fair business done.

Hard Fine done up to 4/7½ for March/April, delivery and 4/7¾ for April/May. At the close, however, prices are a little easier and there are sellers of these positions at a farthing per lb. less.

Soft Fine—very quiet with nothing offering under 4/7 per lb.

Peruvian Fine—value to-day 4/6. Ball—sellers of spot 4/–, March/April 3/11, buyers 3/10½ per lb.

Medium grades are in good demand, but there is very little offering.

Plantation Grown Para—a fair business done privately at very steady prices. Feb./March done up to 5/3½, Feb./July 5/3, April/June 5/2 and 5/2½, July/Sept. 5/– and 5/0½ per lb.

Particulars of the Auction as follows:—

INAMBARI.—26 Pkgs. offered and sold. Fair average unsorted 4/3¼, fair scrappy part sticky 3/6½ per lb.

MANGABEIRA.—88 Pkgs. offered and 16 sold. Pressed sheet fair 2/9½ per lb.

MOZAMBIQUE.—253 Pkgs. offered and 153 sold. Rough Nyassa.

NYASSALAND, ETC.—Biscuits 4/8¾ and 4/9¼, red and whitish pressed ball 4/3 and 4/4, washed rooty 3/6 and 3/9½, washed crêpe 4/5, thin rather rough Ceara sheet 4/5½ per lb.

CENTRAL AMERICAN.—32 Pkgs. offered and 16 sold. Dark Brown rather barky scrap 3/8½ and 3/8¼ per lb.

MANIHOT.—85 Pkgs. offered and sold. Good clean pressed crepe 4/8½ and 4/1¼, dark pressed mixed whitish 4/3, pressed whitish smoked 3/9¼ per lb.

CONGO.—30 Pkgs. offered and sold. Pressed red and whitish ball, part heated 3/6¾ per lb.

The following were offered and bought in:—

MANICOBA 200, MADAGASCAR 18, AFRICAN 35, PERNAMBUCO 20, & MALAYSIAN 28 PKGS.

PLANTATION. At the sales held on the 13th and 14th inst., about Grown Para, 9241 Pkgs. comprising about 400 tons Malay, 110 tons Ceylon and 5 tons Java were offered. Prices opened about a penny under those prevailing at the last Auctions; later however, rates hardened and the decline was fully regained, although at the close prices were again slightly easier.

CREPE.—Fine blanket 5/3¼ and 5/4¼, pale and palish 5/2½ and 5/4¼, light 5/1¾ and 5/3¾, light brown and mottled 5/1½ and 5/3½, brown and dark brown 5/½ and 5/3, dark and black 4/10½ and 5/½, specky and barky 4/9¼ and 5/–, smoked 4/11¾ and 5/2¼ per lb.

BISCUITS & SHEET.—Fair smoked sheet 5/2½ and 5/4¾, fair average 5/2 and 5/3, rather rough 5/¼ and 5/2, per lb.

SCRAP.—Fair 4/5¾ and 4/6¼ per lb.

RAMBONG.—Crepe 4/5¾ and 4/7¼ per lb.

LANADRON.—Block 5/4 and 5/4¼ per lb.

CASTILLOA.—Sheet 4/3½ per lb.

GOW, WILSON & STANTION, LTD.

India Rubber Market Report.

February 15th, 1912.

Since the last auction the market has assumed a rather quieter tone, but prices have only shown very slight variations.

At the sale held this week, the amount advertised was about 120 tons less than a fortnight ago.

In sympathy with the private market, the sales opened with rather quiet competition, but all through the auction the tone steadily improved, and while at the beginning quotations were 1d. to 1½d. below those of a fortnight ago, by the end of the sale the whole of this discount was made up, and rates, especially for Crepe, often marked a slight improvement on those of the end January sale.

The highest figure was 5/4¾ for one parcel of Highlands sheet, 5/4¼ being frequently paid for light Crepe on the second day of the sale.

As will be seen from the figures published overleaf, the total exports of Plantation Rubber from the East during 1911 amounted to nearly 14,000 tons.

		Malaya Etc.	Ceylon.	Total.	No. Pkgs. Sold.	Average Price Plantation Rubber.	Fine Hard Para.		Fine Plantation.
							Tues.	Wed.	
February 13th and 14th	No. Pkgs.	7124	2150	9274	9080	5/1⅞	4/7	4/7¼	5/2½ to 5/4¾
	,, Tons	411	98	509					
Corresponding Sale Last Year	No. Pkgs.	4994	1086	6080	5150	6/1⅞	6/2½	6/2½	6/1 to 6/11¾
	,, Tons	277	48	325					

EXPORTS TELEGRAM TO EUROPE AND AMERICA.

Month of February.

	Steamers.		Wired. Feb. 15 Tons.	Wired. Feb. 29 Tons.
Tin	Str. Singapore & Penang to	U. Kingdom & or	1,660	1,455
Do.	do.	U. S. A.	1,056	405
Do.	do	Continent	895	285
Gambier	Singapore	Glasgow	...	10
Do.	do.	London	10	...
Do.	do.	Liverpool	120	...
Do.	do.	U. K. & or Continent	25	125
Cube Gambier	do.	United Kingdom	10	15
Black Pepper	do.	do.	...	...
Do.	Penang	do.	...	15
White Pepper	Singapore	do.	125	5
Do.	Penang	do.	30	5
Pearl Sago	Singapore	do.	50	15
Sago Flour	do.	London	75	200
Do.	do.	Liverpool	1,300	...
Do.	do.	Glasgow	125	...
Tapioca Flake	Singapore	United Kingdom	260	...
Tapioca Pearl & Bullet	do.	do.	120	...
Para Rubber	Straits & Malaya	do.	725	625
Gutta Percha	Singapore	do.	110	20
Buffalo hides	do.	do.	180	5
Pineapples	do.	do.	17.500	3,150
Gambier	do.	U. S. A.	275	150
Cube Gambier	do.	do.	...	10
Black Pepper	do.	do.	5	5
Do.	Penang	do.	25	...
White Pepper	Singapore	do.	20	15
Do.	Penang	do.	...	15
Tapioca Pearl	Singapore	do.	110	45
Nutmegs	Singapore & Penang	do.	40	4
Sago Flour	Singapore	do.	50	25
Pineapples	do.	do.	4.500	300
Do.	do.	Continent	8,750	2,250
Gambier	do.	South Continent	225	60
Do.	do.	North Continent	340	50
Cube Gambier	do.	Continent	30	35
Black Pepper	do.	South Continent	55	85
Do.	do.	North do.	20	35
Do.	Penang	South do.	75	30
Do	do.	North do.	...	...
White Pepper	Singapore	South do.	5	...
Do.	do.	North do.	15	5
Do.	Penang	South do.	5	10
Do.	do.	North do.	15	...

			Wired.	
			Feb. 15 Tons.	Feb. 29 Tons.
		STEAMERS.		
Copra	Singapore & Penang	Marseilles	400	150
Do.	do.	Odessa	...	50
Do.	do.	Other South Continent	540	150
Do.	do.	North Continent	300	580
Sago Flour	Singapore	Continent	1,700	550
Tapioca Flake	do.	do.	210	55
Do. Pearl	do.	do.	40	5
Do. Flake	do.	U. S. A.	...	...
Do. do.	Penang	U. K.	...	...
Do. Pearl & Bullet	do.	do.	170	250
Do. Flake	do.	U. S. A.	...	...
Do. Pearl	do.	do.	30	290
Do. Flake	do.	Continent	...	10
Do. Pearl	do.	do.	225	110
Copra	Singapore & Penang	England	50	...
Gutta Percha	Singapore	Continent	15	40
Tons Gambier } ...	...	...	...	250
„ B. Pepper }				280
				200
				230
Para Rubber	Straits and Malaya	U. S. A.	50	10
Do.	do.	Continent	50	40

SINGAPORE MARKET REPORT.

February, 1912.

	Tons.	Highest	Lowest.
Copra	3,198	10.70	10.20
Gambier Bale	460	10.45	9.95
„ Cube No. 1 & 2 ...	102	15.85	13.50
Gutta Percha 1st quality ...	...	275.00	200.00
„ medium ...	...	140.00	90.00
„ lower ...	...	70.00	17.00
Gutta Jelotong	...	10.00	8.40
Nutmegs 110s.	...	25.00	24.00
„ 80s.	...	26.00	25.00
Black Pepper	511	22.62½	21.75
White „	94	32.75	30.50
Sago Pearl, small	41	5.35	5.00
„ Flour No. 1	3,820	4.36	4.15
„ „ No. 2	628	1.75	1.60
Tapioca Flake, small ...	356	9.25	8.60
„ Pearl „ ...	126	8.20	7.60
„ „ medium ...	225	9.00	8.50
Tin	2,145	96.90	96.00

SELANGOR.

Abstract of Meteorological Readings in the various Districts of the State of Selangor for the month of December, 1911.

DISTRICT.	Mean Barometrical Pressure at 32 Fah.	Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Wings.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
General Hospital, Kuala Lumpur ...	29.872	147.5	81.4	89.6	73.9	15.7	76.7	0.821	73.3	77	Calm.	11.06	2.66
Prisons "	...	...	...	...	...	...	...	...	...	...	...	14.23	2.27
District Hospital "	...	...	...	...	...	...	...	...	...	...	...	9.44	3.20
" Klang	...	...	...	88.7	69.6	19.1	...	...	...	...	...	15.34	4.65
" Kuala Langat ...	...	...	...	86.1	73.7	12.4	...	...	...	...	...	11.43	2.00
" Kajang	...	...	...	84.5	74.8	9.7	...	...	...	...	...	15.28	1.74
" Kuala Selangor ...	...	...	...	87.3	71.3	16.0	...	...	...	...	...	13.27	2.50
" Kuala Kubu	...	...	...	89.4	70.9	18.5	...	...	...	...	...	13.92	2.82
" Serendah	...	...	...	92.0	70.4	21.6	...	...	...	...	...	16.00	2.35
" Rawang	...	...	...	91.6	72.5	19.1	...	...	...	...	...	13.66	1.75
Sabah Bernan	...	...	...	...	...	...	...	...	...	...	...	9.24	1.19

OFFICE OF THE SENIOR MEDICAL OFFICER,
KUALA LUMPUR, 30th Jan., 1912.

G. D. FREER,
Senior Medical Officer,
Selangor, Negri Sembilan & Pahang.

SELANGOR.

Abstract of Meteorological Readings in the various Districts of the State of Selangor for the month of January, 1912.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
General Hospital, Kuala Lumpur ...	29.883	148.3	81.4	89.2	73.1	16.1	76 5	.826	73.2	77	Calm.	4.76	2.21
Prisons " "	...	...	...	...	...	...	...	...	...	...	...	3.68	2.73
District Hospital "	...	...	...	...	...	...	...	...	...	...	...	4.58	1.57
" Klang	...	...	...	90.4	69.6	20.8	...	...	...	...	...	3.25	0.93
" Kuala Langat ...	...	...	...	88.0	73.0	15.0	...	...	...	...	...	5.73	2.24
" Kajang	...	...	...	87.1	74.4	12.7	...	...	...	...	...	2.12	0.46
" Kuala Selangor ...	...	...	...	89.5	71.6	17.9	...	...	...	...	...	1.66	0.60
" Kuala Kubu	...	...	...	91.8	71.6	20 2	...	...	...	...	...	2.42	0.73
" Serendah	...	...	...	93.3	70.8	22.5	...	...	...	...	...	7.81	2.92
" Rawang	...	...	...	90.5	70.9	19 6	...	...	...	...	...	9.30	4.30
Sabak Bernam	...	...	...	...	...	...	...	...	...	...	...	2.65	2.15

Office of The Senior Medical Officer,
Kuala Lumpur, 26th Feb, 1912.

G. D. Freer,
Senior Medical Officer,
Selangor, Negri Sembilan & Pahang.

PAHANG.

Abstract of Meteorological Readings in the various Districts of the State of Pahang for the Month of December, 1911.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
District Hospital, Kuala Lipis	...	...	78.2	85.1	67.4	17.7	74.5	...	...	...	...	12.52	3.10
" " Raub	...	...	82.9	90.9	67.6	23.3	73.1	...	...	...	...	13.04	2.48
" " Bentong	...	...	80.3	88.5	70.5	18.0	74.0	...	...	...	...	17.07	3.00
" " Pekan	...	...	78.4	83.6	72.2	11.4	76 0	...	...	...	...	47.57	9.52
" " Kuantan	...	...	78.6	86.6	69.8	16.8	76.5	...	...	...	...	35.11	6.52
Dispensary, Temerloh	...	...	...	87.0	67.0	20.0	...	...	...	...	...	11.28	2.14
Sungei Lembing	...	...	...	84.0	73.6	10.4	...	...	...	...	...	35.44	86.2
Kuala Tembling	...	...	...	...	...	...	...	...	...	...	...	11.22	2.43

Office of the Senior Medical Officer,
Kuala Lumpur, 23rd January, 1912.

G. D. Freer,
Senior Medical Officer.
Selangor, Negri Sembilan & Pahang.

PAHANG.

Abstract of Meteorological Readings in the various Districts of the State of Pahang for the month of January 1912.

DISTRICT.	Mean Barometrical Pressure at 32° F.	Maximum in Sun.	Temperature.				Hygrometer.				Prevailing direction of winds.	Total rainfall.	Greatest rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
District Hospital-Kuala Lipis	...	...	79.5	87.0	67.1	19.9	74.5	...	...	...	...	7.09	1.95
" " Raub	...	...	82.6	91.8	67.5	24.3	73.3	...	...	...	...	5.52	1.92
" " Bentong	...	...	80.5	89.1	70.1	19.0	75.2	...	...	...	...	4.09	2.27
" " Pekan	...	...	80.3	84.9	72.2	12.7	74.6	...	...	...	...	8.31	2.68
" " Quantan	...	...	78.5	89.1	70.9	18.2	74.2	...	...	...	...	9.34	4.30
Dispensary, Temerloh	...	...	...	87.9	67.3	20.6	...	...	...	...	...	3.35	0.85
Sungei Lembing	...	...	...	85.8	72.7	13.1	...	...	...	...	...	10.66	2.44
Kuala Tembling	...	...	...	...	...	...	...	...	...	...	...	3.46	1.3

OFFICE OF THE SENIOR MEDICAL OFFICER,
KUALA LUMPUR, 4th March, 1912.

G. D. FREER, *Senior Medical Officer,*
Selangor, Nrgi Sembilan & Pahang.

PERAK.

Abstract of Meteorological Readings in the various Districts of the State of Perak for the month of January 1912.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
Taiping	...	105	82.22	93	69	24	77.13	865	...	79	...	12.49	4.94
Kuala Kangsar	...	...	80.61	92	68	24	75.06	809	...	80	...	5.09	2.32
Batu Gajah	...	95	80.63	92	70	22	75.47	813	...	78	...	4.31	1.35
Gopeng	...	...	80.11	92	67	25	74.06	760	...	74	...	8.72	3.79
Ipoh	...	...	81.91	93	69	24	76.27	830	...	77	...	4 09	2.00
Kampar	...	...	81.09	93	69	24	75.84	824	...	78	...	7.04	2.13
Telok Anson	...	...	81.50	93	69	24	77.18	875	...	83	...	3.96	2.67
Tapah	...	...	81.48	92	65	27	76.17	831	...	78	...	13.75	5.70
Parit Buntar	...	...	81.68	93	68	25	76.26	833	...	78	...	2.47	1.00
Bagan Serai	...	...	81.96	92	70	22	76.76	850	...	78	...	1.35	.54
Selama	...	...	80.94	94	66	28	75.07	792	...	76	...	7.57	2.96
Lenggong	...	...	79.90	90	65	25	75.07	8 6	...	78	...	5.88	1.50
Tanjong Malim	...	...	80.83	94	66	28	76.62	861	...	82	...	9.06	3 74
Grit	...	...	77.61	94	62	32	71.82	708	...	75	...	4.81	2.54
Klian Intan	...	...	...	...	...	...	...	...	...	...	...	4.87	2.37
Pulau Pangkor Laut	...	...	...	...	...	...	...	...	...	...	...	5.15	2.78
Kuala Kurau	...	...	...	...	...	...	...	...	...	...	...	2.65	1.75
The Cottage	...	...	...	...	...	...	...	...	...	...	...	8.46	2.70
Maxwell's Hill	...	...	...	...	...	...	...	...	...	...	...	8.71	2 30

Office of the Senior Medical Officer,
Taiping, 16th February, 1912.

S. C. G. Fox,
Senior Medical Officer.

PERAK.

Abstract of Meteorological Readings in the various Districts of the State of Perak for the month of February, 1912.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
Taiping	...	106	82.28	94	70	24	77.13	864	...	79	...	10.57	1 58
Kua'a Kangsar	...	...	82.00	94	70	24	75.83	811	...	74	...	5.17	1.75
Batu Gajah	...	...	82.11	93	70	23	76.27	828	...	77	...	9.01	3.86
Gopeng	...	...	80.87	92	68	24	74.80	784	...	74	...	6.68	1.97
Ipoh	...	...	82.87	94	70	24	76.23	816	...	73	...	5 74	1.86
Kampar	...	...	81 47	93	68	25	76 34	839	...	78	...	14.43	3.38
Telok Anson	...	...	81.68	93	69	24	77.18	867	...	81	...	10.41	2.10
Tapah	...	...	81.69	92	66	26	76.54	845	...	78	...	9.05	1 79
Parit Buntar	...	...	82.33	92	69	23	76.44	834	...	77	...	3.62	1 26
Bagan Serai	...	...	82.39	92	69	23	77.26	867	...	79	...	6.92	1 85
Selama	...	...	80.95	94	61	33	76.23	842	...	80	...	10.94	3.84
Lenggong	...	...	80.91	94	65	29	75.43	810	...	78	...	7.70	3.22
Tanjong Malim	...	...	81.82	94	65	29	77.11	863	...	81	...	5.31	1.75
Grit	...	...	79.33	97	62	35	71.75	680	...	68	...	3.32	1 79
Klian Intan	...	...	...	...	...	...	...	...	...	...	...	4.54	2.50
Pulau Bangkor Laut	...	...	...	...	...	...	...	...	...	...	...	9.66	1.96
Kuala Kurau	...	...	...	...	...	...	...	...	...	...	...	4.55	1.30
Maxwell's Hill	...	...	...	...	...	...	...	...	...	...	...	7.97	1.78
The Cottage	...	...	...	...	...	...	...	...	...	..	...	4.28	1.10

Office of the Senior Medical Officer,
Taiping, 16th March, 1912.

S. C. G. Fox,
Senior Medical Officer.

NEGRI SEMBILAN.

Abstract of Meteorological Readings in the various Districts of the State of Negri Sembilan for the month of December, 1911.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
District Hospital, Seremban			79.6	87.8	72.1	15.7	76.0	.834	73.9	82	N.W.	11.64	3.30
" " Kuala Pilah			77.9	86.7	71.9	14.8	75.0	.816	73.1	85	...	15.38	4.23
" " Mantin			...	...	...	...	...	...	...	...	...	16.93	3.70
" " Tampin			...	...	...	...	...	...	...	...	...	10.19	2.05
" " Jelebu			...	...	...	...	...	...	...	...	...	7.22	2.57
" " Port Dickson			...	...	...	...	...	...	...	...	...	8.90	1.50
Beri-beri Hospital " "			...	...	...	...	...	...	...	...	...	7.97	1.20

OFFICE OF THE SENIOR MEDICAL OFFICER,
KUALA LUMPUR, 24th Jan., 1912.

G. D. FREER,
Senior Medical Officer,
Selangor, Negri Sembilan & Pahang.

NEGRI SEMBILAN.

Abstract of Meteorological Readings in the various Districts of the State of Negri Sembilan for the month of January, 1912.

DISTRICT.	Mean Barometrical Pressure at 32° Fall.	Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
District Hospital, Seremban	...	146.8	80.0	89.0	70.7	18.3	75.7	.820	73.1	79	N. W.	3.26	0.88
" " Kuala Pilah	...	...	78.9	87.8	70.3	17.5	74.6	.783	71.8	80	...	2.11	0.76
" " Mantin	...	...	...	...	...	...	...	...	...	...	...	2.97	0.56
" " Tampin	...	...	80.2	86.6	73.0	13.6	74 2	...	...	...	...	2.31	0.83
" " Jelebu	...	...	...	...	...	...	...	...	...	...	...	3.17	1.28
" " Port Dickson	...	...	...	...	...	...	...	...	...	...	...	.94	0.60
Beri-beri Hospital	...	...	...	...	...	...	...	...	...	...	...	.81	0.45

Office of the Senior Medical Officer,
Kuala Lumpur, 24th Feb., 1912.

G. D. Freer,
Senior Medical Officer,
Selangor, Negri Sembilan & Pahang.

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— STRAITS —

AND

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AND

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NOTES FOR A DEMONSTRATION CONCERNING THE IMPROVEMENTS IN, OR RELATING TO, THE CURING OF PARA RUBBER.

(PATENTED).

1. This invention relates to improvements in the curing of Para Rubber and refers more particularly to apparatus for coagulating and curing the latex of Para Rubber known as Hevea Braziliensis.

2. It is an anti-metal process and as will be apparent, the apparatus has been designed to accommodate the process of coagulating latex as it is brought from trees, without the addition of chemicals. In this first respect the process differs from all others that obtain, viz:—the machinery or apparatus has been modified so as to coagulate latex direct *and not latex treated or manipulated to suit the machine.*

3. At the time of the first Rubber Exhibition held at Olympia, London, I inquired of some of the leading manufacturers (the real masters of the rubber market) what they wanted from Plantation rubber and wherein it differed from fine hard Para. Plantation rubber was considered softer; the addition of chemicals was disliked; and there was serious objection to variation in the character of the rubber. Not only did the rubber from different estates vary from one another but even from any one estate there was considerable want of uniformity. What manufacturers required was "latex as it came from the tree, cured by smoke as was done in Brazil, without the aid of chemicals."

4. It is not asserted by manufacturers that fine hard Para is always of an uniform character—indeed, I was informed that different results has been obtained from the same ball of such rubber when treated in Hamburg, Harburg, and Vienna—but it is claimed that the variation with Brazilian is far less than with Plantation rubber. It is obvious that climatic differences have to be considered—and due allowance should be made for the much shorter period of tapping in Brazil (April to September) as compared with the almost-all-the-year-round seasons in Malaya—this difference is all the more important if it is remembered that the dry season in Brazil, April to September

(although occasional showers and storms occur) is more pronounced and the rainfall less equable than the driest months in Malaya. Thus, the latex during this period in Brazil would contain the minimum quantity of water and in the more rarified air, or, air containing less water-vapour than in the rainy months, there would be less tendency for latex coalescing too rapidly through atmospheric conditions.

5. The more material advantage, however, lies in the circumstance that trees in tropical * countries conform to their natural periodicities with most regularity where the dry season is sufficiently marked to represent a true resting period. Here in Malaya, between mid-January and March on the western coast of the Peninsula—the season of rice harvest—there occurs a short dry season when most of the deciduous trees shed their leaves and produce flowers. It is so with Hevea braziliensis when the conditions are normal, but when, after heavy rains from September to mid-January the rains still continue, then the rubber trees may not, or only partially defoliate and the floral periodicity may be scant or suppressed. The flowers too, through heavy rains may be poorly pollinated only, and such trees, whether partially defoliated or lightly pollinated, may perform their foliar and floral function during the following August or September † thus providing what is called the Spring crop of seeds, but the result is an irregular and uncertain crop of latex; as a matter of fact, a wet season at the time of year under review is represented by the trees in every physiological phase common to the species at different periods instead of the real season (February). I believe every planter is aware that there is a fall off in the yield of latex at the time of trees wintering, and the diversity of yield in the following tabulated statements will be more apparent when it is reflected that every gradation of difference may have been exhibited by the trees at the time of tapping.

6. In table I the diversity of yield within the same group of 200 trees during a period of 5 years is shown. The diversity of resulting rubber is more variable than the yield of latex.

Table I.

Experiment.	No. of trees tapped.	No. of times tapped.	Season.	Fluid ozs. c/c obtained.	Weight of dry rubber.	Comparative yield of fluid ozs. to ozs. dry rubber advoirdupois.
					lbs. ozs.	
1905	200	25	Oct.-Nov.	11746	199 0	$3\frac{11}{16}$ ozs. c/c
1906	200	25	Mar.-Apr.	10943	154 0	$4\frac{7}{16}$,,
1909	200	32	Aug.-Sept.	11323	181 15	‡$3\frac{14}{16}$,,

* In all countries when the dry season is not an absolute drought.
† It is so with other trees.
‡ Reduced to 25 tappings the result would be much less favourable.

7. The diversity that may occur within one year is represented in the following table 2, but it should be mentioned that Experiment 7 were overcrowded inside trees in which the increment of growth was fractional only and the bark poor as a consequence.

No. of Experiment.	Total fluid.	Total dry rubber avoirdupois		Comparative yield of fluid ozs. to ozs. of dry rubber advoirdupois.	Season 1909.
	ozs. c/c.	lbs.	ozs.	ozs. c/c.	
7	2826	21	10½	8⅛	February—March
Old trees) 1	3323	75	4	2¾	April—May
2	7718	128	7	3¼	May, June—July
3	7861	115	7	3⅜	May, June—July
4	(1st) 11323	181	15	3⅞	August—Sept.
4	(2nd) 5575	75	12	4 9/16	Dec.—January
6	18748	251	8	4⅜	Nov.—December
(Young trees) 9	† 3433	43	0	4 15/16	Oct.—November
Young trees) 8	† 3981	48	0	5 3/16	September
5	11957	175	8	5 5/16	Sept.—October
Young trees) 10	† 3511	37	0	5 10/16	Nov.—December

8. This diversity is further disclosed in table 3, viz:—Not only s the yield of latex variable but the latex is variable per se. From the same group of trees 30 fluid ozs. of latex was taken from the bulk daily, coagulated and weighed separately, with the following result:—

Table 3.

Date	Rainfall inches parts.		Total latex obtained Daily.	Dry weight of Sheet of 30 ozs. latex after Coagulation.	Remarks.
1909.			Ozs. C/C.	(Ozs. avoirdupois).	
Dec. 29	...	60	114	6	From the latex obtained daily 30 ozs. C/C. was kept apart and weighed dry in the form of Sheet.
„ 30	...	...	187	6	
„ 31	...	...	145	7	
1910					
Jan. 3	...	38	210	7	
„ 4	...	85	200	6	
„ 5	...	43	252	7⅛	
„ 6	...	47	270	7½	
„ 7	...	...	291	8	
„ 8	...	...	304	7½	
„ 10	...	...	338	8¼	
„ 11	...	...	272	7½	
„ 12	..	...	276	6¼	
„ 13	...	36	268	7½	
„ 14	...	...	340	7¼	
„ 15	...	30	304	6¾	
„ 16	...	...	288	8	
„ 17	...	...	316	6½	
„ 18	...	...	326	6½	
„ 19	...	89	308	7	
„ 20	...	...	292	6¾	
„ 21	...	...	284	6¾	

Half, not full herring bone tapping, although large trees yield better than young trees pro rata.

9. Another reason of variation may be caused by mixing the latex of trees of different age and size. It is frequently asserted that there is no difference in the latex from trees of different age—a statement which could not be supported by fact. Under normal conditions the water contained in latex may vary from 55° to 65°. It may however, in very wet weather and with young trees, contain a much higher per centage as is shown in the following experiments:—

Table 4.

SMALL TREES.

Number of Trees Tapped.	Aggregate girth at 3 ft. from ground.	Number of times tapped.	Fluid oz. of latex.	Dry weight of rubber.	Ratio of fluid to ozs. Adoir-dupois.	*Including some added water.*
90	220′ 5″	24	3,511	37 lbs.	$5\frac{15}{16}$	Nov.-Dec.
120	276′ $10\frac{3}{4}$″	26	3,433	43 „	$4\frac{15}{16}$	Oct.-Nov.
100	276′ $10\frac{1}{2}$″	28	3,981	48 „	$5\frac{3}{16}$	Sept.
310	774′ $2\frac{1}{4}$″	26 (average)	10,925	128 lbs.	Total small trees.	

LARGE TREES.

150	713′ $4\frac{1}{4}$″	30	18,748	lbs. ozs. 251 8	$4\frac{5}{8}$	Nov.-Dec.

It may be noted that the diversity is greater in the resulting rubber than in the volume of latex from young and old trees

10. Considering the variability of latex which has been referred to, and the objection of manufacturers to the same cause in the resulting rubber, such results are not astonishing when the system of treatment is examined. In Malaya all the latex obtained is coagulated by some chemical re-agent, usually Acetic acid, and as will be evident by glancing at Table 4 different results were obtained from approximate volumes of latex in three experiments, while almost double the weight of rubber was obtained from a less area of bark in another experiment. If therefore, in one instance a given quantity of Acetic acid is necessary to precipitate one pound of dry rubber from one gallon of latex, in another instance the same quantity of acid would be used to precipitate double the weight of resulting rubber. The most that could be claimed for such a system is that it is an empirical one.

11. It should be observed too, that Acetic acid is far from being a perfect re-agent—unless an inordinate quantity of acid is used—there is always some water left, which, if again treated with Acetic acid will precipitate more coagulated latex

12. As a matter of fact, under the system which obtains on nearly all estates, very little latex is coagulated, the process only amounts to coalescing. The globules of caoutchouc suspended in the latex have partially clotted without separating or disposing of much water and that such coalesced latex is fitted to pass through heavy machines is no more rational than milling unripened wheat—except that it would be more evident in the latter instance.

13. The time however is fast approaching when Plantation rubber will have to stand a severer test than has yet been applied. Once the supply of raw material reaches demand and stocks accumulate the value and test of raw rubber, must as with tea, depend on its keeping qualities. It is true a fair proportion of Plantation rubber is superficially smoked, but in effect there is no comparision between smoke-cured and smoke-dried rubber. Superficial smoking is an antidote against most fungi if commenced in good time, and the life of rubber kept free from mould is preserved, but such smoking cannot recure raw material of which the constituent elements are already fixed

14. If the practice of using chemical re-agents was discontinued and all possible care taken over latex from trees of different ages, there is little doubt that Plantation rubber could be brought up to the stan dard of fine hard Para, which it may be remarked represents only a small part of the bulk of rubber which reaches the markets by way of Brazil. Smoke-cured Rubber from Malaya has been declared comparable with fine hard Para and a small sample sent to the recent Exhibition in London cured by myself 14 years ago was perfectly sound. A sample submitted to the Imperial Institute (really as a test for packing smoked rubber) was analaysed and furnished the following result :—

"The results of the chemical examination were as follows :—

				Per cent.
Moisture	...	...	...	04
Caoutchouc	...	...	...	95.01 *
Resin	...	...	...	2.2
Proteid	..	...	...	2.2
Ash	...	...	...	0.6

15. As an instance of the keeping qualities of smoked rubber it may be interesting to remark that, at one time a large manufacturer reported on a sample sent for his opinion as a retrogressive step and subsequently—after keeping the same rubber twelve months—that he had tried it again and obtained much better results and considered it equal to fine hard Para for all practical purposes.

16. In the use of smoke there are already several misconceptions but in the method of application as adopted nothing could be more primitive. Let it be remembered from the outset that smoke is a result of imperfect combustion; that it is not the elementary consti-

* Including 1.3 per cent. of insoluble Caoutchouc."

tuents contained in the fuel but the compound which is formed with sufficient heat in the process of combustion that acts as the real re-agent and coagulates latex; that volumes or clouds of smoke are not only unnecessary but are* positively harmful; that a smoke house should be well ventilated and the temperature kept as low as possible; that the furnace or heat should always be generated outside the smoke house; that smoke from a furnace should never go direct on latex or rubber; that fuel (wood or coconut husk) be always dry in view of furnishing comparatively dry smoke; that all smoke be passed through the furnace chimney until the fire is established or burnt through and the temperature very high; that the fire is well stoked and not choked with too much fuel or allowed to fall too low.

17. How these various items are arranged in the apparatus I am exhibiting will be explained, but I wish to pause here to emphasise the importance of maintaining a regular supply of smoke from a well consumed fire. Of all the constituents contained in wood-fuel water is the most troublesome. However perfect the combustion water-vapour has to be disposed of, and excess smoke-vapour results in condensation within the house and a steamy atmosphere which is fatal to good coagulation. (The fat and oil ever present on superficially smoked biscuits and sheets is really a deposit of wood napthaline and other impurities conveyed by excess vapour in smoke due to wet fuel and the smoke passing direct on to the rubber—an error easily avoided). In the process of coagulation it is essential that the evaporation of water within the thin layers of latex shall be commensurate with the heat supplied (not a high temperature at which caoutchouc perishes), and this cannot occur in an atmosphere surcharged with steam or vapour, and the result is, the water and caoutchouc coalesce and the resulting rubber is uncured.

18. The real problem of the treatment of Hevea latex is one of separation between the water and caoutchouc. With Castilloa and some other latices which contain an acid reaction this can be done by centrifugal motion at high speed, the caoutchouc separates into a mass and can be skinned off. With Hevea latex however, although remarkably flocculent—perhaps more so in Malaya than in South America—such methods are futile. Hevea latex is alkaline to litmus and the process of coagulation, whether with or without a re-agent, is really one of coalescing into an agglutinated mass and the variable water residuum, is I suspect, more the result of pressure than separation or precipitation of caoutchouc. *(Under normal conditions Hevea latex coalesces by natural means satisfactorily if placed in a cylinder of which the height is three or four times that of the diameter and the water residuum is about the same as when treated with a re-agent such as acetic acid. In certain phases of the Hevea tree, at the time of this writing, 29-1-1912, all the latex in a cylinder 7 ins. by 2¼ ins. coalesced in fifteen hours without leaving a drop of fluid. Such re-agents as acetic-acid*

* It is paradoxical. Volumes or clouds of smoke imply excess water-vapour.

merely expedite the process of coalescence). Both by volume and weight water is the larger and heavier body in the composition of latex, from 55°—75°, and even more at certain seasons. If too, it is remembered that the specific gravity of water is heavier than latex, the refinement of the arrangement of partial separation between the water and caoutchouc contained in latex by mechanical means in the process of coagulation by heat and smoke, now to be described, will be apparent.

19. Heat is generated in a furnace supplied with wood, coconut husk, or similar fuel and should be quite dry. The furnace is placed outside the smoke-house and a large pipe is led from the furnace along the ground of the house into a smoke-box, a row of smaller pipes is led from the smoke-box back to the funnel of the furnace, the rate of combustion and also the passage of smoke being controlled by separate dampers. The pipes are perforated underneath so that the smoke in passing through the perforations strike a recovery trough placed beneath which acts, like the smoke-box, as a filter, as the water vapour in the smoke condenses in the trough and deposits various impurities and this liquid is drained away.

20. Latex is exposed to the action of heat and smoke by the employment of an endless flexible band or belt which passes through an adjustable receptacle containing latex placed outside the smoke chamber and continually removes the surface layer of latex out of this supply vessel into which the band dips.

21. The arrangement of belts is such that one or any number can be carried on the same machine, and the belt is carried on pulleys. One pulley (or more) supported by brackets is inside the chamber, and one attached to the driving gear outside the chamber.

22. These brackets are adjustable in two directions, vertically, to allow of lowering or lifting the belts independently, horizontally, to allow of any sagging being taken up, or, if necessary, the removal of same; automatic belt adjusting gear is also attached, which can be easily put in or out of action.

23. The driving machine carries one, or as may be desired, any number of pulleys. These are driven by a worm and worm wheel, and this worm shaft can be driven by either hand or motor power as required. This machine is also adjustable vertically so that the distance between the belts and smoke pipes can be controlled.

24. The supply vessels below the belts are supplied from cylindrical reservoirs carried by movable supports. The supports are controlled vertically by a wheel and screw so that the flow of latex into the supply vessel can be regulated. The reservoirs and support is easily detached from the supply vessel and can be readily removed for the purpose of stripping the belt after coagulation.

25. Smoke and heat is concentrated on the belts by the receiving trough and the temperature of the smoke chamber is regulated by ventilation.

26. Before commencing to coagulate, it is essential that the necessary heat and smoke has been raised and that the furnace fire is burning briskly. The rate of combustion is then controlled by dampers and the requisite heat can be maintained by a slow fire, which, with a heated furnace, dries up most of the moisture in the fuel while affording sufficient smoke on the belt in its passage over the pipes. The smoke chamber is constructed with a raised or lantern roof providing sufficient ventilation for the air and smoke surcharged with vapour from evaporation of moisture in the latex on the belt, thus excluding condensation within the smoke chamber. (It is best to admit air at the bottom of the chamber too, and blanket the smoke. Free circulation of air allows induced draught and the ready escape of smoke from the supply pipes, such dry filtered smoke is then retained sufficiently long to take up all the moisture evaporated during the chamber. When these factors are all in harmony perfect coagulation is assured.)

27. For the process of coagulation the supply vessel, through which the travelling belt passes, is made shallow and to contain very little latex so as to preclude the possibility of coalescence from a smoky belt. This supply vessel is supplied from a reservoir at about the same rate that the latex is removed by the belt, and both vessels are specified to be placed outside the smoke chamber in view of preventing coalescence from the proximity of smoke.

28. The belts may be made of canvas, or other similar material, dipped in rubber solution and vulcanized so as to obtain a smooth outside surface, which is necessary for the easy stripping of the belt after coagulating. The length of the belts is estimated at forty-two feet overall, and the width may vary from a few inches to two feet a greater width is considered unwieldy.

29. As the belt passes through the supply or feeding vessel a thin layer of latex adheres to the belt in its most expanded form and is then exposed to the action of smoke and this re-agent immediately separates much of the water in the latex on the outside of the belt, The pulleys, too, which support the weight of the belt—if maintained at slight tension,—afford sufficient pressure on the belt to express out most of the remaining water left in the latex on the outside of the belt, from where some drops off as clear water, while the the remaining moisture is evaporated by heat and smoke and the resulting caoutchouc is coagulated into a concentric film of rubber. Smoke is therefore the host in three different functions of the process; (a) it is the host which carries the compound re-agent which separates the water from the caoutchouc in the latex; (b) it is the host which absorbs and carries off excess moisture within the chamber; (c) it is the host which fixes the re-agent in the coagulated latex and thus resists oxidization. The process, therefore, consists of coagulation by separation of water from the caoutchouc in the latex by heat and smoke in concentric layers between films of smoke on a travelling belt in which every

component particle, even the molecule, is exposed to the action of smoke and is so polymerised, and thus the keeping quality of the resulting rubber is assured, and the subsequent vulcanizing test satisfactory for years afterwards.

30. It will be evident that the process differs from all others that obtain, and it is asserted that perfect coagulation and curing of Hevea latex can only be effected when the water within the latex is separated and disposed of at the same time. Whatever the re-agent may be, when Hevea latex is treated in volume, the process is one of coalescing (smoke applied to latex in volume furnishes the same result). In volume the re-agent diffuses too slowly, and the particles of caoutchouc flock into an agglutinated mass, leaving a residuum of caoutchouc in the mother liquor. Such coalesced rubber not only oxidises and moulds after preparation, but is also faulty in the vulcanizing process. Smoke coagulated rubber on a belt, where the particles and globules of caoutchouc are expanded, so that even the molecule is exposed and polymerised, improves in keeping, while coalesced rubber which has not been cured but merely agglutinated, deteriorates.

31. The process differs too from the Brazilian method in the application of dry filtered smoke as compared with the water vapourish smoke used in Brazil. In Brazilian smoke the three elements of Hydrogen, Oxygen and Carbon are excessively high, while other elements are only partially generated. The more material difference however, lies in the separation of water by this process against its absorption in the Brazilian one.

32. Mention has already been made of vertical adjusting gear to accommodate the sag of the belt as it becomes loaded, the weight however, is in inverse ratio to the latex supplied, as owing to the separation of water and caoutchouc there is considerable drip and evaporation of moisture.

33. It is estimated that a belt one foot wide would coagulate 7½ gallons of latex in 3 to 4 hours. Before removal from the belt the rubber should be surface dry or slightly hardened for stripping. It can then be readily removed and passed through rollers in the same operation of stripping, when the remaining water is expressed out, and complete drying is effected in a few days, if the rubber is smoked daily, for which purpose the smoke chamber could be utilized. (A sample of such rubber analysed at the Imperial Institute was reported to contain 0:04 moisture and arrived in excellent condition free from mould). On estates where there is washing and preparing machinery the process would be considerably expedited if the belt was stripped at intervals, as the water separates and evaporates quicker the less the belt is loaded. It is estimated that a belt one foot wide and stripped at intervals would coagulate from 4 or 5 gallons of latex per hour. An adjustable rubber brush is attached to the driving gear which scrapes off the freshly coagulated rubber and leaves the surface of the belt comparatively dry. The rubber is brushed into a funnel and drops into a

collecting basin. It can be immediately treated by washing, and prepared in any desired grade. Such smoke coagulated rubber would surpass any plantation rubber that has yet reached the market. In this latter instance a belt two feet wide would be practicable, in the former instance an one foot belt is considered more serviceable.

34. Whether it is better to add some water in the collecting cups, as is done for latex intended to be acid-coagulated, I am not able to say without further observation, but I am inclined to think that the addition of water helps to eliminate resin. The best fine hard Para contains 15% of moisture on arrival in European markets when it is probably one year old, so that the addition of some water, which is expressed within a few hours, is not abnormal. It is very important, however, that the density of latex be taken into consideration. In the dormant or wintering season, mid-January to mid-March, latex reaches its greatest density. With the appearance of flowers, and, as the leaves mature, all the functions of the tree are most active and the consistency of latex changes with the higher percentage of water. At such a time additional water may be superfluous, and also on rainy days or following continuous rain storms when the ground is saturated. Supposing the wintering season to have been normal and the trees to have conformed to their period of defoliation, the best tapping months are from May to November during which time (exclusive of exceptional weather) latex may be of a fair average density and *vice versa* when the seasons have not been favourable.

35. The value, too, of commencing tapping at break of day—with the first streak of dawn should not be overlooked. It cannot be too well known that on warm dry days, Hevea trees contract, through exhalation of moisture, as the day advances, and the tension pressure which sustains the flow of latex is partial only, and the loss of first latex from coalescence increases.

36. It should not be overlooked that latex travels best when strained. Lumps or clot left in latex produce natural coalescence, even the smallest particle of clot or foreign matter furnishes a tendency for latex to flock, some days more than others.

It is suggested :—

(1) That additional drying houses could be supplied with smoke from the smoke-chamber furnaces and that the smoke be applied by piping perforated underneath which should be received in a filter trough before dispersing, care being taken that the fuel is dry. By this system of applying smoke uniform results can be obtained. The drying house would only require slight ventilation during smoking and additional ventilation at other times. A few days' smoking would suffice.

(2) That the process under review could be carried out in existing or central factories, and is also adapted for decentralised factories with hand or motor power, or portable buildings.

It is claimed :—

(1) That the weight of the resulting rubber of a given volume of latex is increased by this process as there is no loss of caoutchouc which occurs when latex is treated in volume.

(2) That it is a perfect system of coagulation, and by the thin accumulation of films of latex and separation of water in the process, coalescing is avoided, and the minutest component particles down to the molecule are exposed to the action of smoke and smoke-curing, thus precluding the possibility of subsequent oxidisation.

(3) That the inherent characteristic of Hevea latex to foul when in contact with another body (a spout, a funnel, or when flowing or dripping) has been overcome in the method adopted in supplying the belt by dipping outside the smoke area.

(4) That the process disposes of the whole difficulty of fungoid attacks whether in the latex; in drying; in store; or in transit.

(5) The keeping quality is assured, a fair sized sample one year old was reported by a large manufacturer "to be equal to fine hard Para for all practical purposes," and the specimens of smoked spindles prepared by myself and analysed at the recent Rubber Exhibition in London and reported comparable to fine hard Para, were three years old.

(6) In the arrangement of combustion, draft, filtration, and ventilation, wood napthaline and other impurities in the smoke injurious to latex are disposed of; the excessive water and the resulting water vapour in wood fuel is exhausted, and a concentrated smoke containing the necessary elements in a compound form is produced.

(7) That the variation in latex, already referred to, is largely overcome by the method of supplying latex on a travelling belt from outside the smoke chamber, where the amount of latex taken up by the belt can be regulated by the adjustable feed pans so as to ensure consistent separation of water and the action of smoke. The variable consistency of latex is disposed of and the resulting rubber is of a standard form.

(8) Finally a standard rubber which will keep for years and prove superior in the vulcanizing process, the real test, to any other Plantation Rubber.

R. DERRY,
Botanic Gardens, Singapore

EXPORTS TELEGRAM TO EUROPE AND AMERICA.

Month of March.

	Steamers.		Wired. Mar. 15 Tons.	Wired. Mar. 31 Tons.
Tin	Str. Singapore & Penang	to U. Kingdom &/or	1,501	1,698
Do.	do.	U. S. A.	506	730
Do.	do	Continent	380	330
Gambier	Singapore	Glasgow	...	...
Do.	do.	London	...	...
Do.	do.	Liverpool	70	...
Do.	do.	U. K. &/or Continent	125	25
Cube Gambier	do.	United Kingdom	25	20
Black Pepper	do.	do.	5	...
Do.	Penang	do.	45	...
White Pepper	Singapore	do.	45	...
Do.	Penang	do.	5	5
Pearl Sago	Singapore	do.	100	10
Sago Flour	do.	London	50	260
Do.	do.	Liverpool	1,700	...
Do.	do.	Glasgow	25	25
Tapioca Flake	Singapore	United Kingdom	130	...
Tapioca Pearl & Bullet	do.	do.	200	65
Para Rubber	Straits & Malaya	do.	350	700
Gutta Percha	Singapore	do.	35	60
Buffalo hides	do.	do.	150	...
Pineapples	do.	do.	25,000	8,500
Gambier	do.	U. S. A.	375	190
Cube Gambier	do.	do.	110	35
Black Pepper	do.	do.	110	10
Do.	Penang	do.	10	30
White Pepper	Singapore	do.	90	...
Do.	Penang	do.	...	25
Tapioca Pearl	Singapore	do.	15	40
Nutmegs	Singapore & Penang	do.	6	29
Sago Flour	Singapore	do.	100	125
Pineapples	do.	do.	5,750	800
Do.	do.	Continent	6,750	1,250
Gambier	do.	South Continent	80	75
Do.	do.	North Continent	140	80
Cube Gambier	do.	Continent	40	10
Black Pepper	do.	South Continent	180	70
Do.	do.	North do.	75	...
Do.	Penang	South do	15	...
Do	do.	North do.	5	...
White Pepper	Singapore	South do.	10	10
Do.	do	North do.	10	...
Do.	Penang	South do.	10	...
Do.	do.	North do.	20	5

			Wired. Mar. 15 Tons.	Wired. Mar. 31 Tons.
	STEAMERS.			
Copra	Singapore & Penang	Marseilles	680	220
Do.	do.	Odessa	1,275	1,025
Do.	do.	Other South Continent	50	...
Do.	do	North Continent	2,300	1,000
Sago Flour	Singapore	Continent	2,000	600
Tapioca Flake	do.	do	50	25
Do. Pearl	do.	do.	45	...
Do. Flake	do.	U. S. A.	5	...
Do. do.	Penang	U. K.	...	...
Do. Pearl & Bullet	do.	do.	75	85
Do. Flake	do.	U. S. A.	...	...
Do. Pearl	do.	do.	100	470
Do. Flake	do.	Continent	...	...
Do. Pearl	do.	do.	575	70
Copra	Singapore & Penang	England	50	100
Gutta Percha	Singapore	Continent	35	30
Para Rubber	Straits and Malaya	U. S. A.	60	20
Do.	do.	Continent	10	40
Tons Gambier	... ...	...	300	300
„ B. Pepper			310	130

SINGAPORE MARKET REPORT.

March, 1912.

	Tons.	Highest	Lowest.
Copra	3,714	11.10	10.40
Gambier Bale	560	10.75	10.20
„ Cube No. 1 & 2 ...	236	15.90	13.75
Gutta Percha 1st quality ...	...	275.00	200.00
„ medium ...	...	140.00	90.00
„ lower ...	...	70.00	17.00
Gutta Jelotong	...	11.75	8 75
Nutmegs 110s.	...	26.00	25 00
„ 80s.	...	28.00	26.00
Black Pepper	399	23.25	22.00
White „	79	33.75	31.75
Sago Pearl, small	1	5.40	5.30
„ Flour No. 1	4,321	4.60	4.17
„ „ No. 2	95	1.90	1.70
Tapioca Flake, small ...	339	9.45	9.25
„ Pearl „ ...	133	8.30	7.85
„ „ medium ...	211	9.20	9.10
Tin	1,830	96.37½	94 00

PAHANG.

Abstract of Meteorological Readings in the various Districts of the State of Pahang for the Month of February, 1912.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
District Hospital, Kuala Lipis	...	...	80.3	89.0	67.3	21.7	74.9	...	...	...	...	5.25	1.50
" " Raub	...	...	83.2	90.2	74.2	16.0	73.6	...	...	...	...	10.70	2.40
" " Bentong	...	...	83.0	90.2	70.6	19.6	76.0	...	...	...	...	7.51	1.70
" " Pekan	...	...	81.3	86.0	72.7	13.3	76.6	...	...	...	...	10.07	2.55
" " Kuantan	...	...	79.7	89.8	70.0	19.8	76.5	...	...	...	...	7.33	2.73
Dispensary, Temerloh	...	...	...	89.7	68.3	21.4	...	...	...	...	...	4.40	1.03
Sungei Lembing	...	...	...	82.7	74.8	7.9	...	...	...	...	...	6.85	1.01
Kuala Tembling	...	...	...	...	...	...	...	...	...	...	...	5.72	2.10

Office of the Senior Medical Officer,
Kuala Lumpur, 28th March, 1912.

G. D. Freer,
Senior Medical Officer,
Selangor, Negri Sembilan & Pahang.

PAHANG.

Abstract of Meteorological Readings in the various Districts of the State of Pahang for the month of March, 1912.

DISTRICT.	Mean Barometrical Pressure at 32° F.	Maximum in Sun.	Temperature.				Hygrometer.				Prevailing direction of winds.	Total rainfall.	Greatest rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
District Hospital, Kuala Lipis	...	...	82.0	90.8	67.7	23.1	75.7	...	...	...	...	2.44	0.70
" " Raub	...	...	83 0	91.6	70.4	21.2	73.6	...	...	...	...	3.20	1.47
" " Bentong	...	...	82.8	90.9	70.7	20.2	75.8	...	...	...	...	7.30	2.76
" " Pekan	...	...	82.4	89.0	71.7	17.3	77.5	...	...	...	...	2.18	1 30
" " Kuantan	...	...	78.1	89.8	...	...	73.4	...	...	...	...	1.24	.62
Dispensary, Temerloh	...	...	...	92.0	67.5	24.5	...	...	...	...	...	2 31	1.03
Sungei Lembing	...	...	...	92.9	74.1	18.8	...	...	...	...	...	7.61	3.44
Kuala Tembling	...	...	...	...	...	...	...	...	...	...	...	3.00	1.27

OFFICE OF THE SENIOR MEDICAL OFFICER,
KUALA LUMPUR, 24th April, 1912.

G. D. FREER,
Senior Medical Officer,
Selangor, Nergi Sembilan & Pahang.

PERAK.

Abstract of Meteorological Readings in the various Districts of the State of Perak for the month of March, 1912.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
Taiping	...	106	82.67	93	70	23	78.01	898	...	81	...	12.18	1.57
Kuala Kangsar	...	...	82.63	94	69	25	76.73	842	...	77	...	5.02	.65
Batu Gajah	...	...	82.99	94	69	25	76.45	823	...	73	...	8.61	1.65
Gopeng	...	...	81.46	93	68	25	75.31	797	...	74	...	13.69	2.42
Ipoh	...	...	82.83	94	70	24	76.81	842	...	75	...	5.88	1.96
Kampar	...	...	82.28	94	71	23	77.11	864	...	79	...	11.08	1.98
Telok Anson	...	...	82.42	93	70	23	77.87	892	...	81	...	7.78	1.77
Tapah	...	...	82.39	92	68	24	77.25	867	...	79	...	12.41	2.60
Parit Buntar	...	...	83.21	92	73	19	77.83	883	...	79	...	8.92	3.17
Pagan Serai	...	...	83.29	93	72	21	78.40	908	...	81	...	4.74	1.37
Selama	...	...	81.87	94	69	25	77.87	899	...	83	...	5.96	1.23
Lenggong	...	...	82.14	94	66	28	76.12	821	...	75	...	6.79	1.95
Tanjong Malim	...	...	81.92	94	68	26	77.72	894	...	83	...	7.03	2.12
Grit	...	...	80.33	96	62	34	73.91	755	...	74	...	6.25	2.80
Klian Intan	...	...	...	...	...	...	...	...	...	...	...	1.18	.55
Pulau Pangkor Laut	...	...	...	...	...	...	...	...	...	...	...	6.19	1.58
Kuala Kurau	...	...	...	...	...	...	...	...	...	...	...	3.60	1.50
The Cottage	...	...	...	...	...	...	...	...	...	...	...	10.46	2.01
Maxwell's Hill	...	...	...	...	...	...	...	...	...	...	...	7.43	1.90

Office of the Senior Medical Officer,
Taiping, 15th April, 1912.

S. C. G. Fox,
Senior Medical Officer

NEGRI SEMBILAN.

Abstract of Meteorological Readings in the various Districts of the State of Negri Sembilan for the month of February, 1912.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
District Hospital, Seremban	...	...	80.4	90.0	72.0	18 0	76.2	.826	73.4	79	...	6.48	1.30
" " Kuala Pilah	...	...	79.0	87.8	70 3	17.5	74 5	.775	71.5	79	...	9.02	2 24
" " Mantin	...	...	...	...	...	...	...	...	...	...	...	7 77	2.02
" " Tampin	...	159.4	80.7	87.7	74.1	13.6	75.0	.771	71.2	73	...	4.27	1.10
" " Jelebu	...	...	...	...	...	...	...	...	...	...	...	6.37	1.54
" " Port Dickson	...	...	...	...	...	...	...	...	...	...	...	4.07	1.04
Beri-beri Hospital " "	...	...	...	...	...	...	...	...	...	...	...	4.54	0 77

OFFICE OF THE SENIOR MEDICAL OFFICER,
KUALA LUMPUR, 23rd March, 1912.

G. D. FREER.
Senior Medical Officer,
Selangor, Negri Sembilan & Pahang.

NEGRI SEMBILAN.

Abstract of Meteorological Readings in the various Districts of the State of Negri Sembilan for the month of March, 1912.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
District Hospital, Seremban	...	151.0	82.2	90.4	72.4	18.0	76.9	.845	74.3	79	N. W.	4.69	0.99
,, ,, Kuala Pilah	...	...	81.8	91.0	72.9	18.1	76.4	.812	73.6	75	...	4.29	2.24
,, ,, Jelebu	...	...	...	...	...	...	...	...	...	...	...	3.40	1.30
,, ,, Tampin	...	155.9	82.4	89.3	74.2	15.1	76.3	.797	72.2	71	...	3.19	1.14
,, ,, Mantin	...	...	...	...	...	...	...	...	...	...	...	5.48	1.25
Town Hospital Port Dickson	...	...	83.8	90.0	75.0	15.0	76.6	...	...	...	...	1.06	0.32
Beri-beri Hospital ,, ...	...	...	...	...	...	...	...	...	...	...	...	0.59	0.40

OFFICE OF THE SENIOR MEDICAL OFFICER,
KUALA LUMPUR, 24th April, 1912.

G. D. FREER,
Senior Medical Officer.
Selangor, Negri Sembilan & Pahang.

SELANGOR.

Abstract of Meteorological Reading in the various Districts of the State of Selangor for the month of February, 1912.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Dry Bulb.	Vapour Tension.	Dew Point.	Humidity.			
General Hospital, Kuala Lumpur ...	29.872	143.2	80.4	89.2	72.5	16.7	76.7	0.825	73.4	75	Calm.	10.50	2.50
Prisons " "	...	...	...	...	...	...	...	...	...	...	...	9.93	1.98
District Hospital "	...	...	...	...	...	...	...	...	...	...	...	5.89	2.22
" Klang	...	...	...	90.6	70.0	20.6	...	...	...	...	...	6.93	1.38
" Kuala Langat ...	...	...	...	88.6	74.4	14.2	...	...	...	...	...	7.16	2.25
" Kajang	...	...	...	88.1	75.2	12.9	...	...	...	...	...	8.38	1.89
" Kuala Selangor ...	...	...	...	89.7	71.9	17.8	...	...	...	...	...	4.16	1.63
" Kuala Kubu	...	...	...	91.5	70.9	20.6	...	...	...	...	...	6.38	2.10
" Serendah	...	...	...	92.4	70.3	22.1	...	...	...	...	...	6.59	2.45
" Rawang	...	...	...	92.3	71.5	20.8	...	...	...	...	...	11.08	2.61
Sabah Bernan	...	...	..	...	...	...	...	...	...	...	...	9.71	1.85

Office of the Senior Medical Officer,
Kuala Lumpur, 22nd Mar., 1912.

G. D. Freer,
Senior Medical Officer,
Selangor, Negri Sembilan & Pahang.

SELANGOR.

Abstract of Meteorological Readings in the various Districts of the State of Selangor for the month of March, 1912.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
General Hospital, Kuala Lumpur ...	29.891	143.0	82.9	91.5	72.6	18.9	76 7	.807	72.7	72	Calm.	6.79	1.30
Prisons " "	...	...	...	...	...	...	...	...	...	...	...	8.60	3.24
District Hospital "	...	...	...	...	...	...	...	...	...	...	...	4.88	1.40
" Klang	...	...	...	91.4	68.7	22.7	...	...	...	...	...	5.29	1.18
" Kuala Langat ...	...	...	...	91.2	74.4	16.8	...	...	...	...	...	1.16	0.50
" Kajang	...	...	...	89.0	76.4	12.6	...	...	...	...	...	7.03	1.71
" Kuala Selangor ...	...	...	...	90.8	72.0	18.8	...	...	...	...	...	1.69	0.72
" Kuala Kubu	...	...	...	93.0	71.0	22 0	...	...	...	...	...	6.61	1.37
" Serendah	...	...	...	92.6	70.5	22.1	...	...	...	...	...	7.03	1.65
" Rawang	...	...	...	92.5	72.2	20.3	...	...	...	...	...	7.49	1.68
Sabak Bernan	...	...	...	...	...	...	...	...	...	...	...	8.15	2.38

OFFICE OF THE SENIOR MEDICAL OFFICER,
KUALA LUMPUR, 26th April, 1912.

G. D. FREER,
Senior Medical Officer,
Selangor, Negri Sembilan & Pahang.

KELANTAN.

Abstract of Meteorological Readings in Kelantan for the Month of January, 1912.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Mean Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Mean Maximum.	Mean Minimum.	Mean Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	%		Ins.	Ins.
Kota Bharu	...	144.0	78.4	83.10	72.54	10 56	75.5	.810	72 9	84.5	...	14.13	4.00
Kuala Lebir	...	...	76.2	87.08	71.69	15.39	74.3	.801	72.6	89 2	...	6.76	2.51
Kuala Kelantan	...	...	...	82.06	73.38	8.68	...	...	...	...	...	13.84	4.50
Kuala Val	...	...	...	82.90	71.77	11.12	...		...	...	...	8.06	2.60
Kuala Pahi	...	...	...	83 84	70.77	13.07	...	...	...	...	...	6.88	2.09
Taku Estate	...	...	...	...	...	...	...	...	...	...	...	6.63	2.48
Chaning Estate	...	...	...	...	...	...	...	...	...	...	...	7.13	2.14
Pasir Jinggi	...	...	...	...	...	...	...	...	...	...	...	6.35	2.26
Kenneth Estate	...	...	...	...	...	...	...	...	...	...	...	10.07	3.34
Pasir Besar	...	...	...	...	...	...	...	...	...	...	...	8 88	3.75
Pasir Gajah	...	...	...	...	...	...	...	...	...	...	...	9.54	3.25
Semerah Estate	...	...	...	...	...	...	...	...	...	...	...	12.13	4.92
Teko Ayer Merah	...	...	...	...	...	...	...	...	...	...	...	15 17	5.20
Ulu Kusial	...	...	...	...	...	...	...	...	...	...	...	10.16	4.72

Residency Surgeon's Office,
Kota Bharu, 17th February, 1912.

John. D. Gimlette,
Residency Surgeon, Kelantan.

KELANTAN.

Abrtruct of Meteorlogical Readings in Kelantan for the Month of February, 1912.

DISTRICT.	Mean Barometrical pressure at 32° F.	Mean Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Mean Maximum.	Mean Minimum.	Mean Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.		Ins.	Ins.
Kota Bharu	...	139.0	79.7	84.74	72 82	11.91	76.4	.820	73.3	80.1	...	9.84	4.01
Kuala Lebir	...	...	76.4	87.9	72.0	15.8	74.4	.812	73.0	89.3	...	3.02	1.24
Kuala Kelantan	...	...	...	83.82	73.44	10.38	...	...	...	...	...	7.59	3.75
Kuala Pahi	...	...	...	85.03	71.31	13.72	...	...	...	...	...	3.79	1.00
Kuala Va' Estate	...	...	...	83.82	72.10	11.72	...	...	...	...	...	6.64	2.32
Semerah Estate	...	...	...	...	...	...	...	...	...	...	...	8.00	3.29
Pasir Jingi	...	...	...	...	...	...	...	...	...	...	...	2.91	1.43
Chaning Estate	...	...	...	...	...	...	...	...	...	...	...	4.02	1.22
Pasir Gajah Estate	...	...	...	...	...	...	..	...	...	...	...	6 49	1 98
Taku Plantation	...	...	...	...	...	...	...	...	...	...	...	3.44	.97
Pasir Besar	...	...	...	...	...	...	...	...	...	...	...	6.71	2.14
Soker Kenneth Estate	...	...	...	...	...	...	...	...	...	...	...	4.80	1.44

RESIDENCY SURGEON'S OFFICE,
KOTA BHARU, 19th February, 1912.

JOHN. D. GIMLETTE,
Residency Surgeon, Kelantan.

KELANTAN.

Abstract of Meteorological Readings in Kelantan for the Month of March, 1912.

DISTRICT.	Mean Barometrical pressure at 32° F.	Mean Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Mean Maximum.	Mean Minimum.	Mean Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	%		Ins.	Ins.
Kota Bharu	...	147.0	81.2	87.50	73.33	14.17	78.2	.897	76.0	84 8	...	1.40	1.23
Kuala Lebir	...	...	79.3	29.8	73.0	18.8	76.0	.832	73.7	83.2	...	2.63	1.16
Kuala Kelantan	...	...	...	86.35	74.77	11.58	...	...	...	...	...	1.41	1 24
Kuala Val	...	...	...	87.90	73.12	14.77	...	...	...	...	...	2.95	0.80
Kuala Pahi	...	...	...	88 06	72.06	16.0	...	...	...	...	...	3.29	1.45
Pasir Gajah Estate	...	...	...	...	...	...	...	...	...	...	...	0.59	0.29
Taku Plantation	...	...	...	...	...	...	...	...	...	...	...	2.63	1.17
Pasir Besar Estate	...	...	...	...	...	...	...	...	...	...	...	2.00	1.00
Kenneth Estate	...	...	...	...	...	...	...	...	...	...	...	2 16	1.19
Pasir Jinggi	...	...	...	...	...	...	...	...	...	...	...	2.7	0.97
Chaning Estate	...	...	...	...	...	...	...	...	...	...	...	2 84	1.45

RESIDENCY SURGEON'S OFFICE,
KOTA BHARU, 23rd April, 1912.

JOHN. D. GIMLETTE
Residency Surgeon, Kelantan.

MALACCA.

Abstract of Meteorological Readings in Malacca for the month of January, 1912.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	Temperature				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
										%		Ins.	Ins.
Durian Daun Hospital	29.923	156.2	82.3	89.3	72.7	16.6	77.7	.886	...	81	N.	.86	.27 on 7th

MALACCA, 4th April, 1912.

E. W. DE CRUZ,
Assistant Surgeon.

MALACCA.

Abstract of Meteorological Readings in Malacca for the month of February, 1912.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
										%		Ins.	Ins.
Durian Daun Hospital	29.910	156.7	82.6	89.0	73.1	15.9	78.0	.890	...	80	N.	3.13	1.50 on 20th

Malacca, 4th April, 1912.

E. W. De Cruz,
Assistant Surgeon.

MALACCA.

Abstract of Meteorological Readings in Malacca for the month of March, 1912.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
										%		Ins.	Ins.
Durian Daun Hospital	29.894	157	83.3	90 3	73.5	16.8	78 7	.914	...	81	N	2.51	1.04 on 20th

MALACCA, 30th Apr 1912.

E. W. DE CRUZ,
Assistant Surgeon.

MINUTES OF A MEETING OF THE PLANTERS' ASSOCIATION OF MALAYA.

Held at 10.45 a.m., on March 3, 1912, at the Selangor Club, Kuala Lumpur.

Present:

MR. E. B. SKINNER, Chairman.

MR. H. C. E. ZACHARIAS, Secretary.

MR. W. G. DOBSON, Legal Adviser.

and the following delegates:—

From the Kuala Lumpur District Planters' Association:—Mr. F. G. Harvey.

" Kuala Langat District Planters' Association:—Mr. R. W. Munro.

" Negri Sembilan Planters' Association:—Messrs. A. Dupuis Brown, T. G. Hickley, P. W. N. Farquharson.

" Batu Tiga District Planters' Association:—Messrs. H. L. Jarvis, H. E. G. Solbe, H. R. Quartley.

" Klang District Planters' Association:—Messrs. C. A. Buxton, W. H. Trotter, John Gibson.

" Kapar District Planters' Association:—Messrs. E. H. King-Harman, J. G. Cruickshank.

" Batang Padang Planters' Association:—Mr. F. J. Ayris.

" Kuala Selangor District Planters' Association:—Messrs. A. Irving, F. G. Souter.

Visitors:—Mr. L. Lewton-Brain, Dir. of Agriculture, Dr. Ch Lane Sansom, P.M.O., Mr. T. J. Cumming.

1. The Minutes, having been taken as read, are confirmed, after the additon of the word "last" on line 18 p. 13.

2. Quarantine.

The Secretary reads the following correspondence:

Chief Secretary, F.M.S.,
Kuala Lumpur.

Kuala Lumpur,
12th January, 1912.

SIR,—I have the honour to inform you that at a Meeting of this Association, held on the 7th instant, the control of the Quarantine Camp on Pulau Jerejak was discussed.

The Meeting was unanimously in favour of this Camp being placed under the control of the Principal Medical Officer of the F.M.S., and that, if necessary, the Camp be leased from the Government of the Straits Settlements ; and I was intructed to submit that H. E. the High Commissioner be approached by you accordingly.

I have etc.,
(Sd.) H. C. E. ZACHARIAS,
Secretary.

No. 2 in 516/1912.
The Secretary,
The Planters' Association of Malaya,
Kuala Lumpur.

Kuala Lampur,
13th February, 1912.

Sir,—I am directed to refer to your letter dated the 12th January, 1912, on the subject of the control of the Quarantine Camp at Pulau Jerejak and to inform you that the question has been referred to the Colonial Government, and a reply has been received to the effect that the Colonial Government regrets its inability to meet the views of the Planters' Association in this mater.

I have etc.,
W. H. MACKRAY,
For Under Secretary, F.M.S.

Mr. E. B. Skinner reports that this matter had again been brought before the Indian Immigration Committee, who had been promised a number of improvements by the Colonial Government. He was in favour of giving them a trial until the end of the recruiting season in September; and to take up the matter again then, if no permanent improvement had resulted. In the meantime he proposed that the matter stand over.

Mr. Cruickshank seconds the suggestion, but wished to know whether there was an inspection committee of planters.

Mr. Skinner replies that the planting members of the Indian Immigration Committee were the officially appointed visitors.

Mr. Skinner's suggestion is agreed to.

3. Chinese Labour.

The Secretary reads the following Report of the Sub-Committee of their Meeting held on January, 21st 1912, there being present Mr. H. R. Quartley (in the chair), Mr. Choo Kia Peng and Mr. H. C. E. Zacharias; also the Hon. C. J. Saunders and Messrs. L. H. Clayton and J. R. O. Aldworth.

REPORT.

The feeling of the Meeting was that there was a sufficiency of Chinese Labour in the country to do all the work required, but that it was desirable to introduce more labour, in order to lower rates of pay. The Planting Industry is really not at all

in need for a large influx of Chinese, but the Mining Industry no doubt is short of labour; Mr. Choo Kia Peng instancing that whereas formerly naichang gangs consisted of 50-80 men, now their maximum number was 30.

The Government having decided to make indentured sinkeh labour illegal after July 1st 1914, the question is what would become of the 25,000 sinkehs, that annually arrived in Singapore? By far the greatest majority went to the Dutch Indies and that transit traffic will doubtless be deflected from Singapore. Of the balance, only very few go to estates in the Peninsula. About a year ago, there was a great and acute demand for Chinese labour, mainly for lalang weeding, but the demand has subsided as suddenly as it started, and latterly there have been great difficulties to place even a few hundred sinkehs then in the depots at Singapore; and the Hon. C. J. Saunders corroborated that at the present moment he knew practically of no sinkehs in the Singapore depots: all of which goes to show, that there is no urgent demand for this class of labour on the estates.

To supply the requirements of planters, the latter, if desirous of getting Chinese labour, will now have to get a kangany connection in China, in the same as way they all have already in India. The kangany system of recruiting in small batches is quite feasible, when not in the hands of professional recruiters, but of the individual estates.

What can be done, if a planter knows how to handle Chinese labour and how to go about the recruiting in the right way, was shown by Mr. Choo Kia Peng, who has recently sent one of his estate kapalas to Amoy, whence he has returned with 15 men of a most desirable stamp. The advances given out amounted to $200, which sum represented the total—irrecoverable—expenditure. The coolies were put on day pay at the rate of 58 cents out of which 2 cents goes to the kapala. These coolies have now been on the estate for ten months and show no inclination of absconding.

Another point, on which there seemed to be a consensus, was that just now in the troubled times China is going through, planters have the best opportunity of making a start with kangang recruiting. People over there finding now neither work nor safety, are apparently only too anxious to emigrate to the Malay Peninsula, and this applies particularly to the better class people and includes families.

Until there is a Chinese Government to treat with, the Government of this country is of course unable to move in the matter anyhow; and unless planters are anxious to see constituted a machinery analogous to the Indian Immigration Committee and Fund, there is at present no object in asking for any Government assistance.

Kangany recruiting in China is possible; it is anyhow the only means of obtaining satisfactory labour from there; and it now rests with the planter, whether or not he can adapt himself to the circumstances of the case.

(Sd.) H. R. QUARTLEY.

Mr. Skinner takes it that the feeling of the Association, after the sub-committee's report, would be that for the present the question of approaching Government should be dropped and the matter left to private enterprise.

4. Chinese Tappers.

The Secretary reports having received the following replies from the various Constituent Associations regarding pay earned by this class of labour, calculating the rate as per 100 trees:

Batu Tiga—			26—30 cents
Johore:		2 estates	20 ,,
		2 ,,	24 ,
		1 ,,	30 ,,
		1 ,,	32 ,,
Province Wellesley	...	1 estate	12½ cents
	...	1 ,,	17 ,,
	...	1 ,,	23 ,,
Klang:	...	1 ,,	35 ,,
K. Lumpur	...	3 ,,	20 ,,
	...	1 ,,	21 ,,
	...	2 ,,	22 ,,
	...	1 ,,	30 ,. (basal V)
	...	1 ,,	32 ,, ,,
	...	1 ,	32 ,, (two cups per tree)
	...	1	35 ,,
	...	1 ,,	39 ,,
	...	1 ,,	45 ,, (40 cts. for young trees.

Kuala Selangor Kapar reported that no Chinese tappers were employed in these districts; and from the remaining six associations, no reply had been received.

Mr. Skinner thinks the figures important and useful although they were not complete: when tabulated that might induce planters to reduce the rates generally.

Mr. Quartley thinks it should be stated whether the tappers scrapped the trees and did everything else necessary themselves; and how many cuts they did.

Mr. Dupuis Brown considers the number of cups ought also to be given; the present information was too vague.

Mr. Irving suggests in order to simplify matters that each employer should show the cost per lb. of his dry rubber.

Mr. Jarvis points out that the ages of the trees should be shown, otherwise, for purpose of comparison, the value of the figures would be lost.

Resolved that the information, as received, be published, and that the Secretary circularize all constituent Associations again, requesting specific replies as to

1. Whether the price paid includes collecting and scrapping.
2. The number of cuts.
3. The number of cups.

5 Javanese Labour.

The Secretary reads the following correspondence :

Chief Secretary. F.M.S.,
Kuala Lumpur.

Kuala Lumpur,
12th January, 1912.

Sir,—I have the honour to inform you, that three members of this Association, Messrs. H. J. Cooper, M. Maude and F. Pears, were some time ago asked to form a Sub-Committee to go into the possibilities of recruiting Javanese coolies.

The said gentlemen have since had an interview with the Consul General of the Netherlands at Singapore and are now desirous of proceeding to Java on a mission of further enquiry.

As the Consul General advised the gentlemen that it will be a great help to them, if they went to Java accredited by the Government of the F.M.S., I have been instructed to ask whether H. E. the High Commissioner would be kind enough to furnish them with a letter to the Governor General of the Netherlands Indies.

I have etc.,
(sd.) H. C. E. ZACHARIAS,
Secretary.

No. 517/1912.

Kuala Lumpur,
27th January, 1912.

The Secretary,
The Planters' Association of Malaya,
Kuala Lumpur.

Sir,—Referring to your letter dated the 13th January, 1912, I am directed to forward a letter addressed by His Excellency the High Commissioner to Hsi Excellency the Governor General of the Netherlands Indies.

I have, etc.,
(Sd.) W. H. MACKRAY,
for Under Secretary, F.M.S

Under Secretary, F.M.S.
Kuala Lumpur.

Kuala Lumpur,
29th January, 1912.

JAVANESE LABOUR.

Sir,—I have the honour to acknowledge receipt of your letter 517 dated the 27th instant and to thank H. E. The High Commissioner for his letter to the Governor General of the Netherlands Indies.

I have etc.,
(Sd.) H. C. E. ZACHARIAS,
Secretary.

H C. E. ZACHARIAS Esq.,
Secretary,
Planters' Association of Malaya,
Kulala Lumpur.

Telok Anson,
10th January, 1912.

JAVANESE IMMIGRATION.

Dear Sir,—I shall be much obliged if you will let me know what action was taken by the P. A. M. on our preliminary report on the question of Javanese recruiting.

It is of course most important that we should go straight ahead with the matter now but neither Mr. Maude nor myself are prepared to pay all the cost of the visit to Java.

I have so far only seen the newspaper reports of the Meeting.

Yours faithfully,
(Sd.) H. J. COOPER,

H. J. COOPER, Esq.,
Telok Anson.

Kuala Lumpur,
15th January, 1912.

Dear Sir,—I thank you for your favour of the 10th instant *re* Javanese Immigration.

The Association at their last Meeting received your preliminary report and instructed me to thank the Sub-Committee for the pains taken and to address H. E. The High Commissioner in accordance with your wishes regarding a letter from himself to the Governor General of the Netherlands Indies; and I have since written to H. E. accordingly.

As regards your visit to Java, the Meeting was unanimous as to its desirability, but as this Association has no funds available for any but current expenditure, they are unfortunately precluded from offering to bear its cost.

Believe me, dear sir,
Yours faithfully,
(Sd.) H. C. E. ZACHARIAS,
Secretary.

The Secretary,
Planters' Association of Malaya,
Kuala Lumpur.

Telok Anson,
19th January, 1912.

Dear Sir,—Your letter of the 15th addressed to Mr. H. J. Cooper has been brought before my Committee, and I am instructed to express their regret that the parent Association is unable to finance the proposed visit to Java, and that not having themselves the necessary funds. They did not see their way to initiate an appeal for the raising of the money amongst the estates of the F. M. S.

My Committee are so impreesed with the general benefit which will accrue by the completion of the work your Sub-Committee have so far advanced that they propose to circularize the estates, and at a Meeting held here yesterday nearly one half of the necessary funds were provided.

It is hoped however that there will be such a ready response to a general appeal that the subscription for each estate will be very small.

I am, dear sir,
Yours faithfully,
The Lower Perak Planters' Association.
(Sd.) F. S. PHYSIC,
Secretary.

F. S. PHYSIC, Esq.,
Lower Perak Planters' Association,
Telok Anson.

Kuala Lumpur,
22nd January, 1912.

Dear Sir,—I have your favour of the 19th instant *re* Sub-Committee's visit to Java.

In the absence of any information to the contrary the Meeting did not feel justified in assuming, that the three gentlemen in question did not propose defraying themselves the cost of this visit to Java, any more than *e.g.,* in the case of Mr. Pears' visit to Hongkong *re* Chinese labour.

As already intimated, this Association has no funds available, except for current expenditure; but had there been any question of the immediate necessity for further funds, an appeal to that effect would no doubt have been decided upon. It is therefore much to be regretted, that neither of the three gentlemen appointed could make it convenient to be present at our last Meeting and lay their case personally before the members present.

Am I correct in saying, that it is now proposed to defray the total cost of the proposed visit out of the funds of the Lower Perak District Planters' Associatian, or do you propose to circularize all other Associations likewise; and what do you estimate is the total sum required?

Believe me, dear sir,
Yours faithfully,
(Sd.) H. C. E. ZACHARIAS,
Secretary.

H. C. E. ZACHARIAS, ESQ.,
Kuala Lumpur.

Telok Anson,
27th January, 1912.

Dear Sir,—I thank you for your letter of the 15th instant *re* Javanese Immigration, which has been laid before the District Association.

I shall be greatly obliged if you will inform me as soon as possible whether H. E. the High Commissioner has addressed the Government of the Netherlands Indies or whether he will give to us the letter for presentation to the Governor Ceneral.

We propose to leave for Java about the 11th February.

Yours faithfully,
(Sd.) H. J. COOPER.

Kuala Lumpur,
29th January, 1912.

H. J. Cooper, Esq.,

Dear Sir,—I thank you for your favour of the 27th instant and now beg to enclose letter, just received from H. E. The High Commissioner on your mission to Java addressed to the Governor General of the Netherlands Indies.

Trusting that your visit will be highly successful.

I remain,
Yours faithfully,
(Sd.) H. C. E. ZACHARIAS.

Mr. Skinner remarks that nothing further could be done at present and that they must await the return of the sub-committee.

6. H. N. Ridley Fund.

The Secretary reports having received to date the following contributions:

from	The Malay Pen. Agr. Ass:	$1,305.00
,,	Johore Planters' Ass:	470.00
,,	Kuala Lumpur D. P. Ass:	300.00
,,	Batang Padang Pl. Ass:	200.00
,,	Batu Tiga D. Pl. Ass:	170.00
,,	Klang Dist. Pl. Ass:	25.00
	Total	$2,470.00

From further promises received, he hopes that a total of 500 guineas will be collected.

The Secretary is instructed to inform all Constituent Associations, that the fund will be closed on the day of the Annual Meeting, and to express a hope that the expected total of 500 guineas will be reached.

7. Standing Committee.

The Secretary reports that the creation of a Standing Committee, decided upon at their last Meeting, constituted an addition to the Rules and would therefore have to be dealt with under Rule 15 at the ensuing General Meeting.

The Legal Adviser had suggested as follows:

"That the following rules be added to the Rules of the Planters' Association of Malaya, viz.,

1. The Association shall at every Annual Meeting elect five of its members as a Standing Committee with power for such Standing Committee to add to its number.
2. The duties of such Committee shall be the following:
   A. To consider all measures (legislative or otherwise) which may be of interest or affect the Planting Community in the Malay Peninsula.
   B. To inform the District Associations of such measures and give them its opinion thereon.
   C. To act as a consultative body for dealing with the current work of the Planters' Association of Malaya.
3. The President and Secretary of the Planters' Association of Malaya shall be ex-officio members of the Standing Committee in addition to the five before-mentioned elected members.

The Secretary is instructed accordingly, to place these draft rules on the Agenda of the General Annual Meeting.

8. New York Exposition.

The Secretary reads the following correspondence:

Kuala Lumpur,
12th January, 1912.

C. Taylor, Esq.,
Secretary,
Rubber Growers' Association,
1, Oxford Court,
Cannon Street, London, E.C.

NEW YORK EXPOSITION, 1912.

Dear Sir,—The question of being represented at this Exhibition has been considered by this Association at their last Meeting held on the 7th instant, when the general consensus seemed to be that it would be very impolitic for this Peninsula not to be adequately represented.

We have asked the Government for an indication of the extent of their support, but before going any further, should be glad to have the views of your Association on the subject.

If any action is eventually decided upon, we trust that we may count on the same hearty co-operation, that your Association was kind enough to render us at the London Exhibition of last year.

Believe me, dear sir,
Yours faithfully,
(Sd.) H. C. E. ZACHARIAS,
Secretary.

Sir William Taylor,
Malay States Information Agency,
88, Cannon Street,
London, E.C.

Kuala Lumpur,
12th January, 1912.

NEW YORK EXPOSITION.

Dear Sir,—I thank you for your favour of November 3rd and enclosures, all of which have been submitted to the members of this Association at their last Meeting on the 7th instant, when it was decided that this Association should take part in the said Exposition, provided the adequate co-operation of the Governments of the Peninsula could be secured.

Believe me, dear sir,
Yours faithfully,
(Sd.) H. C. E. ZACHARIAS,
Secretary.

UNDER SECRETARY, F.M.S
Kuala Lumpur.

Kuala Lumpur,
29th January 1912.

Sir,—I have the honour to acknowledge receipt of your letter 3 in 7950 of the 12th ihstant, which has been submitted to the members of my Association.

In reply I am directed to inform you, that this Association is prepared to give its support to the New York Exposition but before going any further, would like to know, whether and to what extent the various Governments of the Malay Peninsula would co-operate.

I have etc.,
(Sd.) H. C. E. ZACHARIAS,
Secretary.

The Secretary,
Planters' Association of Malaya,
Kuala Lumpur, F.M.S.

London,
5th January, 1912.

Dear Sir,—I am sending for your information a copy of a letter, and particulars and plan of suggested spaces that I have sent to-day to Sir William Taylor, as he will probably send his letter on to the Colonial Secretary, who will forward it again to you, thus causing a slight delay-and it will save time for you to have the letter in advance. The letter is, of course, to be regarded as private, and is sent you so that you may receive some additional information.

Ceylon are making a very fine show, and British Malaya will do the same, I hope. It will be greatly to their advantage, if they wish to get the trade with America. So far we have received favourable responses from nearly every rubber country, including Trinidad and British Guiana.

As you will know from particulars previously sent you, other tropical products may be exhibited at this Exposition, for the purpose of trade and commerce, that are cultivated in rubber growing countries. By this means your Colony will have a chance of obtaining trade for its other products in addition to rubber.

Hoping to receive your support, I am,

Yours truly,

(Sd.) A. STAINES MANDERS,

Organising Manager.

(ENCLOSURE.)

SIR WILLIAM TAYLOR, K.C.M.G.

Malay States Advertisement Agency,

88, Cannon Street,

London, E.C.

London,

4th January 1912.

PRIVATE.

Dear Sir,—I beg to send you herewith plan of the Crude Rubber Section of the International Rubber & Allied Trades Exposition, to be held in New York next September.

You will see that I have marked two blocks, one of which I would suggest for British Malaya in case they should decide to exhibit. I hope they will do so, as in my opinion it would be a suicidal policy if this important opportunity of bringing before the Manufacturers and Investors of the United States of America the vast resources of Malaya as a Rubber producing country were neglected and the chance of displaying the quality and the quantity of rubber they can produce as suitable for the American market.

I may mention that Ceylon will be making a fine show, likewise most of the other rubber producing countries of the world.

I also attach for your information, the exact cost of space, in case British Malaya should prefer to arrange for the building of their own Stand in New York, and I also quote on inclusive price for stands, stand-fittings, both for showing photographs and other products, as well as rubber, and for generally furnishing the stand. This inclusive charge consists of everything which would be necessary for the credit of the Colony with the exception of freight and cartage to the Exposition. I may add that the price includes the unpacking and repacking of the exhibits that may require to be returned.

I understand that exhibits from British Malaya can be shipped by Ceylon direct to New York. It is possible that there may be direct steamers from your Colony to New York.

As arranged at a Meeting recently held in New York, and at the request of several countries exhibiting, it will be permissible to show for the purposes of Trade and Commerce, other products cultivated in rubber growing countries.

I am taking the liberty of sending this letter in duplicate, to save you time in having it copied, and in the hope that you may be able to forward it by this mail, and I should be glad if it could be arranged to have a reply before the end of February as to the space required, as I am leaving for New York, at the date. I return again to London in the early part of April, leave for New York about the middle of May, and remain there until the close of the Exposition. At the same time any matters that require attention will be promptly dealt with at the London Office during my absence.

I am,
Yours truly,
(Sd.) A. STAINES MANDERS,
Organising Manager.

NEW YORK EXPOSITION.

COST OF SPACE ONLY.

No. 1.	67½x 27feet=1809 sq. feet total cost including covered platform the whole length ...	£ 723.12.0
No. 2.	1,179 sq. feet total cost including covered platform	£ 468. 0.0
No. 1.	Stand complete-will fit up necessary stand, tables, screens for pictures, artistic signs and all that may be necessary to give British Malaya a bold display. Unpack exhibit, supply attendant for distributing literature and repack exhibit at the close for a total sum of	£1,200. 0.0
No. 2.	Fit up as described in No. 1 repack and supply attendant for a total sum of ...	£ 855. 0.0

Stands guaranteed to be in good style with special screens for photos etc.

These prices have been cut down very fine, and if more money can be allowed it will be used for special fitting up, and for the benefit of British Malaya.

The Secretary reports that he is still without a reply from the Under Secretary and is instructed to press for an answer.

9. Labour Enactment 1911.

The Secretary reads the following correspondence :

Kuala Lumpur,
6th February, 1912.

H. E. Sir Arthur Young, K.C.M.C., High Comm., F.M.S.
Singapore.

Your Excellency,

I have the honour to inform Your Excellency that at a Meeting of this Association held on January 7th the following resolution was unanimously passed :

"That this Association strongly deprecates the precipitancy with which the Labour Enactment 1911 was passed through the Federal Council".

I have the honour to enclose copy of our Minutes and to refer Your Excellency to Section 9.

I have etc.,
(Sd.) H. C. E. ZACHARIAS,
Secretary.

Misc. 179-1912.

Singapore,
2nd March, 1912.

The Secretary,
Planters' Association of Malaya,
Kuala Lumpur.

SIR,—I have the honour to acknowledge receipt of your letter of 6th February and to inform you that the delay in replying thereto is due to His Excellency the High Commissioner's desire to send you a copy of the Minutes of the Federal Council. This copy has only just been received and is forwarded herewith. *(v. Appendix.)*

2. I am to say that His Excellency is confident that on a perusal of these Minutes those members who considered that the Government passed this bill after pecfunctory deliberation or who thought that the provisions of the bill were too drastic will agree that the measure was one which in the circumstances it was necessary to carry out not only in the interests of the coolies themselves but also in the interests of the whole planting community.

3. I am to add that it is the firm conviction of His Excellency that if the condition of the labourers on this estate had been brought to the notice of the Indian Government and if no efficient action had been taken by the Federated Malay States Government to remedy the state of affairs it might have led to the Indian Government seriously considering whether restrictions should not be placed on the immigration of coolies into the Federated Malay States.

I have etc.,
(Sd.) H. MARRIOTT,
Secretary to High Commissioner for the Malay States.

The Secretary reports that he had addressed similarly all other members of the Federal Council, and that he had received the following further replies:

The Secretary,
Planters' Association of Malaya,
Kuala Lumpur.

Kuala Lumpur,
8th February, 1912.

SIR,—I have the honour to acknowledge the receipt of your letter dated the 6th February informing me that at a Meeting of the Planters' Association of Malaya held on the 7th January a resolution was unanimously passed to the effect that the Association strongly deprecated the precipitancy with which the Labour Enactment 1911 was passed through the Federal Council, The resolution is one with which I think I may say generally that I am entirely in accord.

Nothing but the most urgent necessity could justify the passing of such an important measure in the manner in which it was passed Such necessity did, in the opinion of the Government, exist, and subsequent events showed that opinion to be well founded.

I have etc.,
(Sd.) E. L. BROCKMAN,
Chief Secretary, F.M.S.

The Secretary,
Planters' Association of Malaya,
Kuala Lumpur.

Kuala Lumpur,
12th February, 1912.

Dear Sir,—Your letter of the 6th instant duly received, and the contents are noted.

Yours faithfully,
(Sd.) E. B. SKINNER.

The Secretary,
Planters' Association of Malaya,
Kuala Lumpur.

Tronoh,
14th February, 1912.

Dear Sir,—I beg to acknowledge with thanks your favour of the 6th instant covering Minutes of the Association's Meeting.

I am in accord wilh the resolution regarding the passing of the Labour Enactment. As you may remember I strongly protested against its passing at the Federal Council, and was the only one who would not vote for it.

Yours faithfully,
(Sd.) H. D. GRIFFITHS.

No. 2 in 923/1912.

The Secretary,
Planters' Association of Malaya,
Kuala Lumpur.

Taiping,
13th February, 1912.

Dear Sir,—I am directed to acknowledge the receipt of your letter of 6th February current, forwarding a resolution passed at a Meeting of the Planters' Association of Malaya held on January 7th.

I have etc.,
(Sd.) W. E. PEPYS,
for Ag. Secretary to Resident, Perak.

The Secretary,
Planters' Association of Malaya,
Kuala Lumpur.

Kuala Lumpur,
22nd February, 1912.

Dear Sir,—I beg to acknowledge receipt of your letter of February 6th referring to section 9 of the minutes of your Meeting held on January 7th 1912.

2. I quite agree that the precipitancy with which this Labour Enactment was passed through the Council is to be deprecated. Another member and myself expressed this opinion in Council. I asked if there was no existing legal power to enable the Government to deal with what was obviously, on humanitarian grounds, a matter of urgency. The reply given was that the Legal Adviser had been consulted and that the answer was in the negative.

3. In view of all the circumstances and the fact that your own representative on the Council offered no opposition, I did not feel justified in voting against the Enactment.

4. Your letter raises rather an interesting point. It may be read as an expression of disapproval on the part of your Association that I did not vote against this particular Enactment. Had I voted against a proposal, affecting planting interests, endorsed by your own representative on the council, I could not complain if your Association thought fit to express disapproval. But so long as the selected representative of the Planting Community, who is your own elected chairman, is present at a Council Meeting, you can hardly in fairness blame the other un-official members for taking any sort of action which meets with the planting member's approval.

5. It is so obviously to the interests of the general public that the small unofficial minority on the Council should be united that I think you will find the other un-official members supporting the planting representative even when not altogether in favour of some specific detail. For instance, personally I objected to two sections in a recent enactment which compel employers of labour to keep a check roll showing names, days worked and rate of pay drawn by

coolies employed by an outside contractor, but the planting representative on the Council was satisfied, so I did not vote against the enactment.

I have etc.,
(Sd.) J. H. M. ROBSON.

10 Honorary Members.

The legal adviser submits that the following be the new rules for

HONORARY MEMBERS.

The Association shall be empowered to elect as Honorary Members such persons as it shall think fit, but such person shall not be entitled to vote at any Meeting of the Association. Notice of any proposal for the admission of an Honorary Member, together with the names of the proposer and seconder of such Honorary Member shall be given to the Secretary of the Association at least a fortnight previous to the Meeting at which the election of such Honorary Member shall take place and the Secretary shall put on the Agenda for such meeting the name and address of such person and the names of the proposer and seconder.

The Secretary is instructed accordingly, to place this draft rule on the Agenda of the Annual General Meeting.

II. Bailey Memorial.

The Secretary reports that $1629.28 have been collected to date as follows:—

BAILEY MEMORIAL FUND.

Date paid.			$ c.
1910			
Dec. 2	Harpenden Estate		15.00
23	Johore Rubber lands		200.00
1911			
Jan. 10	Petaling Estate		214.28
17	H. Irving		50.00
Feb. 6	Anglo Malay Rubber Co.		250.00
	Seaport (Selangor)		50.00
15	Selaba Rubber Estate Ltd.		50.00
	Golden Hope Rubber Estate Ltd.		50.00
	Sungkai Chumor		50.00
Mar. 1	Bugit Rajah Estate		100.00
9	London Asiatic		50.00
	Bikam		50.00
20	Selangors Rubbers Co. Ltd.		200,00
Apl. 1	Johore P. A.		50.00
May. 8	Bukit Khjang		150.00
Aug. 19	Sungei Way (Selangor) R. Co. Ltd. ...		100.00
		Total	$1,629.28

The Secretary is instructed to write to the Principal of the Straits Medical School at Singapore and ask his opinion as to how the money could best the expended in connection with the school, the final allocation of the fund being left to the next Meeting.

12. Medical Staff on Estates.

The Secretary reads the following letter :

Principal Medical Officer,
Kuala Lumpur.

Kuala Lumpur,
29th January, 1912.

Sir,—I understand that a scheme is under consideration, providing for the seconding of Medical Officers and Subordinates for service in estate hospitals.

As the present position of affairs is very acute, the members of my Association trust that the necessary steps will be expedited as much as possible.

Will it be possible for me to submit something definite to our next Meeting early in March ?

I have etc.,
(Sd.) H. C. E. ZACHARIAS,
Secretary.

and reports that he had an interview with Dr. Sansom, whom he had asked to be present to-day.

The Meeting goes into Committee and is addressed by Dr. Sansom.

Open Meeting having been resumed, it is resolved after some discussion, that a Sub-Committee of members of the P. A. M. be appointed to go into the question of the supply of dressers for estates and to report as early as possible thereon.

Mr. Skinner proposes, Mr. Farquharson seconds and it is passed unanimously that the Sub-Committee consist of Messrs. F. G. Harvey, H. Dupuis Brown, J. G. Cruickshank, H. E. Burgess, F. J. Ayris, H. R. Quartley, W. H. Trotter, A. Irving and W. Dell.

13. Indian Labour.

RECRUITING COMMISSION.

The Secretary says that at the last Meeting Mr. Gibson suggested a fixed maximum rate should be authorised by the Immigration Committee to do away with the evils resulting from the discrepant and excessive amounts paid to the kanganies by various estates for recruiting purposes. This opend up a very wide question and after correspondence with the Chairman and Mr. Gibson he had deferred communicating with the Indian Immigration Department.

Mr. Gibson says he was convinced that the question he had raised was one of great importance. Coolies that were being recruited by kanganies for estates paying small advances were not reaching these estates. Some planters had been trying to keep down advances to the ordinary rate of about Rs. 10, but other Superintendents were giving their kanganies Rs. 20, Rs. 30 and even Rs. 40. The result was that when the coolies recruited up country on the low advances were brought to the depots in India they were simply bought up by the kanganies who were paid bigger advances and who stuck at the depot doing no real recruiting on their own account. There were many evils arising out of this Coolies came down from the villages believing that they were going to rejoin friends on particular estates, but, being transferred to another kangany, not the original recruiter, found themselves on different and often remotely situated estates. That conduced to a great amount of dissatisfaction. If the Immigration Department fixed a uniform rate, some of the represent anomalies would be removed. He recognised that there were objections to extended powers being given to the Department but this course was the lesser evil and would tend to improve the conditions of recruiting. The present system did not add an additional coolie to the labour forces of the country, but it demoralised the kanganies and put money in their hands which might be better devoted to other purposes. The time had come for controlling the advances in some way.

Mr. Skinner agrees that advances should be kept down, but he thought it rather early to ask for legislation. Latterly a certain number of recruiters' licences had been stopped in India because the kanganies had been discovered buying coolies from others. Power was given to the Immigration Committee, on finding such a thing going on, to caneel the licence. But the kangany thus treated often did not care: he simply went to another licensed kangany and worked the business through him, the coolies coming over under the latter's protection. Further steps had been taken to deal with this move on the part of the kanganies and it was advisable to see how the new system operated to stop the buyers of coolies before advocating fresh legislation.

Mr. Gibson was glad to get this information and was quite prepared to leave the matter in abeyance for a time, seeing that the Immigration Committee were awake to the evils to which he had drawn attention.

14. Indian Labour.

DISCHARGE OF COOLIES.

Mr. W. G. Dobson reads the following opinion given by him on the point raised at the last Meeting:

> "As we understand it, the point on which our opinion is desired is as to whether the Superintendents of Immigrants can require an employer to discharge a coolie provided a month's

wages is deposited in his (the Superintendent's) hands. It is quite clear that a coolie on himself paying a month's wages to the employer can determine the contract without notice. If the cooly is anxious to stay on the estate and has not personally given the employer notice we think the Superintendent of Immigrants would be exceeding his functions in demanding that a coolie should be given up and we therefore think that the employer is not bound to deliver up the coolie in these circumstances. In the event of a coolie under 15 we think that the parents will probably have the right to demand the custody of the child and that therefore the employer could not retain him.

(Sd.) HEWGILL & DAY.

15. Constituent Associations.

The Secretary reads the following letters:

Bagan Datoh Coconut Planters' Association,
Lower Perak,
29th February, 1912.

The Secretary,
The Planters' Association of Malaya,
Kuala Lumpur.

Dear Sir,—The Planters of this District have formed themselves into an association under the above title and I have been instructed by the Committee to write to you and ask for details of subscriptions, delegates etc. to the Planters's Association of Malaya. They also asked me to point out that as it is a new and small association in such case perhaps a reduced subscription could be arranged.

I am, dear sir,
Yours faithfully,
(Sd.) A. J. GILLESPIE,
Hon. Secretary.

The Malacca Planters' Association.
Malacca,
21st February 1912.

The Secretary,
Planters' Association of Malaya,
Kuala Lumpur.

Dear Sir,—We have pleasure in advising that at a Meeting of this Association held on 11th instant it was unanimously agreed to rejoin your Association and we shall be glad if you will advise us what the annual subscription per delegate now is.

Kindly also send us say 6 copies of your rules.

Yours faithfully,
(Sd.) SIME, DARBY & CO., LTD.,
Secretaries.

S. Arden Esq.,
Chairman.
Sitiawan & Dindings Pl. Association,
Sitiawan.

Kuala Lumpur,
12th January, 1912.

Dear Sir,—The question of affiliating your Association was considered at the last Meeting of this Association held on the 7th instant, when I was instructed to inform you that this Association would greatly welcome such affiliation.

As our financial year closes on the 31st of March, I presume that this matter in any case had better stand over until our Annual General Meeting, which this year will be held on April 18th. We trust that yourself and as many of your members as possible, will personally attend on that occasion, when I hope some definite steps will be taken.

Believe me, dear sir,
Yours faithfully,
(Sd.) H. C. E. ZACHARIAS,
Secretary.

Mr. Hickley proposes and Mr. Quartley seconds that the Malacca Planters' Association be not re-affiliated for one year.

This motion having been lost, the Malacca Planters' Association is declared re-affiliated amidst applause.

The Chairman remarks that apparently their Rules made no reference whatever to the affiliation of constituent Associations and suggests that a rule be drawn up by their Lagal Adviser and be placed on the Agenda of the General Meeting.

16. Agricultural Bulletin.

The Secretary reads the following correspondence:—

No. 7 in 1021/1911.
The Secretary,
Planters' Association of Malaya,
Kuala Lumpur.

Kuala Lumpur,
16th January, 1912.

Sir,—I have the honour the enquire whether in the event of the monthly Agricutural Bulletin of the S. S. and F. M. S. being continued by this Department the Planters' Association of Malya is prepared to continue its present annual subscription.

2. I should be glad if you would send me a reply at your earliest convenience.

I have etc.,
(Sd.) B J. EATON,
for Director.

Director of Agriculture
Kuala Lumpur,

Kuala Lumpur,
17th January, 1912.

Sir,—I have the honour to acknowledge receipt of your letter 7/1021 dated the 16th instant.

I am unable to reply to your query without submitting same to the Annual Meeting (to be held this year on April 28th) which passes the budget of our financial year (April 1st to March 31st).

Perhaps you could make it convenient to be present at this Meeting and place personally your views before the members.

I have etc.,
(Sd.) H. C. E. ZACHARIAS,
Secretary.

Mr. Cruickshank proposes, Mr. Gibson seconds and it is carried unanimously that the sum of $1,000 appear again under this heading in the estimates for the ensuing year.

17. Imperial College of Technology.

The Secretary places the following letters on the Table:

The Secretary,
Planters' Association of Malaya,
Kuala Lumpur.

Muar,
18th January, 1912.

Dear Sir,—I enclose copy of a circular received from the Rector of the Imperial College of Science and Technology, South Kensington, which I think should be brought to the notice of your members and I should be much obliged if you could further the objects of the scheme outlined in the circular.

For some years past the Botanical Division of the College has endeavoured to meet the demands for men, who, by special training, are fitted to deal with the problems involved in agriculture both at Home and more particularly in the Tropics. With the rapid growth of tropical agriculture, and the increasing complexity of the many problems associated with the cultivation and the sanitation of plants (rubber, cocoa, coffee, cotton, etc.), an extension of the Department has become a matter of necessity.

The College has been impressed by the magnitude of the issues at stake in connection with the modern developments of Agriculture in the Tropics and it has resolved to meet the need for a thorough training of those who are to undertake the duties of advisors and sanitation officers, by founding a new Department of Plant Physiology and Pathology, under the immediate charge of a man specially selected for his eminence in the branches of science more directly concerned.

Trusting you will give this matter attention.

I remain,
Yours faithfully,
(Sd.) J. MITCHELL.

(ENCLOSURE).

"The Imperial College of Science and Technology desires to increase the facilities for the training of young men for plant sanitaton work especially in the Tropics. The Department of Botany in the College, of which Plant Pathology forms a part, is overcrowded, and it has not been found possibe (having regard to the commitments in respect of other departments of the College Work) to provide out of existing capital the full amount of the funds necessary to place Plant Pathology on a footing commensurate with the industrial importance of the subject. The College has already made arrangements for the maintenance of a teaching staff to deal with the subject, and to vestigate the problems which are continually arising to confront those who are directly concerned with plant sanitation. But the work is seriously hampered by the inadequate space and equipment which can be placed at the disposal of the Department.

A sum of £18,000 is required for building and equipping the laboratories, and of this sum the college is prepared to find £10,000, while a further sum of about £1,000 has been given or promised, leaving about £6,000 still to be raised.

The College therefore appeals to those who are interested in the great plant industries of the Tropics to enable it to obtain this £6,000 and thus to provide the means for proceeding with the work here indicated. Furthermore, it is believed that the existence in London of a trained and active laboratory staff will prove of use in helping to solve in the laboratory many problems that are, for various reasons (e. g. absence of suitable equipment, books etc.,) difficult to attack with much hope in the field. In this, as well as in other ways, the Department will continue to be of direct use to, and in direct contact with, the industries aboard.

Advisory Board: It is also anticipated that it may be possible to form an Advisory Body, largely drawn from those who are directly concerned in the Plant Industries. This would serve as a further means of ensuring that the Pathological Department was placed in immediate contact with the current needs of research, and would add to its usefulness.

Nomination of Students: In view of the influx of students which has now rendered immediate expansion necessary, it is evident that a selection must be made for admission, and it is recognised as reasonable that qualified students nominated by those who may have contributed towards the defraying of the expenses that must be incurred, should have prior claims to attend the courses of training they wish to join.

Donations or subscriptions to the fund for the Plant Pathological Department may be sent to.

THE RECTOR OF THE IMPERIAL COLLEGE,
South Kensington.

18. R. G. A. Research Fund.

The Secretary reads the following letter :

The Secretary,
Planters' Association of Malaya,
Kuala Lumpur.

Kuala Lumpur,
18th February, 1912.

MALAYA RESEARCH FUND.

Dear Sir,—Acting on instructions from the Local Committee of the Malaya Research Fund, and confirming my recent interviews with you on the question of your Association co-operating with the Malaya Research Fund to assist in continuing and extending the work carried on by Mr. Morgan, the Resident Chemist of the above Fund, I shall be glad if you will kindly place the undernoted resolution of the Trustees (in London) of the Research Fund and let me know what support your Association would be prepared to give to the Reséarch Fund financially or otherwise.

RESOLUTION. "That the Planters 'Association of Malaya be invited to support the Rubber Growers' Association scheme with a view to obtaining additional subscriptons in the Federated Malay States."

I remain, dear sir,
Yours faithfully,
(Sd.) J. MORTION.

(ENCLOSURE.)

Rubber Growers' Association.
(Malay Section.)
1, Oxford Court, Cannon Street,
London, E. C., 6th January, 1912.

MALAY RESEARCH FUND.

Dear Sir,—I am instructed by this Association to refer to the arrangements made in June, 1909, by which rubber-producing companies possessing estates in the F. M. S. co-operated in the expense of employing research chemists to conduct experiments with regard to the curing and preparation of plantation rubber for the market, for the guidance of those subscribing to the scheme.

Many companies who were producing rubber at the time guaranteed sums of $50 and $25 per annum for the three periods of twelve months ending respectively June 30th, 1910; June 30th, 1911; and June 30th 1912.

These guarantees will therefore expire on June 30th next, and the work of the chemists in London and their assistant in the F. M. S. terminates, under the present agreement, six months later, viz., December 31st, 1912.

In these circumstances the Council of the Association have discussed whether it would be advisable for these research schemes to be continued and extended, and referred the matter to the Trustees of the Research Fund, who adopted the following resolutions:—

"That it would be desirable to ask the guarantors to continue their subscriptions for a further space of three years, and furthermore, to issue an invitation to all other members of the Rubber Growers' Association with estates in the F. M. S. to become guarantors.

"That the guarantors should not be recommended to allow the reports to be issued to all members of the Rubber Growers' Association, but to continue the existing system of issuing reports only to guaranteeing Companies, their Directors, Agents, etc.

"That the Planters' Association of Malaya be invited to support the Rubber Growers' Association scheme, with a view to obtaining additional subscriptions in the Federated Malay States.

"That existing and potential guarantors be asked to express an opinion as to whether it would be desirable, should the renewed funds permit, to develop the research work by employing Mycologists and additional scientists in other branches.

"That it would be desirable to exchange information with other Associations or Companies who were employing scientific investigators, with a view to obtaining interchange of information."

It will be seen from the foregoing resolutions that the existing guarantors are invited to continue their subscriptions for another period of three years and that companies and other proprietors of estates in the F. M. S. who are now producing rubber should be invited also to guarantee.

It is hoped that this will result in a considerably larger sum being subscribed for the purpose of research work, and should this anticipation be realized, the Trustees will place a revised scheme before the guarantors.

During the past two years the work has been carried out by Messrs. Clayton Beadle & Stevens in London who, under agreement with the Trustees, have employed an Assistant Chemist working in the F. M. S., and have themselves conducted standard tests on manufacturing lines of the samples prepared and sent home by the Assisttant Chemist. The Assistant Chemist has also personally visited Estates and rendered advice and assistance.

The Trustees feel that it would be desirable, should increased funds allow, to consider, before the present agreement expires, in what manner the research work can be extended in the future. For instance, it has been suggested that a Mycologist and an Entomologist should be engaged and that the question of soils and manuring should receive expert attention.

The Laboratory at the Agricultural Station at Kuala Lumpur has been available for the use of the Assistant Chemist by the kind permission of the Government up to the present time, but the Government now require it for their own use and the Trustees have therefore to build a Laboratory—the arragements for this are already made.

I have written, by instructions, to the Secretary of the Local Committee in Kuala Lumpur asking to be favoured with their opinion regarding the manner in which the research work should be continued and extended. In the meantime I am instructed to ask that you will consider this matter, and that you will guarantee up to a maximum of £50 for each of the three periods ending respectively June 30th, 1913, June 30th, 1914, and June 30th, 1915, in order that the Trustees may be able to submit a scheme to all the guarantors when local opinion in the F. M. S. has been ascertained.

I enclose form of guarantee.

Yours faithfully,
C. TAYLOR,
Secretary.

Mr. Gibson and Mr. F. G. Harvey having spoken in support of the letter, it is resolved, "that this association heartily endorses the scheme and recommends all estates to join it."

19. Land Legislation.

The Secretary reads the following letter:

No. (12) in 909/1912.

The Secretary,
Planters' Association of Malaya,
Kuala Lumpur.

Kuala Lumpur,
27th February, 1912.

Sir,—I have the honour to inform you that a Committee has been appointed to consider the existing Land Enactment with a view to deciding what amendments may be necessary and desirable and to state that the Committee will be obliged if the Committee of the Planters' Association of Malaya will appoint a member of the Association to draw up a memorandum in regard to any points in the Enactment which deserve consideration.

I have etc.,
(Sd.) E. G. BROADRICK,
Acting British Resident, Selangor,
Chairman of Committee.

After a short discussion, Mr. E. Macfadyen is appointed to serve on the Committee as representative of the P. A. M.

20. Education on Estates.

The Secretary reads the following letter:

No. 2 in 1516/1912, Kuala Lumpur,
The Chairman, 27th February, 1912.
The Planters' Association of Malaya,
Kuala Lumpur.

Sir,—With the increase in the number of Tamil Immigrants many of whom bring their children with them it has become necessary to consider the question of affording such children facilities for acquiring in this country the rudiments of education in their own vernacular.

That the absence of such provision is likely to have some effect in keeping out of the country desirable immigrants can hardly be doubted apart from the consideration of the welfare of the children themselves and the main point to be considered seems to be the best method of making such provision.

The better course would appear to be for the schools to be provided and maintained by the employers of Tamil Labour the Government undertaking the necessary supervision and rendering such assistance in the way of contributions to the cost of the schools as may be considered fair and reasonable but the matter is one upon which the Government would be glad to have the views of the planters generally and I am to ask you to be good enough to bring it before your Association.

I have, etc.,
(Sd.) A. H. LEMON,
Under-Secretary, F.M.S.

Mr. Cruickshank explains at length the existing system of night schools in Ceylon.

Mr. Skinner bears out the usefulness of having the children on estates taught the three R's in the vernacular; but feels strongly that both English and Religion should be severely left alone.

Resolved that this Association is in favour of Night Schools, as already existing on several estates, that Reading, Writing and Arithmetic be taught in Tamil, and that the estates should provide the teacher and building; and the Secretary is instructed to reply accordingly to the Under Secretary, F.M.S.

The Meeting terminates at 1.15 p.m.

(Sd.) H. C. E. ZACHARIAS,
Secretary.

APPENDIX.

Federal Council, Tuesday, 14th November, 1911.

PRESENT:

H. E. the High Commissioner, Sir Arthur Henderson Young, K.C.M.G.
The Chief Secretary, Mr. Edward Lewis Brockman, C.M.G.
H. H. the Sultan of Selangor, Alaedin Suleiman Shah, C.M.G.
H. H. the Yam Tuan of Negri Sembilan, Tunku Muhammed, C.M.G.
The Acting Resident of Perak, Mr. Reginald George Watson, C.M.G.
The Acting Resident of Selangor, Mr. Edward George Broadrick.
The Acting Resident of N. Sembilan, Mr. Cecil William Chase Parr.
The Resident of Pahang, Mr. Edward John Brewster.
Mr. John Henry Matthews Robson, Mr. Edmund Becher Skinner, Mr. Harry Denis Griffiths, Towkay Foo Choo Choon.

ABSENT:

H. H. the Sultan of Perak, Sir Idris Mersid-el Aazam Shah G.C.M.G.
H. H. the Regent of Pahang, Tungku Mahmud bin Sultan Ahmad, C.M.G.

The Acting Legal Adviser, Mr. Hastings Rhodhs, was present.

THE LABOUR ENACTMENT, 1912.
READING.

The Chief Secretary addressed the Council, and moved that a Bill entitled "An Enactment to make provision for the proper supervision and treatment of Labourers" be read. He said:

This Bill will necessarily be only a temporary measure because the new Labour Code is now in course of preparation and the provisions of this Bill will be corporated in it. We asked the Council to pass this Bill as special circumstances have arisen which make it a matter of urgency. The first part of the Bill follows on the lines of the Bill recently introduced in the Legislative Council in the Colony and which has now been read a second time. I believe, as a matter of fact, the second reading was taken without opposition. Necessity for the second part of the Bill has arisen in the Federated Malay States. Shortly, the facts are as follows:

On a certain estate in the Federated Malay States matters have reached a stage at which the manager is unable to control the labour force there. There has been terrible mortality on the estate, the labour force of which consists of 1,100 men. On a recent visit of inspection, about 500 were found sick about the estate. The hospital accommodation is absolutely insufficient and the medical staff is quite unable to look after the coolies. The manager has been directed to carry out certain works but has failed to carry out promises which have been made. He states that matters have been reported to the Directors but that they have objected to the expenditure necessary to

remedy the state of affairs. He admits that matters have got beyond his control and he has also informed me that he has sent in his resignation. He has been frequently absent from the estate on other business and no one is left in charge who has power to deal with emergencies. In these circumstances it is necessary to ask the Council to confer powers on the Government to see that this state of things shall exist no longer. This is the only the possible way to deal with such a case. As I stated before this is only a temporary measure, because the Labour Bill will soon be before the Council.

The Acting Resident of Perak seconded the motion.

Mr. Parr translated the Bill into the Malay language.

Mr. H. D. Griffiths: I do not see my way clear to support this Bill, and in saying so I think I have quite sufficient reason. The Chief Secretary has given us the outline of the Bill, pointing out the necessity there is for the Bill to go through. I did not hear the whole of his speech, but I gathered enough to understand that the Government consider the proposed measure absolutely necessary. My first point of objection to the reading of the Bill is that it has never been submitted to us before this meeting. As a rule a Bill is submitted to the Unofficial Members and then published in the Gazette.

By that means a Bill becomes generally known and an opportunity is given to the people it affects to discuss it. In the present circumstances we have not been given the slightest inkling. It has been sprung upon us. The Government cannot expect an Unofficial Member to study such a Bill as this one in five minutes and pass it. It is asking too much. As far as I can see from its working the Bill is likely to have far-reaching effects on all employers of labour and will affect them, to my mind, in a detrimental manner. It is only fair that the people interested—people who employ large forces of labour in this country—should be given an opportunity to see the Bill. Why are we compelled to make a special Bill? Would not the Government make rules under the present Enactments to deal with this particular estate without framing a special Enactment? I understand the Government have instituted a special Labour Department, and I suggest this department might deal with the case. The difficulty I see if this Bill is passed into law is, that it will be difficult to upset it again when we find it does not work properly.

I think it would be a gracious act on the part of the Government to give us time to consider it. If there is danger, as the Chief Secretary states, will the Government give us time to bring this Bill to the highest pitch of perfection.

Mr. J. H. M. Robson said: I sympathise with the remarks made by Mr. Griffiths. It is very hard for us to be suddenly presented with this Bill and be asked to pass it right away. We have not had time to consider it in all its bearings. On the other hand, I quite sympathise with the Government and should not like to do anything

to prolong the present state of affairs. I happen to know something about the estate, I think something ought to be done, and that the Government should take steps to do everything necessary.

Mr. Foo Choo Choon was of opinion that the existing law was quite good. If a towkay misbehaved himself the coolies could go to the Protector of Chinese.

Mr. E. B. Skinner: I quite agree with what the Unofficial Members have said about the short notice given. In such a case as the present it is very difficult to express an opinion; but in view of the urgency of the case I, personally, think this Bill should be passed provided we have the assurance of the Government that only very urgent cases will be dealt with until the new measure is ready.

The Chief secretary: It is only because the Government is advised that there is nothing in the existing laws to enable us to deal with the present case that this measure has been introduced. It has necessitated our coming to the Council and applying for this measure which has been considered purely as a temporary one. The labour Code is now in course of preparation. If hon. members give their votes in favour of it to-day we shall not take them as an unqualified approval of the measure we are going to pass. Its provisions will only be applied to cases of a very serious nature and of great emergency. I am perfectly willing to give an assurance that I will only enforce it in cases of great emergency.

The High Commissioner: When I arrived at Kuala Lumpur for this meeting I had no idea this Bill was to be brought before the Council to-day. I did not know there would be any question of emergency. It was only when I arrived that the Chief Secretary showed me the reports that he had about this particular estate. I agreed with him that it was a question of emergency, and Members who have seen the report agree. I am sure that as regards that particular estate it is a question of emergency.

I agree with what the Chief Secretary has said, as regards the provisions of the Bill being enforced against any other estate; and I will go further and given an assurance that its provisions will not be enforced against any other estate until the Unofficial Members of the Council have seen the report upon which we propose to act, that is until we pass a permanent Bill. I consider further this Bill will strengthen the hands of managers of estates. I believe managers are quite willing to help in every way if they see that the Government rules and laws are necessary. But when you get men thousands of miles away they do not see eye to eye with the Government and with the manager. It will strengthen the hands of the managers and lead to Directors at home carrying out what they advise.

The Chief Secretary said with regard to clause 2 of the Bill that it was practically similar to the one that had been read a second time in the Legislative Council in the Colony. That is so.

At the second reading of any Bill in the Colony the Unofficial Members express their views on the principles of the Bill; but in this case not a single Unofficial Member spoke. The Bill comes into Committee on Friday. Clause 3 has not been brought before the Council in any way. I hope the hon. member will withdraw his opposition after we have told him there are no rules in the Enactment in force to secure for the Government what is required by the present Bill and also after I have told him that we will not apply clause 3 to any estate, except in the case of this particular estate, until the Unofficial Members have seen the report upon which the Government propose to act. The Bill will remain in force until it is repealed by a general consolidating law which will be prepared.

Mr. Griffiths: I do not want to take a division in the least, but the Bill seems rather ambiguous and I cannot quite grasp the meaning of it. It seems by the Bill it will be possible to move away a certain kind of labour that does not get on well on a particular estate, and in cases of trouble that the Government can step in, send the labourers away, and prohibit their return. This is giving an enormous amount of power to the Government and will have great consequences to employers of labour. I will withdraw my opposition by not voting if it is absolutely necessary and will not press for a division.

The motion was agreed to.

COMMITTEE.

On the motion of the Chief Secretary the Council went into Committee to consider further the provisions of "The Labour Enactment, 1911."

PASSING.

The Bill having been settled in Committee, was reported to the Council without amendments, and passed.

On the montion of the Chief Secretary the Council adjourned at 12.30 p.m., sine die.

PLANTERS' ASSOCIATION OF MALAYA.

Fifth Annual Report for the year ending 31st March, 1912.

To the Members of the
PLANTERS' ASSOCIATION OF MALAYA.

Gentlemen,

Five meetings of the Association were held during the past year, four in Kuala Lumpur and one in Ipoh.

I am glad to be able to report that the Malacca Planters' Association has rejoined us, bringing up the number represented to 14 again, as before. The affiliation of four further Associations also appears to be imminent, viz:—

The Ulu Selangor District Planters' Association.
The Bagan Datoh Coconut Planters' Association.
The Dindings Planters' Association.
The Ulu Langat District Planters' Association.

If these Associations join, as it is sincerely hoped they will, the only planting districts not represented will be Kinta and Kedah.

It is felt by members living in the North and South of the Peninsula, that meetings of this Association should sometimes be held in Perak, Negri Sembilan, and Johore. Although there is no doubt that Kuala Lumpur is the most central place for both Northern and Southern members, it might be advisable, in order to induce all parties to shew greater interest in the working of the Association, to hold one meeting in the North, and one in the South, each year.

Indian Labour.—The figures for the past year shew a great increase on those for the previous two years, and are as follows:—

	Immigrants.	Emigrants.	Percentage of column 2 to column 1.
1908	54,522	30,920	56·71%
1909	49,817	31,374	62·98%
1910	83,723	39,080	46·66%
1911	108,471	48,103	44·35%

These figures are very satisfactory, and it is expected that those for 1912 will be equally as good. The number of Immigrants in January, 1912 was about 12% more than in January, 1911.

Chinese Labour.—Large numbers of this class of labour came into the country during the past year. The question of recruiting Chinese was gone into by a Sub-Committee, which came to the conclusion that no combined system of recruiting could be resorted to at present, and that it must be done by private enterprise.

The Labour Enactment, No. 12 of 1910.—The Association has felt the want of this Enactment greatly, and they regret that

there should have been such a delay in bringing it into force. Owing to there being one or two points in it which did not meet with the approval of the Secretary of State, a new Enactment is being drafted, which it is hoped will be published shortly.

LABOUR ENACTMENT OF 1911.—A special Enactment was passed on November 14th, 1911, giving the Government certain powers to remove any class of labour from an Estate, if it were thought necessary. The Association deprecated the hasty passing of this Enactment, and forwarded a resolution to this effect to the Government. A new Enactment is being drafted now, which will replace that of 1911, and we understand the draft will be submitted to the Planting Community to consider, before it becomes law.

MEDICAL STAFF ON ESTATES.—The present conditions of obtaining Dressers for Estates are obviously and hopelessly unsatisfactory. A scheme is now being prepared and considered by a Sub-Committee, appointed to go into the matter, and it is hoped that Government will see their way to co-operate with us on the lines to be suggested.

COCONUTS.—The interest in this cultivation is continued, and the public at Home is beginning to realize the soundness of the investment. It is to be hoped that during the coming year, no artificial boom will spoil the present satisfactory condition of this industry, and that considerable areas will be put under cultivation on the same sound financial lines as has been the case in the past.

PESTS AND DISEASES OF RUBBER.—There are still people in the country who do not realise the importance of dealing with outbreaks of these when they occur, and the remarks made in the last year's report, viz:—that too much stress cannot be laid on the importance of all planters seeking the advise of the mycologist and entomologist, and generally keeping up to date with regard to precautionary measures to deal with any outbreaks which may occur, still hold good to-day.

PREVENTION OF PLANT DISEASES.—In order to avoid running any risk of the cultivation of rubber suffering from the neglect of diseases or pests on any particular area, it is advisable that Government be approached, with a wiew to protecting the rubber industry in the same way as they have already protected the coconut industry. It is hoped that the Association will take this matter up during the coming year.

QUARANTINE CAMP.—During the past year a very serious outbreak of cholera occurred in the Penang Camp, which greatly affected the health of the labour on the Estates. A deputation was appointed to meet the Government and discuss the Quarantine question, and, thanks to the immediate efforts of the Government, the planters in the Coast Districts of Selangor and to Dr. Watson, a temporary Camp was erected at Port Swettenham, and all chance of recruiting being stopped, was avoided thereby. It is very satisfactory to be able to record that a large sum of money has been passed in this year's

Estimates by Government, for the construction of a permanent camp at Port Swettenham. Since the outbreak of cholera, the Penang Camp has been improved very considerably, and is now in a satisfactory position to deal with any outbreaks. From the beginning of 1912, quarantine expenses will be paid out of the funds at the disposal of the Immigration Committee.

LOCAL LABOUR.—An effort was made during the year to induce the Government to introduce a Registration Fee of $1 per Tamil cooly engaged locally. This scheme was, however, deferred, as the Government first desired to see what will be the effect of the present local labour tax of $4 her head per annum, and if it induces employers to recruit freely from India.

MR. RIDLEY.—This gentleman, who was truly the Father of the Rubber Industry in this Peninsula, has retired and left the East, after having devoted many years of his life to benefitting the planting industry. The Association wishes to put on record its great appreciation of the services which he has rendered, and hopes to be able to forward him shortly some permanent and useful token of their sentiments.

WICKHAM TESTIMONIAL.—A sum of £135-1-4 was forwarded to London to be presented to this gentleman, in appreciation of the services which he rendered in the past to the Rubber Planting Industry.

RUBBER EXPORTS.—The following are the figures for the past three years:—

EXPORTS IN PARA RUBBER IN TONS AND DECIMALS OF A TON.

From	To U.K.	Brt. Poss.	Foreign Countries.	Total Tons.
Singapore ...	961	67.4	48.6	1,077
Port Swettenham	1,285.7	190.8*	307.5	1,784
Penang ...	762.3	67.4	104	933.7
Total 1909 ...	3,009	325.6	460.1	3,794.7
Singapore ...	1,219.5	83.9	183.9	1,487.3
Port Swettenham	2,815.7	314.5*	471	3,601.2
Penang ...	1,109.8	111.9	5.9	1,227.6
Total 1910 ...	5,145	510.3	660.8	6,316.1
Singapore ...	2,005.4	103.2	703.5	2,812.1
Port Swettenham	4,139.4	380.7*	553.5	5,073.6
Penang ...	2,176.5	164.6	5	2,346.1
Total 1911 ...	8,32.13	648.5	1,262	10,231.8

* Exclusive of exports to Straits Settlements.

ESTATE POPULATION.—At the census taken in March, 1911, the Estate Population as such of the F.M.S. and Kedah was taken according to race. In the Colony and Johore, however, no such census was taken according to race; on the other hand occupation was distinguished, and the figures compiled under the headings "Betel Nuts," "Coconuts," "Rubber," "Tapioca" and "Gambier" have therefore been taken as the equivalent of the "Estate Population" in the other States. The totals thus arrived at are as follows:

	MALES.	FEMALES.	TOTAL.
Selangor	52,128	14,887	68,015
Perak	48,607	14,271	62,878
Negri Sembilan ...	23,537	3,151	26,688
Kedah and Perlis ...	9,536	631	10,167
Malacca	5.426	612	6,038
P. Wellesley ...	3,877	285	4,172
Johore	3,619	12	3,771
Pahang	1,872	185	2,057
Penang Island ...	,1914	1	1,915
Dindings	785	38	823
Singapore Island ...	628	26	655
	152,929	34,250	187,179

STANDING COMMITTEE.—After due consideration, it was decided to appoint a Committee who would be able to consider thoroughly all matters which crop up from time to time, affecting this Association, in order to avoid any risk of resolutions being passed before matters have been considered on all their merits. It is hoped that this Committee will be of great use to the Association.

AGRICULTURAL BULLETIN.—It is a great satisfaction to hear that arrangements have been made for this paper to be edited and published in Kuala Lumpur, as it is one of great use to the Planting Community.

EXHIBITIONS.—During the year,. a successful Rubber Exhibition took place in London. Another Exhibition is shortly to take place in New York, to which it is hoped that members of this Association will give their fullest support, in order to shew America the value of this country as a rubber producer.

KUALA LUMPUR,
April 17th, 1912.

E. B. SKINNER,
Chairman.

ANNUAL MEETING OF APRIL 28TH, 1912.

ACCOUNTS AND ESTIMATES.

Revenue Account for the year ending 31st March, 1912.

To General Charges ..	$ 111.83	By Subscriptions:	
,, Secretary	2,400.00	,, Batang Padang D.P.A.	$ 170.00
,, Library-written off ..	16.48	,, Batu Tiga D.P.A. ..	255.00
,, Furniture	50.00	,, Johore P.A.	340.00
,, Brussels Exhibition ..	499.37	,, Kapar D.P.A. ..	170.00
,, London Exhibition ..	275.95	,, Kelantan P.A. ..	170.00
,, Postages and Cables..	175.88	,, Klang D.P.A. ..	340.00
,, Subscription to Wickham Fund £50 ..	428.33	,, Kuala Langat D.P.A.	170.00
,, Printing & Stationery	487.00	,, Kuala Lumpur D.P.A.	425.00
,, Legal Adviser.. ..	500.00	,, Kuala Selangor D.P.A.	170.00
		,, Lower Perak D.P.A.	255.00
		,, Malay Pen. Agr. Association	170-55
		,, Negri Sembilan P.A.	340.00
		,, Taiping P.A.	255.00
		,, Last Year's subscrip- Kapar D.P.A. ..	400.00
		,, Excess of expenditure over income ..	1,314.84
	$4,944-84		$4,944.48

Balance Sheet 31st March, 1912.

To Bailey Memorial Fund		$1,629.23	By Library:		
,, Ridley Testimonial Fund ..		2,984.62	As per last account	$100.00	
,, Revenue Account			,, Additions ..	16.48	
,, Balance from last year ..	$3,693.08			116.48	
,, Less Deficit	1,314.84	2,378.24	,, Less W/A ..	16.48	$ 100.00
			,, Furniture as per last account ..	100.00	
			,, Less W/A ..	50.00	50.00
			,, Cash at Bank ..		6,842.14
		$6,992.14			$6,992.14

Kuala Lumpur,
11th April, 1912.

H. C. E. ZACHARIAS,
Secretary.

We have examined the accounts of the Planters' Association of Malaya for year ended 31st March, 1912 and found same in order. We hereby certify that the foregoing Statement shows a true and correct view of the Association's affairs at 31st March, 1912, as shown by the books.

NEILL & BELL,
Chartered Accountants.

BENEVOLENT FUND.

REVENUE ACCOUNT FOR THE YEAR ENDING 31ST MARCH, 1912.

To Grants:		By Balance from last year	$5,893.85
£25	$ 213.33	,, Donations:	
£26	213.10	P. S. Murray ..	25.00
£60	426.19	E. B. Skinner ..	50.00
,, Discount on cheques	.50	Sungei Kapar Rubber Co., Ltd. ..	169.91
,, Balance in hand ..	5,462.89	Sungei Salak Rubber Co., Ltd. ..	75.00
		Bank Interest ..	102.25
	$6,316.01		$6,316.01

H. C. E. ZACHARIAS,
Secretary.

We have examined the above statement with the Bank Pass Book and vouchers and certify same to be in order and in accordance therewith.

NEILL & BELL,
Chartered Accountants.

ESTIMATES FOR 1912-3.

Dr.		Cr.	
To Bulletin	$1,000.00	By Subscription at $112.50 per delegate:	
,, Charges	150.00	2 Bagan Datoh Coco. Pl. Ass.	$ 225.00
,, Secretary	2,400.00	2 Batang Padang Pl. Ass.	225.00
,, Legal Adviser ..	500.00	3 Batu Tiga D.P.A. ..	337.50
,, Printing and Stationery	500.00	4 Johore Pl. Ass. ..	450.00
,, Postages	100.00	2 Kapar D.P.A. ..	225.00
,, Depreciations ..	50.00	2 Kelantan Pl. Ass. ..	225.00
,, Contingencies ..	700.00	4 Klang D.P.A. ..	450.00
		2 Kuala Langat D.P.A.	225.00
		3 Kuala Lumpur D.P.A.	337.50
		2 Kuala Selangor D.P.A.	225.00
		3 Lower Perak Pl. Ass.	337.50
		3 Malacca Pl. Ass. ..	337.50
		2 Malay Pen. Agr. Ass.	225.00
		4 Negri Sembilan Pl. Ass.	450.00
		2 Stiawan and Dindings Pl. Ass.	225-00
		3 Taiping Pl. Ass. ..	337-50
		3 Ulu Langat D.P.A. ..	337.50
		2 Ulu Selangor D.P.A.	225.00
	$5,400.00	48 delegates	$5,400-00

Agricultural Bulletin

OF THE

— STRAITS —

AND

FEDERATED MALAY STATES.

EDITED BY THE

Botanic Gardens Department, Singapore.

No. 5. MAY, 1912. Vol. I.

CONTENTS.

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THIRD SERIES

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OF THE

STRAITS

AND

FEDERATED MALAY STATES.

EDITED BY THE

BOTANIC GARDENS DEPARTMENT, SINGAPORE.

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AGRICULTURAL BULLETIN

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No. 5.] MAY, 1912. [Vol. 1

THE EUCALYPTUS.

From time to time a considerable number of letters appear in the local papers commenting on the desirability of planting varieties of the Eucalyptus as suitable roadside trees, and also, on account of their supposed value in purifying localities where severe fevers are prevalent.

We have received many letters asking for advice on the same subjects, and in order to give a general answer to all such correspondents, I shall endeavour to outline the success which has attended the efforts of this Department, to introduce any of the Eucalyptus family.

A Few General Characteristics of Eucalypts.

As is probably well known, the Eucalyptus or Eucalypts are natives of Australia and a few of the adjacent Islands. The genus is a large one, comprising over 150 species. Many of the species are trees varying in height—some of them being amongst the largest in the World, while others are small shrubs which thrive in desert and alpine regions. A number of the species are vigorous growers. The Blue Gum *(Eucalyptus globulus)* is one of the fastest growing of the genus.

From the middle of the last century, the Eucalypts have been distributed all over the World with various degrees of success. As is only to be expected, the most marked success has been attained in countries having a somewhat similar climate to Australia. Eucalypts have been successfully established in Algeria, South Africa, on the Nilghiri and Palui Hills and in North and South America. It is interesting to note that during the last few years, the chief product of the Eucalypts *i.e.*, Eucalyptus Oil has largely been produced in California.

In Australia, the Eucalypts grow in a great variety of soils and climates, varying from deserts or dry mountainous regions to low swamps and moist mountainous ones. It would therefore seem possible to select species which would be suitable to a great variety of situations. All the larger arboreal forms delight in a warm climate but other conditions must also exist to enable them to become successfully established.

Prof. Charles Naudin in his memoir on the genus says:—"The first condition of success in the culture of Eucalypts is a climate appropriate to their nature; that is to say, for a great majority of the species, warm summers, a *moderate amount of rain, a certain amount of atmospheric dryness,* plenty of sunlight and very temperate winters."

I have placed in italics the portion of the quotation from Prof. Naudin's memoir which particularly applies to the Straits and Federated Malay States. It cannot be said that with an average annual rainfall of 96 inches we enjoy a *moderate supply* of rain, nor for the same reason can we lay claim to the certain amount of *atmospheric dryness* in our climate necessary to their successful culture.

Most Eucalypts are benefited by occasional heavy rainfalls which thoroughly saturate the soil, as indeed most arboreal plants are, but frequent heavy rains and the subsequent very humid atmosphere are not conducive to their healthful growth. As has already been mentioned, a few of the species grow in swampy, humid regions, but the majority, though able to absorb large quantities of water by means of their roots, prefer for their aboveground parts a dry atmosphere, at least for a considerable portion of the year.

In Australia, the Eucalypts are generally found forming large forests and indeed many of them do not form very desirable shade trees when planted for that purpose.

As I shall endeavour to show, the raising of Eucalypts is attended with no little difficulty and in view of the fact that the soils and conditions our present roadside trees are subject to, would destroy any chance the Eucalypts might have (provided climatic conditions were suitable) it would seem that we must be content for the present at any rate, with the large and excellent variety of other trees that are available.

It is generally believed that Eucalypts have a most benefiting influence on the climate of those regions in which they are planted to any large extent. There seems to be a great diversity of opinion on this point, however, as the following quotations will show.

The American Consul at Florence, in 1894, writes in his Consular Reports, "It is this latter quality (the property of distributing a balsamic atmosphere) which has brought the Eucalyptus into such prominence in Italy, and has been the cause, not only of the planting of thousands of trees by private individuals and public corporations, but of its receiving the indorsement of the Italian Government as well."

It seems strange that the American Consul at Rome, should take an altogether different view of the subject. In his Consular Report for 1894, he says: "In Italy, although the newspapers had persuaded everyone that the farm of the Tres Fontane, near Rome, had become healthful by means of the Eucalypti, it proved a disagreeable surprise to learn of a sudden outbreak of malaria in 1882 that caused much sickness among the farm hands, while the rest of the Campagna remained perfectly healthy . . . . Dr. Montechiare, a practising physician of Rome, who for many years was physician to the penal colony at Tres Fontane, tells me that his experience justifies him in declaring that no beneficial results against malaria has been derived from the planting of the Eucalypts."

Mr. A. J. McClatchie, M.A., in a Bulletin published by the Bureau of Forestry of the United States Department of Agriculture gives a few reasons why such a property has been attributed to the Eucalypts and though it does not decide the question one way or the other it may be worth while to repeat them here. "It is probable that a great part of the change in the sanitary condition of those places, said to have been benefited by Eucalypts, has been due to other causes, such as the making of drainage ditches, etc., and this will partially account for the conflicting opinions on the subject. When, however, the nature and habit of the trees are considered, it is entirely reasonable to believe that, to a certain extent, they beneficially affect the atmosphere in the region of their growth. The grounds for this belief are: First, their great capacity for absorbing moisture from the soil, and thus reducing the quantity of stagnant water in the ground at their roots; second, their corresponding power of giving off fresh from their foliage, the water thus taken up by their roots; third, exhalation from their leaves and other parts, of volatile oils, which affect the climate not only directly but by changing the oxygen of the atmosphere to ozone; fourth, the purification of germ-infested matter by the foliage dropped upon the ground or in pools of standing water. From the combined action of these four characteristics it seems reasonable to believe that the trees would be beneficial to many climates."

Mr. Ridley did not believe for an instant that, in so far as the Straits and Federated Malay States were concerned, the Eucalypts would influence climatic conditions in any way whatever. We may take it, however, that, unless the Eucalypts thrive exceedingly well and are planted in the form of large forests, no benefits can possibly be derived therefrom. It is not to be expected that a few Eucalyptus trees planted in a swamp, would change the whole climatic conditions of that swamp just as a few nodules on a leguminous plant cannot be expected to have the effect of enriching a large area in nitrogen, to any appreciable extent.

Eucalypts in the Botanic Gardens.

The earliest record of the introduction of Eucalypts to the Botanic Gardens, Singapore was on January 4th, 1876, or practically

12 months after the founding of the Gardens. They were presented by Dr. Schomburg of Adelaide and consisted of packets of seed of the following varieties:—*E. alpina*; *E. amygdalina*; *E. calophylla*; *E. coriacea*; *E. empetrifolia*; *E. ficifolia*; *E. globulus*; *E. Lehmanni*; *E. marginata*; *E. oblique*; *E. piperita*; *E. unifera* and an unnamed species from Tasmania.

Seed of *E. tereticornis* were received in June, 1876, from the Botanic Gardens of Rockhampton and at the same time plants were received of *E. eugenoides* from the same Gardens. In addition to the already mentioned varieties, the following were received from time to time:—*E. citriodora, goniocalyx, rostrata, siderophloia* and *viminalis* from the Gardens, Brisbane in July, 1877. *E. Baileyii* from the Queensland Arboricultural Society in 1878; plants of *E. longifolia and cornuta* in 1878, from the Botanic Gardens, Brisbane; *E. callosa, haematostoma, pilularis and paniculata*, from the Botanic Gardens, Adelaide, in 1879 and so on, practically every year, in ever increasing variety down to the present year. (I have enumerated a few of the many varieties received in order that there may be no doubt about all or nearly all the varieties, which had any likelihood of success in this climate, being tried.)

It would seem quite permissable therefore, to imagine that there ought to be a considerable number of large trees in the Gardens at the present time, but such is indeed far from being the case. Out of the many hundreds of packets of seed which must have been presented to the Gardens during their existence, only one specimen of any dimension is to be found in the Upper Garden *i.e.*, E. intermedia? was planted on rising ground adjacent to the bandstand. It is now a tree of about sixty feet tall and has a circumference of six feet at a distance of three feet from the ground.

The situation must be described as being dry and favourable to the growth of plants requiring such an one (I have been unable to trace "intermedia" in any of the treatises on the genus but as this tree has lately flowered, specimens have been prepared in order that the correct determination may be arrived at).

In the Economic Garden, eleven trees are to be found. Seven of those were planted adjacent to Bukit Timah Road. It is probably well known that this land is frequently covered with water and at no time is the water deeper than about eighteen inches from the surface. The trees do not look healthy and all that can be said of them is that they have merely existed. They are about forty feet in height unbranched and with extremely few leaves on the crowns.

The other four were planted adjacent to the Subordinates Quarters *i.e.* on rising ground. They are practically in a similar state to the other seven and all are slowly dying. No particulars can be obtained as to when those 11 trees were planted nor have I been able to identify them (specimens have also been prepared for identification).

None of those twelve trees can be said to be suitable shade trees as they do not possess one of the essential requirements of a first class shade tree *i.e.*, a good spreading head of branches.

Some six or seven years ago, Mr. Ridley selected the driest part of the Garden for Australian plants; Callistemons, Grevilleas, Acacias and three Eucalypts were planted therein. The present condition of those Eucalypts is as follows;— E. citriodora is now about fifteen feet high, of slender growth, the lower branches continually dying off and altogether not in a very healthful condition; E. gomphocephala is now about eight feet high and in a similar condition to last; E. robusta on the other hand, as the name implies, is of more robust growth. The specimen is now about eighteen feet high and in this case, the lower branches remain on the plant for a much longer period than on any of the other two. It is the most healthy specimen of the three and it will be interesting to note its future growth.

It will be seen therefore, that little or no success has resulted in the endeavour to establish Eucalypts in Singapore.

Why?

Eucalypts are only and can only be propagated from seed, and it is to the inability of the seedling to withstand our humid climate, that the failure of establishing Eucalypts must be attributed. I have personally sown the seeds and attended them in every way possible and after the seedlings have produced their second leaf they suddenly die, damping off at the neck. This happened to all varieties with but one exception *i.e.*, E. citriodora. We have now seven or eight fairly healthy plants in small pots and it is intended to try those at a later date in a variety of situations and note results.

In support of my experience with seed and seedlings I may quote from one of our correspondents. He says:—" I may say that the Eucalyptus has so far shewn no sign of being a success. The seeds were bedded out in the same manner as Tobacco seeds—in "tempat bibits". Only one variety (*E. hemiphloia*) germinated at all in numbers, but these, with a doubtful one here and there in other beds, seemed to be eaten away rapidly and completely. No broken leaves were seen—they simply vanished!"

It may not be amiss to repeat what the late Mr. Murton said in his Report of Botanic Gardens in 1878. He said:—

I have been very successful during the first year in raising the various species of Eucalyptus, which hitherto have proved very difficult to raise from seed in this climate. A number of plants of Eucalypts as well as other plants have been supplied to the Public Works Department for planting in the reservoir grounds near Government Hill and also for the reservoir grounds at Thompson Road.

In his Report for 1878, he said:—

Eucalypts—My anticipation about the Eucalypti when I wrote my last Annual Report, have not been verified; for, although they germinated freely enough, the majority of these species die as they get a few inches high.

E. globulus appears to be the worst species for this climate, *E. citriodora*, *E. amygdalinus*, *E. goniocalyx*, *E. pilularis* and *E. calophylla* do best. I attach very little importance, however, to this, as the belief in their prophylactic virtues is now considerably weakened and they are quite unsuited, owing to their straggling, ragged appearance, for garden ornaments.

In his report for 1880, he said :—

When sown *in situ* they seem to thrive fairly well in Singapore' but do not appear to stand transplanting. *E. siderophloia*, *E. Baileyii* and one or two other species are growing well in the nursery. (none of those are now to be found).

One must perforce come to the conclusion that the Eucalypts (with rare exceptions) are not suited to our climate, and taken for granted that all the useful and healthful effects which are attributed to the Eucalypts, in so far as influence on climate is concerned, be perfectly true, I think it has been proved conclusively that the tree will not grow in sufficient quantities to warrant further trials.

J. W. ANDERSON.

NOTE.

Since writing the above note on the Eucalypts, I have been able to obtain the correct determinations of the eleven large Eucalypts mentioned therein. Specimens were sent to Mr. Maiden, Director of the Botanic Gardens, Sydney and Government Botanist, who most kindly identified them for me. The one adjacent to the bandstand and under the name of *intermedia* has been identified as E. corymbosa, Sm., while those in the Economic Gardens are probable specimens of E. terminalis, F. & M., but owing to incomplete specimens being sent (no seed being available), Mr. Maiden was unable to say for certain as to whether this was correct or not.

A SACCHARINE CONSTIUTENT OF PARA RUBBER.

In October, 1909, two small specimens of smoked Para rubber from the Botanic Gardens at Singapore, representing a consignment offered for sale in the United Kingdom, were forwarded for examination to the Imperial Institue by brokers in London, who stated that the rubber had been prepared experimentally by the Brazilian method

of smoking. On examination in the usual manner, it was found that the rubber contained a very high percentage of "resin" (*i.e.*, matter soluble in acetone), amounting to 5.2 per cent on the dry material. This proportion of resin is very much higher than is usually present in Para rubber from the East, but owing to the smallness of the samples supplied to the Imperial Institute it was not possible to investigate the matter in detail. Subsequently, however, a large specimen of smoked rubber, carefully prepared from the latex of a single tree by the same process as that employed for the earlier specimens, was forwarded for further examination to the Imperial Institute by the Director of the Botanic Gardens at Singapore.

The specimen consisted of a spindle-shaped piece of smoked rubber, weighing 6 lbs., which was almost black externally but whitish within when cut. The rubber was rather moist, and a quantity of brown viscous liquid was present between the concentric layers.

An analysis of the rubber gave the following results:—

	Rubber as received.	Composition of dry rubber.
	per cent.	*per cent.*
Moisture	7.4	——
Caoutchouc	84.6	91 4
"Resin"	4.4	4.8
Proteid	2.9	3.1
Ash	0.7	0.7

The percentage of "resin" present in the dry rubber was a little lower than that found in the previous samples (4.8 per cent. compared with 5.2 per cent.), but was still very much higher than the amount usually present in plantation rubber from the East.

An examination was made of the portion of the rubber dissolved by hot acetone, and it was found that a large quantity of a solid crystalline substance, which was soluble in hot water, was included with the resin. The substance amounted to no less than 2.7 per cent. of the dry rubber, so that the true figure for the percentage of resin in dry rubber was only 2.1 per cent. instead of 4.8 per cent.

The crystalline substance was submitted to a detailed examination and proved to be a carbohydrate, which was identified as *laevo*-methylinosite. The presence of this substance in the aqueous portion of the latex of *Hevea brasiliensis* remaining after the coagulation of the rubber has been previously recorded by de Jong, and closely allied carbohydrates are known to occur in other latices. The presence of such a large amount of the *l*-methylinosite in this specimen of Para rubber is no doubt to be attributed to the method of preparation employed, whereby the whole of the solid constituents of the latex remain in the rubber, whereas in the usual method of coagulation adopted in the East, the rubber separates from the aqueous portion of the latex, which retains the soluble constituents in solution.

In order to complete the investigation, a supply of the latex of the same tree from which the rubber had been prepared was obtained from Singapore. The aqueous portion of this latex, after separating the rubber, was found to contain a quantity of the *l*-methylinosite, amounting to 0.46 per cent. of the total latex. The presence of this carbohydrate has also been proved in fine hard Para rubber from South America.

The results of this investigation are of considerable practical interest as showing that in the analysis of rubber prepared by the Brazilian method (or by any method which leads to the inclusion in the rubber of all the solid constituents of the latex) it will be necessary to take into account the possibility of other substances besides resin being extracted from the rubber on treatment with hot acetone.

A preliminary note on the results of this investigation has been communicated to the Chemical Society of London, by Dr. S. S. Pickles and Mr. B. W. Whitefeild, of the Scientific and Technical Department of the Imperial Institute.—(*Bulletin of the Imperial Institute, April, 1912.*)

PARA RUBBER IN ST. LUCIA.

Ten thousand seeds of Para Rubber *(Hevea brasiliensis)* were obtained from Ceylon and arrived in October. Some of them were distributed to purchasers and the remainder were sown at the Experimental Station nursery. Only 10 per cent. of the whole consignment germinated. At the station 780 plants were raised and some of the number will be reserved for planting in a plot. About 600 will be available for distribution.

Para rubber planting in St. Lucia is at present only on experimental lines, but the trees planted in 1908-09 appear to be making very satisfactory growth, and some interest in the cultivation is developing. A more extended trial is desirable, to test the suitability of different soils and localities for the successful cultivation of this tree.

Experiments have been carried out to test the hardiness of Para rubber plants for distribution in the Island, when they are packed, with the view of reducing the bulk in and therefore the cost of transporting parcels of them, at the same time ensuring that they shall arrive at the various estates in sound condition. The trial was carried out as follows: Twelve plants were lifted from the seed beds, the tops cut back leaving the plants a little over a foot in length and all the leaves were removed. The soil was then shaken from the roots leaving them quite bare. The plants were then divided into two bundles and wrapped up in banana trash, which had previously been thoroughly soaked in water; each bundle containing six plants. One bundle was placed in a dry close potting shed, the temperature of which often reached 95° F., and the other bundle was placed in the Office.

After eight days the plants were examined and found to be in a fresh and healthy condition. The plants placed in the potting shed had been badly gnawed by rats, but were otherwise healthy. The whole twelve were then planted out in the ordinary way, and no special attention or treatment given to them. The plants commenced to grow readily with one exception, and this was the plant that had almost been denuded of bark by rats.

The results are very satisfactory, inasmuch as they prove that Para plants can be sent to any estate in the Island, packed in the way described, without fear of permanent injury, or loss, provided that they receive proper attention upon arrival at their destination. *(Report on the Botanic Station and Experiment Plots, St. Lucia, 1910-11)*

RUBBER IN THE SEYCHELLES.

The following extracts are taken from the Report of the Gurator (M. Dupont) on the Botanic Station, Seychelles. for 1911.

The total number of treess now in Seychelles is estimated at 70,585, of which 4,511 have reached tappable size. The tapping experiments on Hevea trees were continued. Several kinds of tapping knives were tried, but it was found that successful tapping depended more on the skill of the operator than on the instrument employed. The Barrydo knife proved a less dangerous implement in the hands of inexperienced tappers than either the Bowman—Northway or the Eagle knife, both of which produce deep wounds. The "half-herring-bone" method of tapping was used in most cases on the "opposite quarters" system, *i. e.*, one-quarter of the surface of the bark of the tree is tapped during one year, and it takes four years to tap the whole tree before beginning on renewed bark. The full spiral system was adopted in one set of experiments where trees were overcrowded, and although the death of few trees may follow this drastic method, the Curator considers that the greater yield obtained when prices are high fully compensates for this loss. He also suggests that in Seychelles it may be better to tap by this method for three months during the rainy season, when young trees can withstand the effects of serious wounds, than to employ any other method which would necessitate extending the tapping period into the dry season to obtain the same quantity of rubber.

Five-and-six-years-old trees were in one instance tapped by the full spiral method for five or six months, without any apparent check to the growth of the trees or to the fulfilment of their natural functions.

The following table shows the daily yield of latex obtained in one experiment designed to compare the two methods.

	Half-herring-bone Method.			Full Spiral Method.		
Girth of tree at 3 ft. from ground	18 ins.	18 ins.	16 ins.	18 in.	18 in.	16 in.
Date	16.3.11	17.3.11	16.3.11	16.3.11	17.3.11	16.3.11
Latex collected	660 cc.	730 cc.	515 cc.	1075cc.	1045cc	650 cc.
Number of trees	41	41	60	34	34	60
Latex per tree	16 cc.	18 cc.	8 cc.	32 cc.	31 cc.	10 cc.

The latex was coagulated with acetic acid, ammonia solution having been previously added to prevent coagulation on the cuts and in the collecting cups. One cubic centimetre of glacial acetic acid diluted with 250 cubic centimetres of water, was used to each litre of diluted latex.

The rubber was dried slowly in a cool chamber and exported in biscuit form. The slow drying tends to induce the growth of mould, and to prevent this, steps are being taken to effect the drying in a special drying room, after using a smoking machine.

Experiments carried out on a small estate near the Botanic Station serve to indicate to what extent and in what time a Para rubber estate comes into bearing in the hilly districts of Seychelles The estate in question contains 1,800 trees planted in 1905 and 600 trees planted in 1907 and 1908. The soil is rocky and inferior, the trees overcrowded and irregularly planted 10 or 12 feet apart; yet in spite of these adverse conditions about 10 per cent. of the five-year-old trees have reached tappable size, 16 in. and over in girth at 3 feet from the ground. On marshy land about 50 per cent. reach tappable size in five years. The average yield of latex, on the twenty-third day of tapping, from trees 18 in. in girth was 16 cc. per tree by the half-herring-bone method and 24 cc. by the full spiral method The best tree, 23 in. in girth, yielded nearly 100 cc. of latex daily during forty-two days, and this large yield had not decreased at the time the report was drawn up.

No fungoid disease has yet appeared on the Hevea in Seychelles, but as several diseases of other plants, which have spread to Hevea in Ceylon and other countries are present, precautions are being taken against infection.

An attempt was made to introduce rubber stumps from Ceylon, but the experiment was not very successful. The proportion of plants raised from stumps in two consignments received was 30 per cent. and 50 per cent. respectively. The number of plants raised from local seeds is steadily increasing, and it is anticipated that in two or three years it will be unnecessary to import Hevea seed for planting purposes

A NEW COCONUT PEST.

Yet another pest of the Coconut has been discovered in the Philippines and from all accounts it will prove a serious menace to plantations in the Colony and Federated Malay States unless sufficient precautions are taken immediately. So far, it seems to be restricted to certain areas in the Philippines. and the Department of Agriculture are fully aware of the danger arising from this insect, and we may be sure that they will use every means in their power, to prevent its spreading throughout the Philippines and ultimately to the Straits Settlements.

It has been considered advisable to prohibit the importation of palms, etc., from the Philippines.

We reprint the description, etc., of this pest as it has appeared in The Philippine Agricultural Review, together with the copy of the Ordinance as it appeared in the S. S. Gazette, May 31st, 1912.

"A parasite of the coconut palm, which may prove to be the most serious pest of this crop in the Philippine Islands, was discovered in May, 1911. This insect is related to the White Fly of the citrus orchards of Florida, and this fact alone is sufficient to cause the coconut planters considerable anxiety. For the present, however, it appears that this insect, which may be termed the Coconut White Fly, is confined to a district in Negros Oriental, extending from the barrio of Tabon on the north and the barrio of Zamora on the south, range of some 35 kilometers in length. Most of the coconut groves in this area, which extends from the sea-coast back to a range of hills to the west, are infested with the parasite.

The first specimens were collected on the hacienda of Mr. Henry Gardner in the vicinity of Guijulgant. It appears that this is the first occurence of any insect of this genus in the Philippine Islands, and, further more, the species itself is new to science. It has been described by Mr. Quainstance of the Bureau of Entomology, United States Department of Agriculture, D. C., as *Aleyrodicus destructo* a similar species (*A. cocois*, Westw.) occurs in the West Indies and has caused immense damage there to the coconut groves, some districts having even been abandoned largely on account of it attacks.

Like all of the so-called " White Flies " (which are, of course, not flies) and the related "scales," the individuals are very small and not readily noticeable except when present in large colonies. The general color of the older individuals is white or grayish; at first the larvae are nearly naked and of a pale brownish shade, but when about half grown they develop a fringe of white waxy material around the edge of the body. This waxy substance, as the insect grows, gradually covers the entrie body with a mass of cottony thread-like appendages and waxy flakes.

The minute eggs are laid on the under surface of the leaflets, usually on the young leaves of the palm. Thus far it appears the insect is attacking by preference only the young palms, that is, those under 6 or 8 years of age, but unless checked it will probably soon spread to all the palms in the vicinity.

Soon after the eggs are hatched the young insect begins walking about on the underside of the leaf in the endeavour to find a suitable position for its attack, satisfying itself as to location, it inserts its beak through the epidermis of the leaf and begins to suck the sap from the soft inside tissue; after becoming thus attached, the young insect seldom moves, unless disturbed, until it attains its full size. Shortly before emerging as a winged insect it stops feeding, but remains attached to the leaf. Though comparatively weak fliers, the danger of their passing through the air from one tree to another is greatly increased by the action of winds, since when the insect may only wish to fly from one leaf to another, it may be accidently borne by the wind to a considerable distance.

Some of the colonies contain scarcely more than a dozen individuals, while others contain many thousands and form an irregular white area over the underside of the leaf. This feature of their colour is exceedingly valuable to the coconut planter, since it allows him to readily determine the presence of a colony in his grove.

Although a hymenopterous insect, evidently a parasite of this coconut pest, was observed in the act of laying eggs in or upon the immature White Flies, it is not likely that any natural parasites will be of much avail in checking the spread of this pest. Therefore the coconut planters in the infested district should immediately go through their groves, cutting off and burning all attacked leaves, or portion thereof, and by the same token, it would be well for all coconut planters to carefully look over their young groves, and if any white insects are discovered, they should report the fact at once to the Director of Agriculture and should remove and burn all traces of the parasite. In certain cases it might be advisable to treat the pest with kerosine emulsion, or some similar spray, but unless the grower has had experience with such remedies, the use thereof would probably be in vain, if not actually injurious to the tree itself. Fumigation could be recommended only for extreme cases and then only for young trees.

If this pest is taken in hand immediately, there is very little chance of its spreading to other districts of the Philippines; and it is earnestly hoped that coconut planters throughout the Visayas and Tayabas will make a strenuous effort to prevent the spread of this pest, which, although apparently new to these Islands may within a few years become an exceedingly important factor in the coconut industry of the Far East.

(By D. B. Mackie, in *The Philippine Agricultural Review*, Vol. V. p. 142)

"Whereas it is provided by "The Destructive Pests Ordinance 1908" that the Governor in Council may from time to time make such Orders as may to the Governor in Council appear expedient for preventing the introduction into the Colony of any insect, fungus or other pest destructive to agricultural or horticultural crops, or to trees, or plants and for preventing the spreading in the Colony of any such insect, fungus, or other pest"

"AND WHEREAS information has been received to the effect that a disease of the coconut palm, believed to be the disease known as "WHITE FLY" (Aleyrodicus destructor) has apppeared among coconuts in the Philippines Islands."

"NOW, THEREFORE the Governor in Council in exercise of the powers conferred on him by the aforesaid Ordinance prohibits until further notice the landing in the Colony of any palms, alive or dead, or any stems or foots or parts of stems or roots of palms or of any products of palms other than such as are expressly exempted from the operation of this Order, from the Philippine Islands, and authorizes the destruction of any such article, if landed in the Colony from the Philippine Island. This Order does not apply to dried copra or to oil expressed from coconuts."

(Sd.) M. S. H. McArthur,
Clerk of Councils.

Council Chamber,
Singapore, 28th May, 1912.

THE CASTOR OIL PLANT.

Having received enquiries from Planters as to the suitability or otherwise of the Castor Oil Plant as a "Catch Crop" for Rubber, it may be helpful to others with like ideas, if a few of the details of this plant are enumerated for their guidance.

The Castor Plant (*Ricinus communis*) is probably well known to many Planters in the Peninsula, as scattered plants are generally to be found growing round Tamil Coolie Lines, the coolies sowing a few seeds in order to obtain the oil from the plants thus sown.

Belonging to the Natural Order Euphorbiaceae, it is thus related *Hevea brasiliensis* and many other plants yielding valuable oil seeds. It is generally believed to have been originally a native of North Africa, but the plant is now largely cultivated throughout the world, in Tropical and sub-tropical and occasionally in Temperate regions.

It is said to occasionally attain a height of from 20 to 30 feet, but it rarely if ever attains a larger size than from 5 to 7 feet in the Peninsula.

As a purely decorative plant it appeals to many and is largely cultivated in temperate countries for this quality alone, but the chief product derived from this plant, as perhaps every one knows, is the valuable oil obtained from the seeds.

There are many varieties of this plant—the seeds varying in size and shape, but for all practical purposes, the numerous forms may be grouped into two classes, *i.e.*, the large-seeded and small-seeded kinds. The former are more prolific in yield of seeds and the oil obtained from them is largely used as a lubricating oil, and in India it is used as an illuminant and is commercially called " Lamp Oil ". The latter, *i.e.*, the small seeded kinds, yield a much finer oil and this is preferred for use in medicine.

The soil best suited to the Castor Plant is, a rich well-drained sandy or clayey loam. Owing to its well developed root system the Castor plant demands a deep rooting medium. The Castor plant soon exhausts the soil and if virgin land is not available for the crop, natural or artificial manures are necessary. It will be readily seen that round coolie lines is an ideal situation for this plant, in so far as food is concerned as decaying matter of all kinds is ever to be found in such places.

One of the most valuable manures for this plant is the residual cake left after the expression of the oil from the seeds.

In the tropics the cultivation of this plant seems to be restricted by excessive rainfall, while in Malaya it is attacked and often denuded of leaves by a Caterpillar (Ophiusa sp.).

Before sowing the seeds it is advisable to steep them in slightly warmed water for about 24 hours. This treatment soften the hard seed coat and tends to ensure quick and uniform germination. The large seeded kinds are generally planted in rows from 5 to 5 feet apart with a similar distance between the plants in the row. The small seeded kinds are planted closer, *i.e.*, about 3 feet between the rows and 18 inches from plant to plant. It is advisable, to secure an event crop, that 2 or 3 seeds be planted at the distance mentioned above.

After germination, the weaklings one be removed and the strongest one in each case allowed to continue its growth.

In India the Castor Plant is seldom grown as a pure crop, it being usually interplanted with cereals or some leguminous crop. It is often planted as a border to cotton or sugar fields, when planted as a pure crop, about 10 lbs. of seeds of the large seeded varieties are required to plant an acre and about 14 lbs. in the case of the small seeded kinds.

After thinning, it is advisable to slightly mould up the plants by drawing the soil up round the stem, this preventing moisture from collecting at the base.

The capsules of the small seeded varieties commence to ripen in from 4 to 6 months from the time of sowing and those of the large seeded varieties from 7 to 10 months according to variety and the prevailing climate conditions. Owing to the irregular ripening of this crop, the harvesting is a somewhat tedious process, but as the work involved is not laborious, it could be done by women and children.

As the capsule dehisces and scatters the seed immediately they are ripe, it is necessary to look over the plants at least once a week, collecting those sufficiently ripened. The seeds after collecting require drying and may then be stored in bags in a dry place until sold or pressed for oil.

The average yield per acre (pure crop) is given as 4 to 6 cwt. of seeds average good crop.

From the foregoing it would seem that it is not altogether a suitable Catch Crop for rubber owing to its habit of exhausting the soil. When practical, however, this plant could be planted as a border to rubber, but this is largely a question of the quality of soil in individual Estates.

J. W. A.

MR. H. A. WICKHAM COMING OUT TO CEYLON WITH A CURING MACHINE.

The father of the plantation rubber industry, Mr. H. A. Wickham, is due in Colombo towards the end of the month, the chief purpose of his visit being to introduce a machine which embodies his ideas, acquired in the home of Hard Fine Para, as to the curing of rubber. Mr. Wickham has every hope that his machine will have a great effect upon the plantation rubber industry. During his stay in England, Mr. Wickham has been making arrangements with regard to the machine, but owing to the time it has taken to settle matters, has been delayed longer than he expected, otherwise he would have been in the Island now.

We understand that Mr. Wickham claims that his machine imitates the well-known smoking process employed by the natives on the Amazon, each layer of rubber being smoked and the article consequently thoroughly permeated by the disinfectant fumes. It is Mr. Wickham's contention that under the present processes some of the best qualities of the rubber are lost, carried away in the washing, and it will be interesting to watch how far he will be able to substantiate his claim by the production of samples of superior resiliency and tensile strength than the present first quality rubber turned out on estates. It is also claimed that the machine will turn out a perfectly uniform quality, whereas at present the rubber from the same estate varies considerably. *(Times of Ceylon 6th June, 1912).*

CLEARING WITH EXPLOSIVES.

The Value of Explosives in Clearing.

It will be found that the chief uses to which explosives can be put with economy in clearing land, are in the removal of stumps, and in so shattering logs or standing trees that they burn more readily. Trees can be blown right out of the ground; but, owing to their greater weight they take more explosive than stumps. I therefore consider it more economical to put sufficient explosive under them to blow the earth out from around the roots, at the same time cracking and breaking the roots and butt of the tree. The cracks will extend from 4 to 15 feet up the trunk of the tree; and after a week's exposure to the air in dry weather, even bad burning timber will then burn readily. I have burnt down trees 7 feet in diameter at the ground in six to twenty four hours having used 5s. worth of explosive on some. These trees would have taken a week to burn down in the ordinary way, that is, digging the earth away from them, and drawing timber around them with horses or bullocks.

The economy of the method will be realised when I state that I have cleared 12 acres of land at a cost of £3 per acre, whereas an adjoining block of similar land cost me about £6 per acre to clear in the old way. This was on light red volcanic soil, overlying light clayey loam.

The method cannot be recommended in cases where timber burns right out of the ground, leaving no roots. But in this district I have found the saving in cost to vary from 25 to 50 per cent. on the usual methods of grubbing and burning. With practice, much better work can be done at less cost with explosives. The procedure should be varied to suit different timbers and different soils; the exercise of a little judgement will be found profitable.

Sound timber, whether trees, stumps, or logs, will be shattered with better effect than hollow or rotten timber, as it offers more resistance to the explosives.

Condition of the Soil.

To obtain best results I find that the ground requires to be fairly dry. If it is very dry, the explosion is not quite so effective; whilst if it is too wet, the force seems to act too deeply in the earth, instead of near and above the surface. In some districts, I am informed, best results are obtained when the ground is wet; but that is not my experience and I do not know to what degree it holds good.

Explosives Recommended.

For firing, a battery *guaranteed* to fire five or more shots is absolutely necessary for best results. It is possible to work in small timber with fuse and caps, but the method is not so satisfactory as the use of a battery.

The explosives which I have used are rackarock and rendrock. I consider the latter the better for earth holes, as it seems to take more roots with the stump; but I can recommend both. I have used a little gelignite, and it seems very good; I intend to give it further trials. Other explosives are worthy of trials, but I should not advise farmers to use dynamite, as it is more subject to chemical changes, particularly in hot climates.

If rackarock is used, insert the detonator in half a plug of gelignite for earth holes. Much better combustion will result if this is done.

Bursting the Timber.

When it is desired to burn trees or stumps level with the ground, or to burn sound logs, bore holes 1 to 2 feet deep into the soundest part of the timber, with 1 inch to 1½ inch auger, and charge same with ½ lb. to 1 lb. of explosive. A number of shots fired simultaneously with the battery will do very much better work than when they are fired singly with fuse. This method is suitable for Yankee grubbing, as it uses less explosive; but is not as good as the next method for getting rid of trees and stumps.

Clearing for the Plough.

To remove trees and stumps for the plough, put holes under the heaviest and soundest parts of same, 12 inches or more in depth, with a 3-inch earth auger or small bar and scraper. When placing the charges, take into consideration the lay of the main spur roots. Best results are obtained by using three charges or more according to the size of the tree. Place each charge up against a big strong root, or better still in the fork of two roots. If it is not easy to get the charge against a root, ram small stones into the bottom of the hole, so as to make a sound bottom for the charge, as the more resistance obtained the better the results of the explosion. Do this before any explosive is put in the hole, or there would be great danger.

In some cases it is better to use both earth and wood holes, placing the latter in big spur roots; but I rarely do so, as it snaps the roots and leaves portion in the ground.

The charges should be carefully tamped with damp clay or earth observing the proper rules, as there is considerable danger if they are neglected. Water tamping is not at all effective in wood, though it is in rock.

In earth holes I find 1 lb. of explosive about the minimum effective charge for large trees and stumps; but I have blown out small stumps with as little as ¼ lb. With well-placed charges stumps frequently come out, shattered into many pieces, leaving few if any roots. When any remain they are so shattered that they burn easily

A Warning.

A beginner will require 50 lbs. of explosive to give the method a thorough trial. He should start on medium-sized sound stumps, as they are easier to operate on. Necessary case should be observed when handling explosives, and he should be extremely careful of the detonators. He should also bear in mind that large bits of wood will sometimes fly 150 yards. Detonators should never be *stored and kept* with explosives in the same receptacle.

(*H. B. Faviell, Bonville, in the Agricultural Gazette of New South Wales, May 2, 1912.*)

NOTICE.

A CATALOGUE of all the plants in the Botanic Gardens, Singapore, has been compiled and is ready for issue.

It contains plants of Economic, Decorative and Botanical Interest. Copies may be obtained direct from the Botanic Gardens or from Messrs. Kelly & Walsh, Singapore, post free on receipt of one dollar.

Early application is essential as only a limited number of copies have been printed.

EXPORTS TELEGRAM TO EUROPE AND AMERICA.

Month of April.

	Steamers.		Wired. Apl. 15. Tons.	Wired. Apl. 30. Tons.
Tin	Str. Singapore & Penang to	U. Kingdom &/or	725	1,758
Do.	do.	U. S. A.	380	825
Do.	do.	Continent	120	427
Gambier	Singapore	Glasgow	...	...
Do.	do.	London	...	25
Do.	do.	Liverpool	10	...
Do.	do.	U. K. &/or Continent	...	50
Cube Gambier	do.	United Kingdom	5	10
Black Pepper	do.	do.	...	5
Do.	Penang	do.	...	10
White Pepper	Singapore	do.	40	10
Do.	Penang	do.	...	...
Pearl Sago	Singapore	do.	10	40
Sago Flour	do.	London	100	375
Do.	do.	Liverpool	1,200	160
Do.	do.	Glasgow	50	75
Tapioca Flake	Singapore	United Kingdom	75	10
Tapioca Pearl & Bullet	do.	do.	150	120
Para Rubber	Straits & Malaya	do.	550	800
Gutta Percha	Singapore	do.	60	95
Buffalo hides	do.	do.	110	60
Pineapples	do.	do.	17,500	17,500
Gambier	do.	U. S. A.	140	175
Cube Gambier	do.	do.	40	110
Black Pepper	do.	do.	160	45
Do.	Penang	do.	...	...
White Pepper	Singapore	do.	80	25
Do.	Penang	do.	...	15
Tapioca Pearl	Singapore	do.	...	...
Nutmegs	Singapore & Penang	do.	9	27
Sago Flour	Singapore	do.	550	650
Pineapples	do.	do.	4,500	2,750
Do.	do.	Continent	1,500	2,750
Gambier	do.	South Continent	50	75
Do.	do.	North Continent	125	190
Cube Gambier	do.	Continent	45	10
Black Pepper	do.	South Continent	60	95
Do.	do.	North do.	...	...
Do.	Penang	South do.	...	...
Do.	do.	North do.	...	...
White Pepper	Singapore	South do.	10	...
Do.	do.	North do.	...	...
Do.	Penang	South do.	5	10
Do.	do.	North do.	...	...

			Wired.	
		STEAMERS.	Apl. 15. Tons.	Apl. 30. Tons.
Copra	Singapore & Penang	Marseilles	500	400
Do.	do.	Odessa	780	780
Do.	do.	Other South Continent	100	240
Do.	do	North Continent	480	1,700
Sago Flour	Singapore	Continent	1,500	1,100
Tapioca Flake	do.	do.	75	35
Do. Pearl	do.	do.	10	30
Do. Flake	do.	U. S. A.	...	...
Do. do.	Penang	U. K.	...	...
Do. Pearl & Bullet	do.	do.	80	50
Do. Flake	do.	U. S. A.	...	...
Do. Pearl	do.	do.	10	420
Do. Flake	do.	Continent	...	...
Do. Pearl	do.	do.	180	25
Copra	Singapore & Penang	England	50	...
Gutta Percha	Singapore	Continent	5	35
Para Rubber	Straits and Malaya	U. S. A.	85	40
Do.	do.	Continent	45	55
Tons Gambier	...	...	400	700
„ B. Pepper	...	...	150	320

Month of May.

			Wired.	
		STEAMERS.	May.15. Tons.	May.31 Tons.
Tin	Str. Singapore & Penang to	U. Kingdom &/or	1,840	1893
Do.	do.	U. S. A.	645	960
Do.	do.	Continent	120	295
Gambier	Singapore	Glasgow	...	...
Do.	do.	London	60	...
Do.	do.	Liverpool	70	...
Do.	do.	U. K. &/or Continent	...	...
Cube Gambier	do.	United Kingdom	10	15
Black Pepper	do.	do.	...	...
Do.	Penang	do.	...	...
White Pepper	Singapore	do.	...	10
Do.	Penang	do.	...	...
Pearl Sago	Singapore	do.	10	5
Sago Flour	do.	London	175	200
Do.	do.	Liverpool	1,400	...
Do.	do.	Glasgow	...	100
Tapioca Flake	Singapore	United Kingdom	35	170
Tapioca Pearl & Bullet	do.	do.	160	30
Para Rubber	Straits & Malaya	do.	525	540
Gutta Percha	Singapore	do.	20	75
Buffalo hides	do.	do.	100	50
Pineapples	do.	do.	25,000	16,250

		STEAMERS.	Wired. May 15. Tons.	Wired. May 31. Tons.
Gambier	United Kingdon	U. S. A.	25	450
Cube Gambier	do.	do.	...	50
Black Pepper	do	do.	30	230
Do.	Penang	do.	...	55
White Pepper	Singapore	do.	5	50
Do.	Penang	do.	...	45
Tapioca Pearl	Singapore	do.	...	30
Nutmegs	Singapore & Penang	do.	6	40
Sago Flour	Singapore	do.	...	400
Pineapples	do.	do.	2,250	7,500
Do.	do.	Continent	1,500	2,250
Gambier	do.	South Continent	100	...
Do.	do.	North Continent	325	210
Cube Gambier	do.	Continent	15	40
Black Pepper	do.	South Continent	75	190
Do.	do.	North do.	...	...
Do.	Penang	South do.	...	15
Do.	do.	North do.	...	...
White Pepper	Singapore	South do.	10	5
Do.	do.	North do.	5	...
Do.	Penang	South do.	...	...
Do.	do.	North do.	...	...
Copra	Singapore & Penang	Marseilles	100	50
Do.	do.	Odessa	...	900
Do.	do.	Other South Continent	100	150
Do.	do.	North Continent	3,100	2,200
Sago Flour	Singapore	Continent	700	875
Tapioca Flake	do.	do.	60	55
Do. Pearl	do.	do.	...	20
Do. Flake	do.	U. S. A.	...	...
Do. do.	Penang	U. K.	...	100
Do. Pearl & Bullet	do.	do.	85	225
Do. Flake	do.	U. S. A.	...	...
Do. Pearl	do.	do.	120	550
Do. Flake	do.	Continent	...	...
Do. Pearl	do.	do.	370	85
Copra	Singapore & Penang	England	100	150
Gutta Percha	Singapore	Continent	40	35
Tons Gambier	... ...	...	700	700
„ B. Pepper			340	225
Para Rubber	Straits & Malaya	U. S. A.	30	85
Do.	do.	Continent	55	25

SINGAPORE MARKET REPORT.

April, 1912.

		Tons.	Highest	Lowest.
Copra ...	...	3,736	11.20	10.60
Gambier Bale ...	...	1,126	10.45	10.00
„ Cube No. 1 & 2	...	169	16.00	13.62½
Gutta Percha 1st quality	...	...	275.00	200.00
„ medium	...	...	140.00	90.00
„ lower	...	...	70.00	17.00
Gutta Jelotong ...	...	...	11.60	9.25
Nutmegs 110s. ...	...	...	25.00	23.00
„ 80s. ...	...	...	27.00	25.00
Black Pepper ...	...	518	22.12½	20.75
White „ ...	...	119	32.50	30.50
Sago Pearl, small ...	...	...	6.00	5.30
„ Flour No. 1 ...	...	3,179	4.75	4.35
„ „ No. 2 ...	...	251	1.70	1.60
Tapioca Flake, small	...	186	9.40	8.90
„ Pearl „	...	140	9.00	7.80
„ „ medium	...	178	9.40	9.00
Tin ...	...	1,950	100.62½	95.37½

May, 1912.

		Tons.	Highest.	Lowest.
Coffee Bali ...	...	10	...	...
Copra ...	...	4,752	11.80	10.50
Gambier Bale ...	...	1,465	10.20	9.85
„ Cube No. 1 & 2	...	307	15.85	13.60
Gutta Percha 1st quality	...	...	275.00	200.00
„ medium	...	...	140.00	90.00
„ lowest	...	...	70.00	17.00
Gutta Jelotong ...	...	...	11.25	8.50
Nutmegs 110s. ...	...	...	25.00	...
„ 80s. ...	...	...	27.00	...
Black Pepper ...	...	468	22.00	21.12½
White „ ...	...	144	33.00	31.00
Sago Pearl, small ...	...	25	6.75	5.75
„ Flour No. 1 ...	...	4,403	5.07½	4.40
„ „ „ 2 ...	...	...	2.10	2.00
Tapioca Flake, small	...	684	9.70	8.90
„ Pearl „	...	199	8.50	7.90
„ „ medium	...	221	9.85	9.00
Tin ...	...	2,295	105.00	100.75

PENANG.

Abstract of Meteorological Readings in District Hospital, Penang, for the month of April, 1912.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
												Ins.	Ins.
PENANG.	29.812	15.5	85	95	72	not recorded.	82.4	.895	74.8	73.2	not recorded.	5.48	79

SENIOR MEDICAL OFFICER'S OFFICE,
PENANG, 30th May, 1912.

B. DANE.
Senior Medical Officer, Penang.

NEGRI SEMBILAN.

Abstract of Meteorological Readings in the various Districts of the State of Negri Sembilan for the month of April, 1912.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
District Hospital, Seremban	...	153.9	82.4	91.5	73.5	18.0	76.9	.821	73.2	74	N	2.60	1.60
" " Mantin	...	...	...	...	...	...	...	...	...	...	...	4.97	1.82
" " Tampin	...	150.6	83.1	90.2	75.3	14.9	76.7	.805	72.8	71	...	2.41	1.64
" " Kuala Pilah	...	...	82 6	91.3	74.3	17.0	77.7	.855	74.3	77	...	5.78	2.31
" " Jelebu	...	...	...	...	...	...	...	...	...	...	...	2.24	1.42
" " Port Dickson	...	164.0	84.4	90.3	75.5	14.8	78.3	8.52	74.4	72	...	2.19	0.71
Beri-beri Hospital " "	...	...	...	...	...	...	...	...	...	...	...	1.77	0,90

Office of the Senior Medical Officer,
Kuala Lumpur, 28th May, 1912.

G. D. Freer.
Senior Medical Officer,
Selangor, Negri Sembilan & Pahang.

KELANTAN.

Abstract of Meteorological Readings in Kelantan for the Month of April, 1912.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Mean Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Mean Maximum.	Mean Minimum.	Mean Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	%		Ins	Ins.
Kota Bharu	...	142.0	82.2	88.4	75.0	13.4	79.2	.927	77.0	84.8	...	4.04	1.38
Kuala Lebir	...	...	80.6	92.6	74.6	18.0	77.3	.871	75.1	83 5	...	4.21	1.60
Kuala Kelantan	...	...	...	86.43	74.20	12.23	...	...	...	...	...	2.09	0.76
Kuala Pahi	...	...	...	88.80	73.76	15.04	...	...	...	...	...	3.09	1.06
Kuala Val	...	...	...	89 00	74.76	14.23	...	...	...	...	...	1.96	1.20
Chaning Estate	...	...	...	91.00	74.00	17.00	...	...	...	...	...	3.63	1.03
Pasir Jinggi	...	...	...	...	...	...	...	...	...	...	...	2.68	.72
Semerah Estate	...	...	...	...	...	...	...	...	...	...	...	2 77	.50
Toko Ayer Merah	...	...	...	...	...	...	...	...	...	...	...	2.34	.50
Pasir Gajah Estate	...	...	...	...	...	...	...	...	...	...	...	1.05	0.70
Taku Plantation	...	...	...	...	...	...	...	...	...	...	...	1.61	1.09
Pasir Besar	...	...	...	...	...	...	...	...	...	...	...	1.94	1.25
Kenneth Estate	...	...	...	...	...	...	...	...	...	...	...	31	.23

Residency Surgeon's Office,
Kota Bharu, 18th May, 1912.

John. D. Gimlette,
Residency Surgeon, Kelantan.

PERAK.

Abstract of Meteorological Readings in the various Districts of the State of Perak, for the month of April, 1912.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
Taiping	...	106	83.18	93	71	22	78.43	909	...	81	...	14.50	2 67
Kuala Kangsar	...	...	82.52	95	71	24	77.19	862	...	79	...	11.18	3.42
Batu Gajah	...	...	83.46	95	70	25	78.27	898	...	79	...	15.80	4.15
Gopeng	...	...	82.05	94	70	24	76.42	836	...	77	...	13.31	3.46
Ipoh	...	...	83.37	95	72	23	77.88	882	...	79	...	10 77	3.41
Kampar	...	...	82 46	94	68	24	77.54	879	...	81	...	13.16	4.72
Telok Anson	...	...	82.21	94	69	25	77.96	900	...	83	...	7.94	1.55
Tapah	...	...	82.75	93	68	25	77.61	879	...	79	...	21.59	3.22
Parit Buntar	...	...	83.93	92	73	19	78.62	908	...	79	...	4.23	1.25
Bagan Serai	...	...	83.66	92	72	20	79.16	935	...	81	...	7.33	2.18
Selama	...	...	82.64	94	71	23	78.52	920	...	83	...	19.19	3.62
Lenggong	...	...	82.69	94	63	31	77.30	868	...	79	...	5.48	1.75
Tanjong Malim	...	...	82.43	95	68	27	78.34	915	...	83	...	13.68	2.56
Grit	...	...	82.25	96	68	28	76.02	816	...	75	...	11.02	2 37
Klian Intan	...	...	...	...	...	...	...	...	...	...	...	3.97	1.68
Pulau Bangkor Laut	...	...	...	...	...	...	...	...	...	...	...	5.45	1.74
Kuala Kurau	...	...	...	...	...	...	...	...	...	...	...	6.07	2.95
The Cottage	...	...	...	...	...	...	...	...	...	...	...	12.54	4.60
Maxwell's Hill	...	...	...	...	...	...	...	...	...	..	...	9.39	2.05

OFFICE OF THE SENIOR MEDICAL OFFCER,
TAIPING, 14th May, 1912.

S. C. G. FOX,
Senior Medical Officer.

PERAK.

Abstract of Meteorological Readings in the various Districts of the State of Perak. for the month of May, 1912.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
Taiping	...	106	81.88	92	72	20	77.96	905	...	85	...	25.22	5.34
Kuala Kangsar	...	...	81.14	93	73	20	77.26	885	...	85	...	8.87	2.15
Batu Gajah	...	111	81.88	92	73	19	77.88	899	...	83	...	11.20	2.75
Gopeng	...	...	80.75	91	70	21	76.36	851	...	82	...	22.53	4.74
Ipoh	...	...	81.81	92	72	20	77.56	888	...	83	...	12.65	2.00
Kampar	...	...	81.78	92	71	21	77.76	896	...	83	...	18.56	2.50
Telok Anson	...	...	81.40	93	69	24	77.59	894	...	85	...	11.15	1.88
Tapah	...	...	81.27	92	70	22	77.41	891	...	85	...	25.50	3.10
Parit Buntar	...	...	82.62	92	72	20	78.06	899	...	81	...	9.49	2.03
Bagan Serai	...	...	82.64	91	72	19	78.69	927	...	85	...	19.73	3.87
Selama	...	...	82.01	92	72	20	78.58	931	...	87	...	23.17	5.52
Lenggong	...	...	81.32	93	73	20	77.38	887	...	85	...	8.83	2.33
Tanjong Malim	...	...	81.09	93	68	25	78.30	934	...	89	...	17.80	3.62
Grit	...	...	80.67	94	72	22	76.66	863	...	82	...	11.03	1.16
Klian Intan	...	...	...	...	...	...	...	...	...	...	...	5.09	.72
Pulau Pangkor Laut	...	...	...	...	...	...	...	...	...	...	...	10.10	1.82
Kuala Kurau	...	...	...	...	...	...	...	...	...	...	...	16.25	3.10
The Cottage	...	...	...	...	...	...	...	...	...	...	...	27.75	4.38
Maxwell's Hill	...	...	...	...	...	...	...	...	...	...	...	24.04	3.10

OFFICE OF THE SENIOR MEDICAL OFFICER,
TAIPING, 14th June, 1912.

S. C. G. FOX,
Senior Medical Officer.

SELANGOR.

Abstract of Meteorological Readings in the various Districts of the State of Selangor, for the month of April, 1912.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Dry Bulb.	Vapour Tension.	Dew Point.	Humidity.			
General Hospital, Kuala Lumpur ...	29.884	148.5	83.2	92.2	74.3	17.9	77.6	0.845	74.2	74	Calm.	10.76	3.60
Prisons „ „	...	...	...	...	...	...	...	...	...	...	...	10.48	3.62
District Hospital „	...	...	...	...	...	...	...	...	...	...	...	12.07	3.22
„ Klang	...	...	...	94.1	71.3	22.8	...	...	...	...	...	6.27	1.90
„ Kuala Langat ...	...	...	...	92.3	75.5	16.7	...	...	...	...	...	3.43	.90
„ Kajang	...	...	...	89.9	76.9	13.0	...	...	...	...	...	5.96	1.78
„ Kuala Selangor ...	...	...	...	91.0	72.7	18.3	...	...	...	...	...	3.77	0.80
„ Kuala Kubu	...	...	...	94.1	71.6	22.5	...	...	...	...	...	8.19	1.50
„ Serendah	...	...	...	93.2	70.6	22.6	...	...	...	...	...	10.26	1.75
„ Rawang	...	...	...	92.4	71.8	20.6	...	...	...	...	...	15.54	3.30
Sabah Bernam	...	...	..	...	...	...	...	...	...	...	...	7.65	2.10

OFFICE OF THE SENIOR MEDICAL OFFICER,
KUALA LUMPUR, 28th May, 1912.

G. D. FREER,
Senior Medical Officer,
Selangor, Negri Sembilan & Pahang.

MALACCA.

Abstract of Meteorological Readings in Malacca, for the month of April, 1912.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
												Ins.	Ins.
Durian Daun Hospital	29.901	156.6	83.5	89.6	73.6	16.0	79.5	.919	...	83	N.	5.85	2.60 on 29th

MALACCA, 22nd May, 1912.

E. W. DE CRUZ,
Assistant Surgeon.

PAHANG.

Abstract of Meteorological Readings in the various Districts of the State of Pahang, for the month of April, 1912.

DISTRICT.	Mean Barometrical Pressure at 32° F.	Maximum in Sun.	Temperature.				Hygrometer.				Prevailing direction of winds.	Total rainfall.	Greatest rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
District Hospital, Kuala Lipis	...	...	81.8	90.9	68.6	22.3	75.9	...	...	...	...	5.39	1.05
" " Raub	...	...	82.4	92.4	71.0	21.4	73.0	...	...	...	...	9.87	1.89
" " Bentong	...	...	82.1	90.9	70.9	20.0	76.3	...	...	...	...	5.55	1.94
" " Pekan	...	...	81.9	88.3	72.8	15 5	77.5	...	...	...	...	7.29	1.95
" " Kuantan	...	...	78.5	90.7	...	...	73.7	...	...	...	...	7.43	2.28
Dispensary, Temerloh	...	...	...	92.9	67.5	25.4	...	...	...	...	...	1.61	0.80
Sungei Lembing	...	...	...	89.2	75.0	14.2	...	...	...	...	...	11.07	3.22
Kuala Tembling	...	...	...	...	...	...	...	...	...	...	...	10.68	3.50

Office of the Senior Medical Officer,
Kuala Lumpur, 24th May, 1912.

G. D. Freer,
Senior Medical Officer,
Selangor, Negri Sembilan & Pahang.

The

Gardens' Bulletin

STRAITS SETTLEMENTS,

into which is incorporated all that has been published as the third series of the Agricultural Bulletin of the Straits and Federated Malay States.

Vol. I. Issued December 15, 1913. No. 6.

CONTENTS.

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THE

GARDENS' BULLETIN,

STRAITS SETTLEMENTS.

INTO WHICH IS INCORPORATED ALL THAT HAS BEEN PUBLISHED AS THE THIRD SERIES OF THE AGRICULTURAL BULLETIN OF STRAITS AND FEDERATED MALAY STATES.

The Gardens' Bulletin will be published as material becomes available. Its price is fifty cents a copy, post free, or in advance for a volume of twelve numbers, post free,

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Thirteen shillings in Europe.

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SINGAPORE:
THE STRAITS TIMES PRESS, LIMITED

THE

GARDENS' BULLETIN,

STRAITS SETTLEMENTS.

Vol. I. Issued December 15, 1913. No. 6.

EDITOR'S NOTE.

Since 1891 the Botanic Gardens have had a publication; at first it was an occasional publication, then in 1902 it became a monthly, by a joint agreement with the Governments of the Straits Settlements, and Federated Malay States and the United Planters' Association of Malaya. Now, again, the period of the agreement having terminated, it will be occasional.

The price for each issue and for each volume remains as hitherto; but the title has been changed in order to avoid confusion with the Agricultural Bulletin of the Federated Malay States. It is thought that the title "Gardens' Bulletin, Straits Settlements" is satisfactorily descriptive, distinctive and conveniently short. The five parts published as the third series of the Agricultural Bulletin, Straits and Federated Malay States, become the first five parts of the Gardens' Bulletin.

As to our aims and the scope of the publication, this number gives a fair representation. There will be more original matter within the cover than formerly, but no market reports and no proceedings of meetings. Illustrations will be inserted where required.

Our readers will understand that, if for each fifty cents we give more original work than formerly, we cannot go to press with the same frequency, as we did. Subscriptions paid to the first volume of the Third Series of the Agricultural Bulletin, entitle the payers to this and six more parts of the Gardens' Bulletin.

THE COCONUT BEETLES.

Oryctes rhinoceros and Rhynchophorus ferrugineus.

The Coconut Trees Preservation Ordinance, No. IV of 1890, declares that it is the duty of the owner or person is charge of a coconut tree, dead or attacked by either of the two common coconut beetles to uproot the tree, to burn or to bury it in the ground at a depth of not less than three feet or to submerge it.

The Ordinance and the Amendment, Ordinance No. IX of 1895, give powers to certain inspecting officers to order that this duty be carried out.

A great improvement in the condition of the coconut trees of Singapore was recorded as the result of the enforcing of the Act But now, time having obscured the difference between the former state of the beetle-attacked plantations and their improved condition, it has become a not uncommon thing for plantation-owners to claim that the stumps are not dangerous, and sometimes the order to remove them is met by a grumble that the cost is heavy. In consequence of this, a little reminder of the necessity of removing the stumps appears desirable; and in the following paragraphs with a view to removing misapprehensions it is shown what part they play in furnishing a breeding ground for the common Rhinoceros beetle, and how this beetle prepares the breeding ground for the more destructive Palm-weevil.

The cheapest way of removing accumulations of stumps known to the writer is by the use of explosives. Before recommending it, experiments were tried in Singapore which may be at once briefly described: the experiments were done by Mr. MacQueen, Agent for Messrs. Nobel's Explosives Company, Ltd., in the presence of the writer.

For the purpose in the first instance a row of living stumps was chosen,—stumps of trees newly felled under the Municipal Act: the wood was hard and healthy, and the utmost possible resistance was to be expected. To prepare a place for the explosive, a hole was drilled into each stump on the ground level passing a little beyond the centre, and into this hole the charge was put, and exploded. In the second instance standing dead trees were taken and similarly prepared, charged and the charge exploded. These were the results:—

four cartridges of blasting gelatine, properly placed in the base of a stump, and exploded, blew it so much to pieces that it was not necessary even to pick up the pieces,

four cartridges of blasting gelatine similarly placed in the base of a standing dead tree, and exploded, brought it down leaving in the ground insufficient to serve as a breeding place for the Rhinoceros beetle, and freeing the trunk so that it could be removed easily,

four cartridges of gelignite did not suffice to do the work thoroughly,

three cartridges of blasting gelatine were not quite sufficient.

The cost of thus disposing of coconut trees that have to be removed, amounts to about half of what it costs to fell and subsequently to remove the stump by tediously digging it out. The two operations can be done in one, for the hole for the charge should be drilled in the standing tree and the trunk brought down by the destruction of the butt end.

The two beetles legislated against in the Straits Settlements are *Oryctes rhinoceros*—the Rhinoceros beetle and *Rhynchophorus ferrugineus*, the Palm-weevil. The first is the commoner but individually the less destructive. It feeds as an adult insect in the stems of living palms, generally coconut palms, tunnelling into the softer parts of the stem ; and it sometimes lays its eggs in these tunnels, but for the most part it deposits them in decaying vegetable matter, sawdust, rotting grass, old rotting thatch, wood which is soft enough, especially the central parts of dead palm trunks, and as decay loosens the bark, in the layer of tissue along the line where it and the wood unite. It has been recorded as breeding even in rich vegetable mould. It demands besides the decaying vegetable food, a considerable amount of moisture. As it may happen that the tunnel made by the mature insect in the apex of a palm tree collects rain water and rot is set up, so even if these tunnels are not at first suitable places for egg-laying, they are liable to become so after a short time.

The Palm-weevil lays its eggs on the coconut trees, making for each egg a small hole with its long characteristic snout, then turning round and depositing it to the best of its ability in the hole. The burrows of the Rhinoceros beetle give the Palm-weevil access to the inside of the palm, and full advantage is taken of them, eggs being deposited in or on their walls in preference to any other spot about the palm tree. The eggs give rise to greedy fat white grubs, which eat out galleries through the softest tissue, thereby doing the maximum amount of damage, for they destroy the heart of the palm-cabbage. On the other hand without the aid of the Rhinoceros beetle, they start life in superficial rather hard tissue, at a disadvantage and somewhat exposed to enemies.

The Rhinoceros beetle is a common insect from India to the Philippine Islands wherever large palms abound. In Africa its place is taken by *Oryctes monoceros* and *O. boas*, which attack palms in exactly the same way as *O. rhinoceros*. In Madagascar six other species of palm-attacking Oryctes live. In the Island of Reunion there are two species. Tropical America has a closely allied genus—*Strategus*—which furnishes at least one species of similar habits. Allied genera—*Pimelopus* and *Scapanes* in New Guinea, *Camelonotus* in America—attack young palms burrowing into their stems from the ground.

The Palm-weevil of Asia occurs in India, Ceylon and eastward to the Philippine Islands.

It is replaced by *Rhynchophorus phoenicis* in tropical Africa, by the allied *R. palmarum* in Tropical America and also by the smaller *R. cruentatus*. The latter seems to have a predilection for certain palms of small growth, less perhaps on account of their physical nature than its habit of flying low in the moistest air near the ground. Another similar weevil—*Rhabdocnemis obscura*—destructive to sugar cane in the Pacific islands has been found there in coconut palms.

In 1910 or perhaps one year earlier, a mischance took the Rhinoceros beetle to Samoa. It is believed that a consignment of rubber stumps from Ceylon actually carried it thither. Its presence was first noticed on November 4th, 1910, by reason of damage done to coconut palms growing close to the Customs House of Apia. From Apia it spread widely, chiefly in the direction of the prevailing wind, crossing the island of Upolu, from Apia on the north and passing westwards, but not passing so much eastwards. From the island of Upolu the beetle has flown across the strait dividing Upolu from the island of Savaii. Fears that it might reach Fiji have caused legislation to be brought in preventing the importation from the Samoan islands of anything which might carry its eggs or grubs or pupæ.

Against the pest in the Samoan islands the Government has taken energetic measures, a knowledge of which may be useful to us. Much may be learned from the two papers on it, which have appeared in Der Tropenpflanzer and from one in the Bulletin of the Department of Agriculture, Fiji.*

The first paper was by Dr. Gehrmann, an officer of the Government of Samoa, then in charge of measures against the coconut crab. He described how the mature beetle tunnels for the sake of food into the cabbage of the palm and may kill it: "the loss of palms, ... attribute to Heart-rot and to lightning" had in his opinion, he said, "during the preceeding year been due in chief measure to the beetle."

The second paper was by Mr. F. J. Jepson, Government Entomologist in Fiji, who was sent to Samoa in April, 1912, to ascertain the seriousness of the pest, lest it should be introduced into Fiji.

The third paper is by Dr. K. Friederichs, the Government Officer who now has charge of the operations against the beetle, and like the first was published in the Tropenpflanzer.

Jepson gave a map showing the area in Upolu, over which the beetle had spread in April, 1912. Friederichs has published another map bringing our information up to date and graphically showing that in spite of the strenuous measures which have been taken the pest is spreading. Since Jepson wrote it has passed over to the island of Savaii; this required the crossing of nine miles of sea; but

*Gehrmann, in Der Tropenpflanzer, xv. (1911) pp. 92. Friederichs, K., in the same, xvii. (1913) p.p. 538. Jepson, F.J., Bulletin, No. 3, Department of Agriculture, Fiji, (1912).

the strait has two islets in it, whereby the widest interspace is reduced to five miles; yet as on Savaii the beetle appeared in three villages, it is just to infer that more than one female insect had crossed the strait, and that with the wind helping, the flight can be at least five miles. However, abundant evidence shows that it is generally much less, the insect seeking a palm tree to feed in, and finding it usually near to its birth place.

As to the extent of the damage done by the beetle about the beginning of 1912, an official statement was made that one hundred and fifty trees had then been destroyed and six to eight thousand, or one-fifth of the others in the affected districts had received damage enough to put their yielding back one or two years. In April of that year, Jepson stated that about Apia and Saleimoa—the worst localities—75 per cent. of the coconut palms showed signs of attack, 30 per cent. had had their yield reduced to a great or small extent, and 1 to 2 per cent. had been killed (some doubtless by the excessive zeal of the natives in their cutting out of the beetles from the crowns). In other districts 25 per cent. of the trees had been attacked and 10 per cent. had had their yield set back.

The measures taken to cope with the beetle have been as follows. On the eighth of November, 1910, the Government of Samoa issued a proclamation in vernacular to the effect that the beetles and their grubs should be collected and promising a reward of one mark (36 cents) for every twenty beetles and the same for every fifty grubs. Seventeen days later a law was promulgated stopping coconut planting, ordering the cleaning up of all existing plantations, forbidding the using of coconut trunks for bridges and pig-styes, and arranging for inspections. About £2,000 was the cost of this method of dealing with the pest up to the end of January, 1912, and yet no satisfactory impression had been made on its numbers. Therefore on the first of February, 1912, it was made compulsory to search for and destroy the insect. Following this there was issued on April 19th, 1912, a decree calling into being a commission with powers to inspect and compel owners of coconuts to keep their estates clean, and to remove structures made of coconut trunks, or standing dead trees at the owner's expense. Then on the 10th of May, 1912, appeared an order requiring all able-bodied persons in the affected districts to turn out at six o'clock on every Wednesday to search for beetles and grubs which were to be brought to the village headmen, counted and destroyed by fire or hot water. Into this great holocaust passed the grubs of beetles which happen to be similar to those of Oryctes. Friederichs names them specifically; but their number is a matter for estimation. From the 1st of April, 1912, to the 31st of March, 1913, roughly, ten million grubs and a quarter of a million beetles were collected and killed on the island of Upolu; allowing for the grubs of the similar beetles, Friederichs puts down the Oryctes larvæ destroyed as six million and the beetles as two hundred thousand—a nice little family originating in a few grubs imported in 1910 or possibly 1909.

To this figure has yet to be added the number of the grubs and beetles collected on the European Plantations. On the estate of the Deutsche Handels- und Plantagen- Gesellschaft der Sudsee-Inseln zu Hamburg over the same period were collected and destroyed about 350,000 grubs and 23,200 beetles. Further the number of insects trapped by the Commission over the same period was 180,000 eggs, 776,000 grubs, 220 pupæ and 11,300 beetles. The traps will be described next.

For the making of a trap a hole is dug in the ground from nine to twelve feet square, and about two and a half feet deep. Rotten coconut stumps, plantain stems, and soil are put into it; and over the top large leaves such as coconut leaves, breadfruit leaves, and plantain leaves are placed rising perhaps a foot above the surface of the soil. Into these pits the female beetles penetrate to lay eggs and the male beetles to find the females. What beyond digging the traps is necessary is that they should be opened at regular and a not too distant periods, or that the beetles in them may be in some way killed.

At distances of about one hundred yards along some of the roads in Samoa these traps have made in series, and on the plantation of the Deutsche Handels- und Plantagen- Gesellschaft there is one trap to every hundred standing trees.

On the latter estate the traps are opened every six weeks or two months.

Jepson states that it takes six men about two and a half hours to open and remake one trap; therefore six men can attend to four traps only per diem, or in rotation 160 to 200. He suggested that the traps might be treated with bi-sulphide of carbon and not unpacked at all. Six ounces of carbon bi-sulphide were accordingly injected into a full sized trap, which after an interval of twenty-four hours was opened. Then all the larvæ in the trap—450 in number—were found dead; three mature beetles were partially asphyxiated, but recovered; rats and mice were found dead. The trap was remade, and re-examined eighteen days later, when to that officer's satisfaction it was found to be again full of beetles, showing that the treatment did not destroy its usefullness, but rather increased it, as a record catch was made. A second trap treated with nine ounces of carbon bi-sulphide at the same time, but opened thirty six hours later, contained 249 dead grubs and one dead beetle.

Unfortunately the German officers discovered that the cost of carbon bi-sulphide in Samoa is too high to make the method worth adopting. The building of traps, however, is a useful proceeding so long as the organisation for inspecting them is efficient; for as we saw above by their means in 1912 the Commission collected 180,000 eggs, 776,000 grubs, 220 pupæ and 11,300 beetles.

Friederichs further gives the following figures to show that the traps are efficient for catching the male insects as well as the female :—out of 1,000 insects taken, 566 were females and 434 males.

Of the lessons to be learned from this Samoa outbreak, the outstanding one is that the beetle is enormously prolific when unchecked. Regretfully we learn too that man cannot keep it down, for it has gained ground in spite of strenuous direct efforts against it ; it ought probably to be attacked through its natural enemies—parasitic ichneumon flies and Tachinid flies. These, however, will never serve instead of cleanliness about the plantations and the removal of that in which the grubs prefer to mature.

In German East Africa the method of collecting the grubs and beetles by paying so much for them was adopted some years ago.

It seems that there planters had put out coconuts on virgin forest soil which was full of grubs living in rotten wood in or on the soil, and so they had courted the beetle. At any rate its abundance alarmed them and rewards were offered for the collection of the grubs and beetles. Preuss (Der Tropenpflanzer, xv. 1911, p. 73), says that in October, 1899, on the Muea Plantation of the German East Africa Company 140,000 were taken from the ground at a fixed sum ; . . . in Dar-es-Salam in June, 1907, as the result of an offer of a sum for each grub . . . there was a grub-fever among the natives and within a few days 25,000 to 30,000 were collected and destroyed.

In the region of the natural distribution of the Rhinoceros beetle, viz, India to the Philippine islands, a not inconsiderable amount of attention has lately been directed to the damage done by it in various quarters, not so much because of any outbreaks as because Economic Entomology has come to the front. Messrs. J. McKenna and K. D. Shroff do indeed claim that it has lately invaded Tenasserim (Bulletin No. 4 of the Department of Agriculture, Burma, 1910, p. 3), but it is hard to believe that this should have been the case ; rather is it more likely that the increase of industries which leave vegetable refuse about, such as saw milling, are responsible for an increase in the numbers of the insect. This might particularly be the case about Rangoon, where it was said that so abundant had the beetle become in, and from 1907 that the very existence of palms in the neighbourhood was threatened.

The laying out of new coconut plantations in Ceylon by European planters brought the beetle to notice through the colony, but especially in the Batticaloa District, where the new plantations chiefly were : and 1903 saw an agitation for legislation against those who allow it to mature.

In the Philippine islands at the other end of the insects limit American enterprise brought to bear on the backward agriculture, turned the light on to it; and of the coconut groves, heavily grassed over and full of fruitless trees, Mr. C. S. Banks said, in 1906, that he found scarcely a tree not marked by its ravages.

From the latter's pen and from that of Mr. C. C. Ghosh, Assistant to the Imperial Entomologist, Agricultural Research Institute, Pusa, India, have come new studies of the life history and manner of working of the insect.

The insect is too familiar to need any description, but there are still several points in its life history, whose obscurity will be brought out by the following paragraphs.

The mature beetle is noctural, generally shunning light and very anxious to hide when exposed to daylight. Ridley (Report on the Destruction of Coconut Palms by Beetles, Journ. Asiatic Society, Straits Branch, No. 20, 1889) says that the insects may be attracted to fires lit in the plantations by night; and Ghose states that they fly to light in Behar, in the Ganges valley, and suggests that they may be trapped by light traps; but others have concluded that lights have not influence enough on the beetle to be worth using. At night both sexes fly abroad in search of food and in search of each other. By preference they do not fly far. Both sexes for the purpose of feeding alight in the tops of coconut palms and other palms†; there they seek the softest spots and commence to burrow with their powerful mandibles. After half an hour's work they are about one quarter of an inch into the tissues; at dawn they have penetrated at least more than their own considerable body-length. Young palms, which are growing fast and so expose a greater length of rather soft tissue than do the old palms are on this account more exposed to attack; perhaps also, they are more attacked because their soft parts lie in the still damp air near the ground, whence the beetle may have emerged and whither, if female, it probably will go to lay eggs. The beetle chews the tissues as it burrows swallowing the juice but ejecting from its jaws the fibrous parts. At first it burrows chiefly for the sake of a lair, but as it wants fresh food throughout its life, it continues its tunnel to feed. It is a matter of chance in what direction the tunnel goes; if by chance it reaches to the centre of the growing apex of the stem, the tree is killed; again if the hole so lies open that rain water gets into it rot sets in and again the tree is killed. But fortunately for the most part the beetle finds food enough in the young leaves enwrapping the apical bud, and by boring transversely through these, tangentially to the apical bud, cuts them while folded so that on emerging from the bud they appear as trimmed,

† The following palms are recorded as attacked by the Rhinoceros beetle:—

Cocos nucifera—the Coconut, *Cocos plumosa, Martinezia caryotæfolia, Phœnix dactylifera*—the Date palm, *Phœnix sylvestris, Livistona chinensis, Verschaffeltia splendida, Dictyosperma album, Hyophorbe amaricaulis, Elaeis guineensis*—the African oil palm, *Corypha umbraculifera*—the Talipot palm, *Corypha Gebanga, Borassus flabelliformis.*

topped, or belted. The damage so done can be measured in the proportion of leaf tissue cut off; in severe cases it amounts to a set back of one year. Rarely does the insect directly kill the tree; but we do not know how often. In Malaya it is certainly common to ascribe to lightning the work of the Rhinoceros beetle.*

The beetle must be attracted to the trees by some chemical substance; and it has been suggested that this is to be found in the odour of the sap, but Friederichs experimented with palm toddy fermented and fresh, and did not take a single beetle thereby. The observation is curious, for it is known that attacked trees may become favourite trees and one boring is followed by another. However, as Friederichs found that the sex odour of the beetles is attractive, we perhaps find an explanation for the repeated attentions of the beetles to one tree in the attraction of a beetle for more individuals of the other sex than one, and the surplus insects being unwelcome in the mating burrow, excavate one of their own in the same tree top.

The beetles of course find some attraction in the decayed material which they seek for egg-laying. Friederichs combining the attraction of rotten cocoa husks with the smell of a large number of imprisoned beetles of both sexes, and placing a light over the cage caught in eight nights ten females and twelve males which were attracted. The catch seems small, and as he remarks hardly worth making.

It is certainly no odour of the flowers, which attracts the beetles, for long before flowering they are attacked; and a writer in the Tropical Agriculturist (Beven, on p. 111 of N.S. vol. xxiv., May, 1905) says that the king coconut is particularly liable to attack in the alternate years between flowering.

The beetles mate in the holes that they make, but rarely lay eggs in them. The eggs are deposited in decayed vegetation wherever that may be; and it is possible that the undoubted cases of egg-laying within the burrow have been induced by some decay within it. Perhaps the burrower has struck an old hole with decay in its sides; but events which take place in the tops of palms are rather hidden from the eye of man. Let it suffice to say that undoubtedly the female rhinoceros beetle does sometimes lay eggs within the burrows, and that then destruction of the tree follows. The writer knows well that the very first signs of decay in a felled palm top are signals for the appearance of young larvæ from eggs there deposited.

Into the holes penetrate the Palm-weevils to lay eggs, and in giving them access to the soft tissues is the unpardonable crime of the Rhinoceros beetle.

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* Cf Koningsberger, J. C., Mededeelingen van 'Slands Plantentuin, xxii. (1898) p. 42.

The Rhinoceros beetle probably lives long as a mature insect; but observations are wanting. Without food Ghosh found it to live for three weeks. If dissected, very few eggs can be found in the female at any one time, and Ghosh observed that they are laid, say, three on one day, two on the next, two on the following day, and so on, each egg apart from any other.

But unless this slow egg-laying continues over a long period how could one get the millions of grubs which were collected in Samoa? The eggs, Ghosh found, were laid at night. The grubs hatched out after ten to twelve days, at the beginning of June. On the twentieth of October, grubs from these same eggs appeared to him to be full grown. Where Ghosh worked, a cold dry weather sets-in, in October, and is followed by a hot dry weather lasting until June. Ghosh's beetles made no progress during the cold dry season, though they were not dormant. One beetle only survived it and emerged on the fifth of May, having taken nearly twelve months to complete its cycle.

Yet it seems probable that in warmer damper countries such as the Malay Peninsula, growth is continuous and the life-cycle shortened to fewer moths; if this were not so we should find a greater proportion of large full grown grubs than we do, and the writer has some reason for thinking that six to seven months are enough for the beetle to pass from one generation to another: and again supposing that four grubs were introduced into Samoa in 1909, two of each sex, and that they matured and laid eggs, so large a supply as was present in 1913 requires that each female should have deposited considerably more than two hundred eggs, if the period of one generation be twelve months; but if the period of one generation be six months, fifty-four millions might be reared from two females laying fifty eggs apiece.

The grubs are blind, and very soft-skinned behind the head. Five minutes exposure to sunlight kills them at maturity. They have a breathing apparatus capable of being closed, which is an adaptation for living in almost liquid decaying matter. Their demand for moisture is very great. We can kill them easily by letting them dry, and conversely we can greatly encourage them by supplying to them damp coconut stems. There is a no more mischievous practice than that of lining the banks of a ditch or stream with coconut logs and every such place must be ruthlessly destroyed. The practise of using coconut logs for bridges is only a little less obnoxious, and should be stopped. The leaving of stumps in the ground in dry places through dry weather is not obnoxious; but the leaving of stumps in the ground in wet places and in wet weather is ; and as sooner or later wet weather comes on the once dry stump becomes damp enough for the beetle-grubs to grow in it. The necessity for removing such stumps depends on the length of time that they are likely to remain damp enough for the grubs—whether it may be a period approaching their (apparently) six months course of growth or less.

Upright tall dead trunks commonly harbour grubs, for the wood decays faster than the bark and a cup which catches rain is formed just suitable to the beetle.

Now it is not to be thought that the coconut stump is the only one to be removed; the beetle can live in many palms apparently as well as in saw-dust of soft woods of trees that have no relationship to the palms. It can live in manure heaps, and old tan heaps; all such heaps should be turned over (if it is necessary to keep them) at least once within the period of the life time of a grub, viz., six months (which period it were better to reduce to three for safety). In turning over the heaps, grubs exposed to the sun will be killed. Old decaying thatch in which it can live, should not be left to breed the beetle. When full fed the grub makes for itself a case in varying fashion; it seems as if it took to rotation and when lying in fibrous material thereby arranged the fibres more or less concentrically, or if lying in earthy material compacted for itself a wall. In this case it turns to a pupa and from it emerges a mature insect, ready to attack the living palms.

The Palm-weevil—*Rhynchophorus ferrugineus*—also has been studied by Ghosh, at Pusa in the Gangetic plain. He bred it in March, April and May and he found that it passed through a life cycle in about two months. As well as from its more destructive habits as from so rapid a course it is more dangerous as a pest than the Rhinoceros beetle; and when, as there has been recently in Singapore, an outbreak of it occurs, we cannot afford to let three months go by as in the case of the Rhinoceros beetle, but must pay constant attention to the infected spot. It breeds at all seasons, and there is no evidence that the cold weather of the Gangetic plain retards its growth, through there is some evidence that egg-laying may be retarded as is the case with the American Palmetto weevil *Rhynchophorus cruentatus*.*

The mature beetle seeks the tops of the palms chiefly by night, but also by day, and with its long snout makes a small puncture, into which to the best of its ability it places an egg. If entry is to be had to the inside of the palm by a ready-made hole so much the better for the weevil and the worse for the palm; full advantage is taken of all such holes. In a hole, according to Banks, it does without making any appreciable puncture, but pushes the egg into the tissue a little way. The eggs are laid several upon one tree, near together but not in contact, and if laid from the outside, not within one of the Rhinoceros beetle's borings,—are placed ¼ to ¾ inch deep in the tissue, right at the bottom of the puncture. Eggs were laid in Ghosh's laboratory by day as well as by night. One insect deposited 276 eggs in a life time of 49 days, another 127 in 46 days and four kept together 213 in 24 days. The greatest number of eggs laid

*Summers in Canadian Entomogolist, v., p. 123.

by a single female on one day was 32. The grub, like the grub of the Rhinoceros beetle, shuns light and is easily killed by exposure to the sun; it likes much moisture so that the hacking open of stems in which they have been growing and the exposure of them, is a good preliminary operation whenever an attacked palm has to be cleared away. They seek the softest tissues of the palm and therefore the very heart, and if left undisturbed they kill the tree with a certainty which is foreign to the Rhinoceros beetle. They do not need the tissue to be absolutely healthy, but finish their growth in dying palm stems among most obvious decay. At maturity they make a case twisting fibres from the stem round themselves and to reach the fibres they have to approach the outside of the trunk which they do close to some place from which they can emerge. The twisting on the eve of pupation is only an exaggeration of the grubs ordinary movements in progression. The pupa stage lasted, under Ghosh's observations, about 25 days.

The most rapid growth recorded by Ghosh was of one insect which emerged as a perfect beetle, 48 days after the egg was laid; 54 and 56 days were quite common periods.

The palm weevil feeds on other palms as freely as on coconut palms. It is recorded as destroying *Oreodoxa regia,*—the Royal palm, *Borassus flabelliformis, Phœnix sylvestris,* and the writer has found it in *Arenga saccharifera* and *Elaeis guineensis.* Such palms require watching as do the coconuts for signs of the presence of the grubs, because outbreaks may commence in them and spread to the coconut palms.

Blanford, in an interesting paper on the American Palm Weevil (Kew Bulletin, 1893, p. 37), refers to a very reasonable belief that the period when that insect became a most serious pest in British Honduras began with the giving over to cultivation of ridges where the *Attalea* palm grew. The Attaleas were felled and left to decay, whereupon the weevils multiplied excessively, and flew when their food on the ridges existed no longer, to the near coconut plantations, doing there very extensive injury.

As in the case of the felling of the *Attalea* palms in Honduras, so now in Malaya during the current vogue of removing coconut palms from among rubber, we have a menace to the coconut plantations. A young coconut, such as is so often cut, affords to the palm weevil a splendid breeding ground; it is nutritious from top to bottom, and the beetle is very prompt to take advantage of it.

This is a fact worth remembering; and experience lately in Singapore Island has shown that double vigilance in coconut tree inspection is required, while land owners, of small means and small knowledge, or it may be wanting in public spirit, continue the felling of coconut palms on their properties.

SUMMARY.

The Rhinoceros beetle, though laying eggs slowly, can multiply with great rapidity and as it in all places seems to kill a few coconut palms, when it is unchecked the amount of destruction done may mount up to something appreciable (upwards of 1—2 per cent. in the worst localities in Samoa); beyond the destruction there is a reduction of the yield in less severely attacked palms. Young palms are more liable to its attacks than old ones, partly because they stand in the still or moist air near the ground where the mature beetle seems chiefly to fly, but more because of the greater length of relatively soft tissue which they offer to attack.

The mature beetle tunnels in palms for the sake of food, making its tunnel a lair; it usually burrows through the enfolded young leaves and does not reach the heart of the cabbage and so does not kill the palm: it probably lives for several months, the female steadily laying eggs throughout the period, but the duration of life and the continuance of egg-laying are matters of conjecture. The beetles, and their grubs, shun day-light: they mate in the feeding tunnels or else in the places where the eggs are laid. They sometimes fly to light at night, but not with sufficient readiness for lights to be used as traps. There is something about a palm attractive to them, but it is not the odour of the drawn sap nor of the flowers. The opposite sexes have an attraction for each other; but the caging of the one to entrap the other is only moderately effective. Eggs are laid in decaying vegetation, and when as sometimes happens they are laid in living coconut stems, it may be that some decay had already been set up in an old wound. The smell of decaying vegetation, particularly of decaying palm stems is very attractive to them and may be used for the making of traps. The eggs hatch in 10-12 days, and the grub seems to require about five months for maturing; then it pupates and remains for a brief time as a pupa, emerging a beetle, it would seem, within seven months of the laying of the egg, unless cold or dry weather delays it.

The grub is very thin-skinned, and requires moist food; it can live in very moist food (slush). Exposure to dry air very rapidly kills it.

The way to attack the insect is to remove its food-supply, for although within the region of its natural distribution there are doubtless parasites and enemies, which do something in the way of keeping its numbers down, we know nothing of them, nor are we likely at present to use them to effect. Where the insect has appeared in excessive numbers, the cause has been man, in most, if not in all cases; usually man by putting an exceptional amount of food in the way of the insect, has given it the means of unduly increasing. It behoves us to keep all vegetable refuse under control both in the plantations and about neighbouring tan-yards, saw-mills and villages, for the beetle is not of restricted flight. Old coconut stumps and trunks

sooner or later become vegetable refuse, which must be removed. Traps such as those described above, are effective in direct proportion to the cleanliness of the area in which they are.

When many stumps have to be removed the cheapest method of destroying them is by the use of explosives.

The Palm-weevil goes through its life-history more rapidly than the Rhinoceros beetle; and it would seem that it should multiply more rapidly, as the female can lay nearly 300 eggs within fifty days, but that it is less in evidence is probably due to the circumstance that it is so much more particular about its food; it may be also that it has more enemies, but this we do not know. In any case it is to be remembered that an outbreak of it would be more rapidly destructive than one of the Rhinoceros beetle.

The female lays her eggs in living palm tissue, taking advantage of wounds, of which the commonest are those made by the Rhinoceros beetle; the mature beetles also feed on the palm tissue. If the female finds no hole in the palm, she makes one for herself, but only ¼ to ¾ inch deep; into it she places one egg; if she finds a Rhinoceros beetle tunnel she pushes eggs into its walls. The nearer to the heart of the tree the eggs are placed, the more serious must the attack be; the heart of the attacked palm is then tunnelled through by the fat greedy grubs, and its top falls over, declaring the presence of the invader only when the damage done is past repair. Though the grubs may not be mature when this happens, they finish their course in the tissues. The eggs may be laid also in palm tissues commencing decay.

Soft decaying palm-tissue should never be left lying about the estates to the advantage of the beetle, neither of coconut palms, nor in a general way of other large palms, for though there are palms in which the tissues hold abundant needle-crystals, until a palm, whatever it be, has been proved unpalatable to the grubs, it should be looked upon as possible food for the weevil.

I. H. BURKILL.

CLEROME GRACILIS,

a Butterfly destructive to Palms.

A social caterpillar with a yellow head, black body, densely covered with long hairs which are rusty red above the base, and freely come out, irritating the human skin, had been found doing damage to Rhopaloblaste palms in the Botanic Gardens. It was reared to maturity and proved to be *Clerome gracilis* Butler.

The caterpillars, both when feeding and when resting, take line from each other: they stand parallel on the lower surface of the leaf that they are or have been eating. They feed at night and rest by day.

When mature, they are nearly two inches long.

The chrysalis is of a brilliant green, angular as that of the familiar tortoise shell butterfly (*Vanessa urticæ* Linn) and hangs by the tail from the under surface of some object.

The butterfly is of a rich brown colour.

I. H. BURKILL.

NOTES ON PLANTS OF INTEREST IN THE BOTANIC GARDENS, SINGAPORE.

Porphyroglottis Maxwelliae, Ridley.

Among the orchids which flowered in the Botanic Gardens, Singapore, in 1913, was *Porphyroglottis Maxwelliae.* This strange orchid of still somewhat doubtful affinities was described by Mr. Ridley in 1896, from dried specimens and drawings sent to him from Sarawak. Otherwise it has remained unknown, and living plants had been in no Botanic Garden, until a small collection from Dutch Borneo was offered to him for purchase in 1911. By chance *Porphyroglottis Maxwelliae* was in the collection.

A new Variety of Eria gracilis, Hook. f.

An orchid which has recently flowered in the Botanic Gardens is *Eria gracilis* in a variety not described. The lip is obcuneate, with the middle lobe reduced to a minute point overtopped by the truncate side-lobes. It may be called var. *obcuneata.*

There is a label on the Singapore plant calling it a "Dendrobium from Java." Possibly this label has been transferred from another plant, for *Eria gracilis* is a local orchid of Singapore, extending northwards to Penang, but unknown in Java.

The flowers are flesh-coloured with sparse crimson hair outside and the lip has a crimson line down its very margin, as in the allied *E. oligantha,* Hook. f.

A new Variety of Sarcochilus stenoglottis, Hook. f.

A variety of *Sarcochilus stenoglottis* flowered in the Gardens early in August. Unfortunately the origin of the plant is unknown.

Sarcochilus stenoglottis was described by Sir Joseph Hooker in the Flora of British India, vi. (1894) p. 34; and a plate is given in the Annals of the Royal Botanic Gardens, Calcutta, v., (1895) t. 62, a reproduction of a sketch made in Calcutta in 1883, from a plant obtained in Sumatra by Kunstler.

The plant which has come under observation has red colour neither in the peduncle nor in the flower; and the margins of the lip are not frilled, but even.

A drawing has been placed in the Singapore collection.

Habenaria Havillandi, Kränzlin.

In 1912, Mr. J. W. Anderson, the Assistant Curator, was sent on a collecting trip to Sarawak, whence he brought back a series of interesting plants. One of the plants proved to be the orchid *Habenaria Havillandi*, Kränzlin. Large green flowers are always interesting, because the number of species having them is small; *H. Havillandi* is one of the number. The flowers, vertically from the tip of the upper sepal to the tip of the labellum, measure 2 cm.; the spur is long and full of honey at the lenticular end; the flowers have a faint but pleasant scent. Many of them are open together, so that in a conservatory with a setting of flowers of other colours this orchid is quite conspicuous. It flowers twice a year.

The explosive Flowers of Plocoglottis porphyrophylla, Ridley.

Another orchid, brought back by Mr. Anderson from Sarawak, proved to be *Plocoglottis porphyrophylla,* a plant of wide distribution in Malaya, but because inconspicuous and a lover of deep shade, little known. The Sarawak plant carried only one flower open at a time, but it remained in flower over more than three months, producing a fresh one every few days until the raceme was more than two feet long, and had borne fifty. Specimens and drawings in the Singapore herbarium indicate that sometimes two flowers may be expanded at the same time; this, however, never happened in the plant which came under observation.

The flowers have a most conspicuous asymmetry, are explosive, and exhibit an extraordinary series of changes, which have passed undescribed hitherto; indeed the existing descriptions of the flower are quite inadequate for giving any true idea of its appearance. Other species of Plocoglottis have bilateral symmetry, and seem widely distinct enough from our subject.

It is convenient to begin the description of the flower by an account of the half-grown bud.

The ovary begins to twist, as is the way in orchids, when by its growth it has overtopped the bract; it carries the swelling bud through about 75 degrees and then stops twisting. During this twisting the dorsal sepal outgrows the other sepals pushing over the apex of the bud. If the bud be dissected the tips of the lateral petals will be found within the apex, but the lip only slightly overpasses the middle of the bud.

All the sepals at this stage are similarly narrowly ovate, the lateral sepals being asymmetrically so. The lateral petals are linear, and curved round the column to meet at their tips. The lip is nearly as broad as long, cuspidate above its broad shoulders, with the margins in the lower part frilled and turned under. If these margins be uncurved it will be seen that they are the lateral lobes of the lip. Under each broad shoulder a wart has begun to form: three lateral nerves end close to each of these warts.

Between this stage of the bud and maturity the following changes take place. The contiguous halves of the lateral sepals thicken from the middle upwards; the cuspidate tip of the lip turns back, its shoulders enlarge and the warts become sharp little upstanding cones, while the side lobes increase along their margins so that they are too full for the space that they have and towards the base of the lip tend to form an upstanding rounded crest.

Two very fleshy bodies, being the staminodes, lie within the curve of this crest, one on each side.

The opening of the flower takes place late in the afternoon or in the early part of the night. In it, as a commencement, a slit appears between the lateral sepals from the middle, downwards first, and then to the tip. Next these lateral sepals break away and slowly take a position at right angles to the ovary, and their thickened areas begin to become convex inwards and thr w the thin parts back. Following this movement the lateral petals rapidly elongate, curving over strongly so that their points pass between the bases of the lateral sepals, and in this curious action they deflex the lip on its base holding it down against a certain amount of resistance, in contact with the lateral sepals. Thus the flower gapes somewhat.

If in the early stage of the flowering, the lateral petals are cut, the lip springs up elastically against the column, being forced up by the turgid tissue at its base and perhaps in less measure by the pull of the margin. Meanwhile the dorsal sepal has not moved.

This is the first stage of the flower and lasts into the night. It is accompanied by the development of two eccentricities: one of these is a movement of the column towards the right hand side of the flower (right hand of an observer facing the flower), whereby later it comes into contact with the shoulder of the lip; the other is the unequal curving of the lateral sepals, the upper curving most, whereby they come to form a platform with their swollen areas presented forwards and upwards, and one, the upper, presses on the tip of the labellum. The bilateral symmetry which was present in the bud is now completely lost.

During the night the second stage comes on, beginning with the turning back of the dorsal sepal, and continued by the straightening of the lateral petals. The upper of the lateral sepals no longer held away from its fellow by the lateral petals, now moves down to be in contact with it, and is thus almost median as regards the lip, and as

the lateral petals move away the lip is left caught lightly against its convex swelling, and held folded down as the lateral petals placed it. A touch now frees the lip and causes it to spring up against the column, its right shoulder being under the pollinia. Pressed thus against the column it remains while the flower withers on the following morning. In withering the lateral petals curve inwards until their tips meet; the lateral sepals rise up until they touch the lower side of the lip; the dorsal sepal follows; and the life of the flower is over.

It has no scent as far as the human nose can test it. It has no free honey. Its colours are lemon yellow to yellowish green with deep crimson markings on the lip; and the swollen parts of the lateral sepals are maroon.

How it is fertilised it is not possible as yet to state, but it would seem likely that insects of rather small size, attracted to the flower, are trapped by the up-springing of the lip against the coloumn, and in struggling to free themselves effect pollination. Sections through the swollen parts of the lateral sepals show that this tissue contains large cells with raphides towards the outer surface, and small cells towards the inner.

The mechanism is most curious; the lip is a trigger put into place by the lateral petals, and held there by one of the lateral sepals. This alone makes it of unusual interest; but the interest is heightened by the angle at which the flower stands, by the movement out of the median plane of the column, and by the movement towards it of a lateral sepal.

Hapaline appendiculata, Ridley.

A third interesting plant brought back from Sarawak by the Assistant Curator is *Hapaline appendiculata* with variegated leaves. Mr. Anderson had found it plentiful near Bau. It flowered in cultivation in the end of May.

Hapaline appendiculata differs from the two other known Hapalines in having an appendix to its spadix, which slightly overtops the narrow white spathe. Is is the most southern representative of a rather badly constituted genus. It was once before in cultivation in the Gardens, but either was lost or is bedded out in some unrecorded nook under the trees. The specimen grown earlier had dark green leaves without the conspicuous pale green cloudy markings of the new one. The leaves take a peculiar attitude, the petiole bending so as to place them beyond the rim of the plant pot in which they may be grown.

I. H. BURKILL.

THE EXTREME HARDNESS OF THE SEEDS OF CAESALPINIA DIGYNA.

In 1910, the writer obtained two dozen seeds of *Caesalpinia digyna*, Rottl., from Burma, intending if possible to isolate on them the water-resistent layer which hinders the germination of quite a number of the Leguminosae, such as *Acacia arabica* and various indigos. The intended study was never completed; but observations were made on the resistance of the seeds to germination.

The seeds were placed half-submerged in clean water, which was frequently changed, but none germinated during nine months; next they were allowed to dry and after about three months out of water, they were placed in it again half-submerged as before; still there was no germination. A few were removed from the experiment to see if they were alive; they were cut slightly so that the impervious layer was broken, whereupon they all germinated. The remainder passed another six months half-submerged, but did not germinate; then they passed a year dry. Half-submerged again for the third time, as before they did not germinate during two months.

It seemed probable after this that the alternation of wet and dry seasons such as occurs where the plant chiefly grows, has nothing to do with the germination. However, it was thought that perhaps jungle-fires might bring it about; and ten seeds were accordingly placed under a layer of dry leaves prepared to produce a flame a foot high, which was fired; the seeds, when the fire had passed from them, were collected and replaced again in water, they still did not germinate until they were cut. With this the experiments ended, the supply of seeds being exhausted; but the living plants now in cultivation in the Economic Garden, Singapore, are the offspring of these seeds.

It seems as if *Caesalpinia digyna* only germinates after direct injury to the outermost layer of the seed-coat.

Several years ago Professor W. R. Dunstan, Director of the Imperial Institute, London, showed what splendid leather is produced by tanning with the pods of this plant, but a barrier to its use was found in the high cost of collecting them from the bushes which grow too scattered. Should it ever be possible to bring the pods into the market, it is most likely to be by encouraging the plant to grow thicker by sowing prepared seeds in waste places.

I. H. BURKILL.

A DISEASE OF AGAVES.

There is a disease on *Agave* plants in Singapore, and in the state of Johore, due to a fungus. This fungus attacks the mature leaves on the upper surface, rendering them valueless for the

extraction of fibre. The first sign of it is the appearance of white blotches which spread, then darken to a deep brown, becoming sunken, and when quite dead the skin takes on a rather silvery look; this change is followed by the breaking out of small black pustules which are often in rather regular concentric rings.

On cutting sections of the diseased parts of the Sisal plants it can be seen that in the earlier period of the attack the bleaching is due to the destruction of the chlorophyll-containing cells under the epidermis, whereby cavities are formed leading to the shrinkage of the dying epidermis onto the layer of fibres below. The whole afterwards becoming more and more disorganised, air obtains access to the cavities; and this leads to the silvery appearance. In the final stage spores of a fungus are formed in the cavity under the epidermis and escape through cracks in it.

The attack is like that of the fungus *Colletotrichum Agaves* which is described and figured in the Sixteenth Annual Report of the Missouri Botanic Garden, 1905, p. 153, plates 35-37, but the destruction seems to spread more longitudinally down the leaf, and under the microscope it is seen that the spores are not the spores of a *Colletotrichum*, but of a fungus of the allied genus *Coryneum*.

Coryneum and *Colletotrichum* both belong to the Melanconiales, and as they are of the same habit, the treatment for one would seem to be the treatment for the other.

Colletotrichum Agaves is known to occur in India, and may be attacked as recommended by Dr. Butler, in the Agricultural Journal of India, i. p. 260, thus :—

"SISAL HEMP DISEASE. A disease of cultivated Agaves, caused by the fungus *Colletotrichum Agaves* . . . . . has been found in several parts of India, and has been the cause of alarm on Sisal estates. In America it has not been known to attack Sisal; but in India it often does so. The older leaves are first attacked, sunken patches appearing where the fungus has entered. These turn brown and dry up in the centre, while they spread at the margin In the dried up parts, spores are produced in little black clumps, which blow about and infect healthy leaves . . . . . All diseased leaves should be cut and burnt as soon as the patches appear."

In the Report of the Missouri Botanic Garden, it is recorded that the garden authorities had succeeded in checking the spread of the disease by such means; but it is added that moisture predisposes to the attack. Missouri with its dry climate then has a great advantage over this country where we cannot avoid the moisture.

I. H. BURKILL.

THE FERTILISATION OF CACAO.

The number of Cacao pods formed on a tree is very much out of proportion to the number of flowers produced. In Dominica, West Indies, there is formed but one pod to every two hundred flowers. To ascertain why this is so, Mr. G. A. Jones has had plants under observation in that island, but without reaching a final conclusion. This, however, was ascertained that if the common red ants which tend green fly about the flowers are kept away, no pollination at all results. The criticism which comes to the mind on reading the remarks of this observer, is that the pollination only takes on one flower out of every two hundred; and that positive evidence is required to prove that the red ants have anything to do with the fertility of the flowers.

CAPRIFICATION IN MALAYA.

A paper in the Philippine Journal of Science, viii., section D., No. 2, (1913) p. 63, by Mr. C. F. Baker, on the fertilisation of the Philippine fig—*Ficus nota*, Merrill, is of great interest. As is usual in fig-trees there are produced on certain sterile trees, figs holding gall-flowers associated with male flowers, wherein the fertilising fig-insects breed; and there are produced fertile figs on other trees, to which the fertilising insects bring the pollen from the sterile trees. The multiplication of the insects, of which on *Ficus nota* there are no less than seven species, goes on all through the year; one insect is a *Blastophaga*, similar to that which fertilises the Smyrna fig. "If a large mature caprifig (gall-fig) be opened, the walls of the interior are found to be thickly massed with the densely packed brown galls, produced from the modified ovaries of the infertile flowers" ..... "In due time from certain of the galls appear numbers of queer clumsy wingless yellow insects, the males of the Blastophaga. Immediately after they emerge they turn their attention to gnawing small holes in the still unopened galls; this—their quest for the female—seems completely and continuously to occupy their attention. Many times holes are made, then immediately deserted," if the quest has been fruitless. These small holes are made at any accessible point on the surface of the gall. In case the gall happens to contain a female Blastophaga, the tip of the male's abdomen which is closely recurved under the body and projects forward between the fore legs and just beneath the mouth, is introduced into the gall without any change in general attitude of the body of the male, and copulation with the imprisoned female takes place ..... Copulation accomplished, the males make no attempt whatever to enlarge the minute hole made for this purpose, "but leave the female to gnaw her own way out, which she

does immediately after copulation. This is in striking contrast to the case of the Smyrna fig insect in which, the male is supposed, as stated by Eisen, to liberate the female after copulation. However, observations on this point should be repeated. The male continues on its quest, rapidly gnawing into gall after gall and repeating the act of copulation, until exhausted and dying. In its nervous haste it occasionally bites into the stamens also, but any intentional attack on the stamens, as described by Cunningham for *Ficus Roxburghii*, does not occur in *Ficus nota*. With the rapid emergence of the males, followed by the emergence of the females, the scene in the fig becomes exceedingly animated, and the more so because during this time, males also of various guests and parasites begin to emerge and seek their respective females.

It is a remarkable fact that the tens of thousands of Blastophagas, guests, and parasites, constantly emerging, apparently make direct for other figs on the same trees or go to other trees of *Ficus nota*. In case the female Blastophaga passes to younger figs on the same tree or on another caprifig, she proceeds at once to the ostiolar end of the receptacle and enters there pushing her body back and forth between the closely overlapping scales in most laborious fashion, until the interior is reached." Whether the wings are broken off during this attempt, as states by Eisen for the Smyrna *Blastophaga* or whether they are deliberately removed by the insect tiself, as occurs in the female of many ants, Mr. Baker was unable to ascertain. In any event entrance of the fig always involved dealation. "Having accomplished entry to the fig, the females find the specially modified funnel shaped stigmas awaiting the deposition of eggs, and insert one to each style just within the ovary, so that it lies upon the ovule destined to furnish food to the developing larva. One female is capable of depositing very many eggs; . . . . . and often as many as a dozen females or more gain entrance to the same fig, so that the oviposition is usually quite complete. The female dies immediately after egg-laying is concluded. However, in case the female has found her way to a tree bearing only figs destined to produce seed, and she seems entirely incapable of detecting this fact, she enters the figs in the same way, but there encounters only stigmas . . . . . not adapted to the reception of her eggs. She vainly searches the interior of the fig, over and over, involuntarily distributing to the normal stigmas the pollen with which her body was thoroughly dusted, until thwarted and exhausted, she finally dies. From one to a dozen or more dead bodies of females sacrificed to this service may be found in each young fertile fig."

None of the guests nor parasites of *Ficus nota* enters the fig by the ostiole for oviposition as does the *Blastophaga*. They all possess ovipositors of extraordinary length with which the entire wall of the receptacle is pierced. Thus are they of no use in the bringing of figs to maturity. It is the female *Blastophaga* which alone does the work.

RECORD OF A FEW ORCHIDS

and other interesting plants found in Setol and on Kedah Peak.

During a collecting expedition to Setol and Kedah Peak in 1912, the following orchids and other plants were collected for the Waterfall Gardens, Penang. It is of interest to record their occurrence in the places named.

Melastomaceæ.

Sonerila cyclaminella, Stapf and King.	...	K. Peak.

Gesneraceæ.

Didymocarpus citrina, Ridl.	...	K. Peak.
D. albina, Ridl.	...	K. Peak.

Orchidaceæ.

Dendrobium cruentum, Reichb. f.	...	Setol.
D. secundum, Wall.	...	Setol.
D. tenuicaule, Ridl.	...	Setol.
D. hymenopterum, Hook. f.	...	Kedah Peak.
D. atrorubens, Ridl.	...	K. Peak.
Platyclinis linearis, Ridl.	...	K. Peak.
Bulbophyllum Lobbii, Lindl.	...	K. Peak.
B. stella, Ridl.	...	K. Peak (flower widely expanded).
Eria ochracea, Rolf.	...	Setol (Kew Bulletin No. 9, 1909, p. 366).
Spathoglottis aurea, Lindl.	...	K. Peak.
Cypripedium niveum, Reichb. f.	...	Setol.
Arundina chinensis, Blume, (A. Philippii, *Reichb. f.*)	...	K. Peak.
Habenaria carnea, N. E. Br.	...	Setol.
Spathoglottis Handingiana, Par. and Reichb. f.	...	Setol.
Saccolabium curvifolium, Lindl.	...	Setol.
Eulophia graminea, Lindl.	...	Setol.
Calanthe rubens, Ridl.	...	Setol.
Coelogyne asperata, Lindl.	...	K. Peak.
C. Dayana, Reichb. f., var. *tomentosa*.		K. Peak.
Phalaenopsis esmeralda, Reichb. f.	...	K. Peak.
Dipodium pictum, Reichb. f.	...	K. Peak.
Anoetochilus Reinwardtii, Blume.	...	K. Peak.
Acanthephippium sp.	...	Setol.
Arisaema fimbriatum, Mast.	...	Setol.

Filices.

Matonia pectinata, R. Br.	...	K. Peak.
Dipteris Lobbiana, Moore.	...	K. Peak.

Lycopodiaceæ.

Lycopodium Hookerii.	...	K. Peak.
Do. phlegmaria, Linn.	...	K. Peak.

MOHAMED HANIFF.

RAINFALL

at the Director's House, Botanic Gardens, Singapore, from February 12th, when a new guage was put into position, to June 30th, 1913.

Readings taken always at 8 a.m., and credited to the date in which the twenty-four hours began.

Day.	February	March.	April.	May.	June.
1st	not recorded	Trace	0.31	0.05	0.02
2nd		1.81	..	3.40	1.14
3rd		6.62	0.38	0.05	0.04
4th		4.25	...	0.05	0.47
5th		0.07	1.49	0.10	0.01
6th		0.62	0.01	0.46	...
7th		...	0.36	Trace	1.55
8th		0.02	0.82	...	0.23
9th		0.55	0.10	...	0.01
10th		0.94	0.34	0.26	...
11th		..	...	0.07	Trace
12th	...	...	...	0.46	...
13th	...	0.03	0.14	0.01	0.15
14th	...	...	...	0.37	Trace
15th	Trace	...	...	2.09	...
16th	...	...	0.12	Trace	1.28
17th	...	0.08	...	...	0.28
18th	..	0.83	0.05	..	1.30
19th	...	...	...	0.07	0.04
20th	...	...	3.15	0.31	1.30
21st	...	...	0.11	Trace	0.38
22nd	...	0.06	...	0.17	Trace
23rd	0.01	0.01	1.51	...	1.30
24th	...	0.84	...	...	0.47
25th	..	...	...	0.37	0.36
26th	0.15	0.07	...	0.05	0.30
27th	0.36	1.50	0.76	...	Trace
28th	0.48	0.35	0.24	...	3.96
29th		...	...	0.58	...
30th		...	0.10	...	1.87
31st		0.05		0.27	

LISTS OF PLANTS,

which may be obtained generally at the Prices stated, from the Botanic Gardens.

The cost of packing and all subsequent charges are extra.

LIST A.—Ornamental Plants.

		$	cts.	
Abrus precatorius—Crab's Eye—climber	...	0	10	
Acalypha Godseffiana—shrub	...	0	15	
Acalypha macrophylla—shrub	...	0	15	
Acalypha macrostachys—shrub	...	0	15	
Acalypha torta—shrub	...	0	15	
Acalypha obovata—shrub	...	0	15	
Acalypha Sanderiana—shrub	...	0	15	
Actinorhytis calapparia—palm	...	0	20	and upwards
Adiantum Capillus-Veneris—Maiden Hair fern		0	50	and upwards according to size and variety or race
Aglaonema commutatum—pot plant	...	0	15	and upwards
Aglaonema costatum—pot plant	...	0	50	,,
var. inornatum	...			
var. virens	...			
Allamanda cathartica—shrub	...	0	15	
Allamanda Schottii—half scandent shrub	...	0	15	
Allamanda violacea—half scandent shrub	...	0	40	
Alloplectus Lynchii—pot plant	...	0	20	
Anemia rotundifolia—fern	...	1	00	and upwards
Angelonia salicariaefolia—half herbaceous plant		0	10	
var. alba	...	0	10	
Anthurium Bakeri—pot plant	...	1	00	and upwards
Anthurium cristallinum	...	1	00	,,
Antigonum leptopus—Honolulu creeper	...	0	15	,,
var. alba	...	0	15	,,
Antigonum guatemalensis—climber	...	0	25	,,
Archontophoenix Alexandrae—palm	...	0	25	,,
Areca Catechu—Betel-palm	...	0	15	
Arenga saccharifera—Kabong—palm	...	0	20	
Aristolochia Duchartrei—climber	...	0	20	
Aristolochia hians—climber	..	0	25	
Aristolochia elegans—climber	...	0	15	
Aristolochia saccata—climber	...	0	50	
Aristolochia gigas var. Sturtevantii—climber		1	00	
Arundina bambusaefolia—terrestial orchid	...	0	25	and upwards
Arundo donax var. variegata—ornamental grass		0	20	
Asparagus plumosus—climber	...	0	50	and upwards
Asparagus Sprengeri—climber	...	0	50	,,
Attalea spinosa—palm	...	0	50	,,
Barleria prionitis—shrub	...	0	20	

Bauhinia spp.—shrub	0	25	
Beaumontia grandiflora—flowering climber	0	25	
Beloperone oblongata—shrub	0	20	
Bignonia magnifica—climber	0	25	
Bignonia crucigera—climber	0	25	
Bignonia aequinoctialis—climber	0	15	
Bougainvillaea glabra—climbing shrub	0	20	
Bougainvillaea Sanderiana—climbing shrub	0	25	
Bougainvillaea lateritia—climbing shrub	1	00	
Bromheadia palustris—terrestial orchid	0	25	
Brownea ariza—flowering tree	0	50	
Brunfelsia americana—shrub	0	20	
Buxus sempervirens—Box	0	25	
Caesalpinia pulcherrima—shrub	0	25	
Callistemon linearis—shrub	0	25	
Calanthe veratrifolia—terrestial orchid	1	00	and upwards
Calyptrocalyx spicatus—palm	0	25	,,
Camoensia maxima—climber	0	25	
Canna indica, various races, unnamed	0	05	
named races	0	10	and upwards
Cassia fistula—Indian Laburnum—small tree	0	40	
Cassia siamea—flowering tree	0	15	
Casuarina equisetifolia—tree	0	20	and upwards
Chlorocodon Whiteii—climber	0	10	
Chonemorpha Rheedii—climber	1	00	
Chrysalidocarpus lutescens—palm	0	25	and upwards
Clerodendron Minnehassae—flowering shrub	0	40	
Clerodendron speciosum—climber	0	15	
Clerodendron capitatum—shrub	0	15	
Cocos plumosa—palm	0	25	and upwards
Cocos flexuosa—palm	0	25	,,
Congea tomentosa—climber	0	25	
var. azurea	0	20	
Crotons—Codiaeum—in variety	0	10	and upwards
Cryptostegia madagascariensis—flowering shurb	0	25	
Cymbidium Finlaysonianum—orchid	1	00	and upwards
Cyrtophyllum fragrans—Tembusu—tree	0	10	
Daedalacanthus nervosus—shrub	0	20	
Dendrobium thyrsiflorum—orchid	1	00	
Dictyosperma album—palm	0	40	and upwards
Dieffenbachia spp.—pot plants	0	25	,,
Dipladenia Harrisii—climber	1	00	,,
Dracaena fragrans var. Lindeni—foliage plant	0	25	,,
Duranta Ellisii—shrub	0	15	
Duranta Plumieri—shrub	0	15	
Dypsis madagascariensis—palm	0	25	and upwards
Elaeis guineensis—palm	0	15	,,
Eranthemum atropurpureum—shrub	0	15	
Eranthemum malaccense—shrub	0	25	

Eranthemum reticulatum—shrub	...	0 15	
Eranthemum Wattii—shrub	...	0 50	
Eucharis grandiflora—Amazon Lily	...	0 15	
Euphorb.a heterophylla—herb	...	0 05	
Evodia hortensis—shrub	...	0 15	
Evodia Ridleyi—snrub	...	0 20	
Excœcaria bicolor—shrub	...	0 15	
Faradaya papuana—climber	...	0 25	
Ficus Benjamina—tree	...	0 20	
Ficus repens—creeper	...	0 25	
Filicium decipiens—small tree	...	0 25	
Gardenia florida—shrub	...	0 20	and upwards
Gloriosa superba—climber	...	0 15	
Gratophyllum hortense—shrub	...	0 15	
Hamelia patens—shrub	...	0 25	
Hemigraphia colorata—creeper	...	0 15	
Heterospathe elata—palm	...	0 25	and upwards
Hibiscus Cameroni—shrub	...	0 15	
Hibiscus mutabilis—shrub	...	0 15	
Hibiscus Rosa-sinensis—Shoe-flower—shrub		0 10	
var Cooperi	...	0 20	
Hibiscus schizopetalus—shrub	...	0 10	
Holmskioldia sanguinea—shrub	...	0 25	
Hosea Lobbii—climber	...	0 20	
Inga (Pithecolobium) saman—Rain tree	...	0 15	
Ipomoea digitata—climber	...	0 15	
Ixora Bandhuca—shrub	...	0 15	
Ixora coccinea—shrub	...	0 15	
var. lutea	...	0 20	
Ixora macrothyrsa—shrub	...	0 20	
Jacobinia magnifica, var. carnea—shrub	...	0 40	
Jacquemontia violacea—climber	...	0 25	
Jacaranda mimosaefolia—tree	...	0 25	
Jasminum Sambac—half climbing shrub	...	0 25	
Kentia Woodfordii—palm	...	0 50	and upwards
Kopsia fruticosa—shrub	...	0 20	
Lagerstroemia Flos-reginae—tree	...	0 25	
Lagerstroemia indica—shrub	...	0 25	
Lagerstroemia subcostata—tree	...	0 40	
Lasia heterophylla—herb	...	0 25	and upwards
Ledenbergia roseo-oenea—herb	...	0 15	
Licuala grandis—palm	...	1 00	and upwards
Licuala spinosa—palm	...	0 25	,,
Licuala triphylla—palm	...	0 25	,,
Livistona altissima—palm	...	0 25	,,
Livistona chinensis—palm	...	0 25	,,
Livistona Hoogendorpii—palm	...	0 25	,,
Lobelia syphilitica—herb	...	0 25	,,
Lonicera macrantha—Honeysuckle	...	0 20	
Malpighia coccigera—shrub	...	0 15	

Malpighia nitida—shrub	...	0	25	
Martinezia caryotaefolia—palm	...	0	25	and upwards
Memecylon coeruleum—shrub	...	0	25	
Mesua ferrea—tree	...	0	50	
Miconia Hookeriana—pot plant	...	0	25	
Montrichardia aculeata—herb	...	0	25	
Murraya caloxylon—shrub	...	0	25	
Mussaenda erythrophylla—half climbing shrub		0	25	and upwards
Mussaenda luteola—shrub	...	0	15	
Nyctanthes Arbor-tristis—shrub	...	0	25	
Oreodoxa regia—palm	...	0	25	and upwards
Orthosiphon stamineus—half herbaceous	...	0	15	
Panax fruticosum—shrub	...	0	15	
var. Guilfoylei	...	0	20	
var. Victoriae	...	0	15	
Pandanus graminifolius—Screw pine	...	0	25	and upwards
Pandanus Houlletii—Screw pine	...	0	25	,,
Pandanus utilis—Screw pine	...	0	15	,,
Passiflora laurifolia—Sweet Cup or Passion Fruit		0	15	
Passiflora vitifolia—climber	...	0	25	
Passiflora Watsoniana—climber	...	0	25	
Pentaclethra filamentosa—tree	...	0	40	
Pergularia odoratissima—climber	...	0	15	
Petrea volubilis—half scandent shrub	...	0	25	
Phaleria Blumeii—shrub	...	0	25	
Philodendron gloriosum—ornamental plant ..		1	00	and upwards
Phoenix rupicola—palm	...	0	25	,,
Phoenix reclinata—palm	...	0	25	,,
Phoenix Roebelini—palm	...	2	00	,,
Phyllanthus pulcher—shrub	...	0	10	
Pinanga Kuhlii—palm	...	0	25	and upwards
Pinanga patula—palm	...	0	25	,,
Pithecolobium Saman—Rain tree	...	0	15	
Plumbago rosea—shrub	...	0	20	
Plumeria lutea—shrub	...	0	20	
Podocarpus neglectus—tree	...	0	25	
Poinciana regia—Gold-mohur tree	...	0	15	
Porana volubilis—climber	...	0	15	
Ptychococcus paradoxus—palm	...	0	50	and upwards
Ptychosperma McArthuri—palm	...	0	20	,,
Ptychosperma sanderiana—palm	...	0	50	,,
Quassia amara—shrub	...	0	25	
Randia macrantha—shrub	...	0	40	
Raphia Hookeri—palm	...	0	50	and upwards
Rhapis flabelliformis—palm	...	0	25	,,
Rhopaloblaste hexandra—palm	...	0	20	,,
Roupellia grata—shrub	...	0	50	
Ruellia ciliatiflora—	...	0	10	
Russelia juncea—shrub	...	0	15	
Russelia sarmentosa—shrub	...	0	20	

Saraca declinata—tree	...	0	50
Saraca indica—tree	...	0	50
Saraca trijuga—tree	...	0	50
Saraca taipingensis—tree	...	0	50
Sagus laevis—Sago palm	...	0	20 and upwards
Salvia coccinea—flowering herb	...	0	15
Sanchezia nobilis—shrub	...	0	10
Sarcocephalus esculentus—shrub	...	0	25
Selaginella spp.—various	...	0	25 and upwards according to size and variety or race
Solandra grandiflora—shrub	..	0	20
Solanum maroniense—shrub or small tree	...	0	25
Spathodea campanulata—tree	...	0	15
Stephanotis floribunda—climber	...	0	75 and upwards
Stevensonia grandifolia—palm	...	0	25 ,,
Stigmaphyllon ciliatum—climber	...	0	15
Stigmaphyllon lancifolium—climber	...	0	20
Strobilanthes Dyerianus—foliage plant	...	0	25
Tabernaemontana coronaria—shrub	...	0	20
Tecoma stans—shrub	...	0	20
Thunbergia erecta—shrub	...	0	20
Thunbergia laurifolia—climber	...	0	15
Tinnea aethiopica—shrub	...	0	15
Tinnea Sacleuxi—shrub	...	0	15
Tococa platyphylla—shrub	...	0	25 and upwards
Tristellateia australasica—creeper	...	0	15
Turnera ulmifolia—herb	...	0	15
Verschaffeltia splendida—palm	...	0	25 and upwards
Vinca rosea—herb	...	0	10
var. alba	...	0	10
Vitis discolor—climber	...	0	15
Wedelia biflora, double flowered—shrub	...	0	15
Xanthosoma Lindeni—pot plant	...	1	00 and upwards
Zalacca edulis—palm	..	0	15 and upwards

LIST B.—Economic Plants.

AT TWO CENTS PER SEEDLING OR PER SUCKER.

Alpinia Galanga—Galangal
Curcuma longa—Turmeric
Cymbopogon Nardus—Lemon Oil Grass
Hevea brasiliensis—Para Rubber tree
Mentha viridis—Mint
Panicum maximum—Guinea Grass
Sanseviera zeylanica—Bowstring hemp
Sanseviera sulcata
Sanseviera guineensis

AT THREE CENTS PER SUCKER OR PER ROOT.

Ananas sativa—Pineapple, races Mauritius, Ruby Jamaica, Harvey's and Pernambuco

Andropogon squarrosus
Boehmeria nivea—Rhea or Ramie, two races
Boehmeria tenacissima
Maranta arundinacea—Arrowroot

SOLD AT 15 CENTS IN FOUR-TO SIX-INCH POTS, OR AT MORE THAN 15 CENTS IF LARGE PLANTS IN LARGER POTS.

Adenanthera pavonina
Achras Sapota—Chiku
Aegle Marmelos—Bel
Albizzia moluccana
Aleurites triloba—Candle nut
Aloe vera—Barbados aloes
Anacardium occidentale—Cashew nut
Anona muricata—Soursop
Anona squamosa—Custard Apple
Areca Catechu—Betel nut
Artocarpus integrifolia—Jack fruit
Artocarpus lanceaefolia—Kledang
Artocarpus polyphemia—Champedak
Artocarpus rigida—Monkey Jack
Averrhoa Carambola—Carambola
Boehmeria tenacissima—Ramie
Bouea macrophylla—Kundangan
Cananga odorata
Carapa guineensis
Carica Papaya—Papaw
Castilloa elastica—Central American rubber
Cedrela Toona—Tum
Chrysobalanus Icaco—Coco plum
Chrysophyllum Cainito—Star apple
Cinanmomum iners
Citrus decumana—Pumelo, white fleshed
Citrus decumana—Pumelo, red fleshed
Citrus medica, var. acida—Citron
Citrus acida—Lime
Citrus Aurantium—Orange, Chinese
Coffea arabica—Arabian coffee
Coffea Laurentii
Coffea liberica—Liberian coffee
Coffea stenophylla
Coffea zanzibarica
Cola acuminata—Cola
Connarus semidecandrus
Cordia myxa
Croton tiglium—Croton oil plant
Cynometra cauliflora—Num-num
Derris elliptica—Tuba

Dialium laurinum—Kranji
Dichopsis gutta—Gutta percha tree
Diospyros discolor—Mabola
Durio zibethinus—Durian
Elaeis guineensis—African oil palm
Erythina indica—Dadap
Eugenia brasiliensis—Brazil cherry or Grumixameira
Eugenia grandis—Jambu ayer laut
Eugenia jambos—Rose apple
Eugenia leptantha
Eugenia malaccensis—Malay apple
Eugenia uniflora—Ibipitanga
Eugenia xanthocarpa
Erioglossum edule—Mertajam
Flacourtia Cataphrata
Flacourtia Ramontchi
Funtumia elastica—Lagos rubber tree
Garcinia Cowa
Garcinia dulcis—Mundu
Garcinia ferrea
Garcinia Mangostana—Mangosteen
Inocarpus edulis—Othaheite Chestnut
Jagera speciosa
Jatropha Curcas
Lansium domesticum—Langsat
Lansium domesticum, var. Duku—duku
Manihot Glaziovii—Ceara rubber
Mimusops Elengi—Bunga tanjong
Mitrephora Thorelii
Morus alba—Mulburry
Nephelium lappaceum—Rambutan
Nephelium malaiense—Mata kuching
Nephelium mutabile—Pulasan
Noronhia emarginata
Pandanus utilis
Passiflora laurifolia—Sweet cup
Paranephelium macrophyllum
Pentaclethra filamentosa
Piper nigrum—Pepper
Pithecolobium acre
Pithecolobuim Saman—Rain tree
Pittosporum pentandrum
Pittosporum viridiflorum
Pithecolobium fasiculatum
Pogostemon Patchouli—Patchouli
Psidium Guajava—Guava, large fruited
Psidium laurifolium
Pterocarpus indicus
Sandoricum radiatum—Kechapi
Spondias dulcis— a Mauritius race

Sterculia Jackiana
Strophanthus dichotomus
Styrax Benzoin
Swietenia macrophylla—Broad leaved Mahogany
Tamarindus indica—Tamarind
Terminalia Catappa—Bengal Almond
Terminalia procera
Treculia africana
Thespesia populnea
Theobroma Cacao—Cocoa, Garden seedlings
Triphasis Aurantiola
Zalacca edulis—Buah Salak

AT 25 CENTS IN LARGE POTS.

Cinnamomum Camphora—Camphor tree

AT 50 CENTS EACH IN LARGE POTS.

Achras Sapota—Chiku, grafted plants
Eugenia caryophyllata—Clove
Myristica fragrans—Nutmeg

FORTHCOMING CONGRESSES.

The fourth International Congress of Tropical Agriculture and Colonial Development will meet in London in 1914. Those wishing to join the congress may enroll themselves as members of the International Association of Tropical Agriculture and Colonial Development, paying one pound per annum, (due on the first of January of each year), to the Secretary, British Section of the International Association, Imperial Institute, London, S.W., and for this they will receive all the publications of the Association and the quarterly Bulletin of the Imperial Institute, in addition to being entitled to take part in the London Congress.

An International Rubber Congress is to be held in Batavia from September 7th to 10th, 1914, in connection with the Batavia Rubber Exhibition (September 8th to October 10th).

The International Botanical Congress, held at Brussels, in May, 1910, decided on the invitation of the Royal Society of London, that the next Meeting should be held in London, and it has now been arranged, that it, the fourth Congress, will take place from May 22nd to May 29th, 1915. The subscription for membership of the Congress is fifteen shillings. Members will receive all the publications. Ladies accompanying members may attend the meetings and excursions of the Congress on payment of ten shillings each. The General Secretary of the Organizing Committee for the coming Congress is Dr. A. B. Rendle, British Museum of Natural History, South Kensington, London, S.W.

The

Gardens' Bulletin

STRAITS SETTLEMENTS,

into which is incorporated all that has been published as the third series of the Agricultural Bulletin of the Straits and Federated Malay States.

Vol. I. Issued June 20th, 1914. No. 7.

CONTENTS.

To be purchased at the Botanic Gardens, Singapore from Messrs. Kelly and Walsh, Ltd., No. 32 Raffles Place and 194 Orchard Road; and the Straits Times Office, Cecil Street, Singapore.

DEPARTMENTAL NOTICE.

A few plants of the Avocado or Alligator Pear—*Persea gratissima,* and a few plants of the Brazil nut—*Bertholletia excelsa*—to be sold within the Peninsula at fifty cents each.

Seeds of *Hevea brasiliensis*—Para Rubber—as available from little tapped trees, twenty-eight years old, to be sold at fifty cents per hundred.

THE

GARDENS' BULLETIN,

STRAITS SETTLEMENTS.

INTO WHICH IS INCORPORATED ALL THAT HAS BEEN PUBLISHED AS THE THIRD SERIES OF THE AGRICULTURAL BULLETIN OF THE STRAITS AND FEDERATED MALAY STATES.

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THE

GARDENS' BULLETIN,

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THE SIRANGOON OUTBREAK (1913) OF BRACHARTONA CATOXANTHA.

About the middle of the year, 1913, a few moths of *Brachartona catoxantha*—the coconut pest—(vide Agricultural Bulletin, Straits and F.M.S., viii, 1909, page 357, and Bulletin, Department of Agriculture, F.M.S, No. 4) were observed near Singapore town; but no outbreak followed their appearance at that place; instead a severe outbreak followed in the coconut plantations about the head of the Sirangoon river. The centre in the early part of the outbreak was near the Mission church at Sirangoon, and in the small Chinese holdings between it and the Trafalgar Estate; the Trafalgar Estate was rather badly attacked, and also coconut palms about duck farms between the Ponggul Road and the river; while towards Singapore town the caterpillars were to be found sporadically for three miles. They occurred in addition on the leaves of a species of *Calamus* and on those of the *Areca* palm among the coconut palms in the badly affected area.

A generation of moths was found to be emerging from the pupae on November 1st; and several hundred pupae were collected in order to ascertain the degree of parasitisation, as well as the nature of the parasites. The degree was found to be only 4 per cent. and the parasites were in the first place a Tachinid fly, and in the second a Brachonid ichneumon.

As it was evident that these were far from getting the attack under, preparations were made for trying to confine the moth to the area it occupied and for seeking the co-operation of coconut palm owners in the extermination of the pupae. A circular was printed in

Malay, Tamil, and Chinese explaining the nature of the attack, and asking those with attacked trees to burn the lower leaves on which the caterpillars in large quantities had pupated, i.e., the already destroyed leaves. This circular was distributed as soon as an inspector had been appointed for the purpose.

During the month of December, it became evident that the centre of the attack was moving south under the prevailing wind and had got to the junction of the Tampinis Road with the Sirangoon Road. Very sparingly the moth had reached Tanjong Ponggul northwards against the wind.

Spraying meanwhile had been resorted to on the Trafalgar Estate and had done good, for the young trees were free; but the machine was not powerful enough for the spraying of tall palms.

At this stage Nature came to the rescue in the form of a fungus allied to that which causes Muscardine in silk worms—a fungus, new to science which will be described by Mr. G. E. Massee of the Royal Botanic Gardens, Kew, as *Botrytis necans.*

It was first detected near the edge of the Bukit Sembawang Rubber Estate, on the Tampinis Road; and no sooner was it found than it was seized on as a weapon against the moth. The special inspector, having been made familiar with the insect in all its stages and with the fungus, was set to the work of distributing the latter to any colony of caterpillars that he could find free from it. This distribution was done by taking strips of coconut leaves with dead caterpillars or pupae on them, and tying them to the leaves of trees where healthy caterpillars were feeding. Fortunately the caterpillar pupates blatantly in a silken hammock under the leaf that it has been eating, and, if fungus-infected, generally dies inside the hammock, the spores coming to the outside in the form of flour; the fungus is therefore easily found and there was no difficulty in collecting supplies as required.

The inspector, thus working, for instance, spread the fungus through the coconunts about Ponggul, on January 15th, among a brood then maturing which soon pupated and whereof, the Tachinids and Brachonids had but infected 5 per cent. In the next brood the attack was killed out. About Gelong which the moth succeeded in invading, the fungus was also spread; but there is reason to believe that south of the centre the wind did more by distributing the fungus spores that the inspector could have done In February, the outbreak was over.

It is memorable for revealing a means of which we were not aware of possible utility for meeting another attack.

I. H. BURKILL.

CALOGRAMMA FESTIVA, Donovan,—

a Caterpillar destructive to Crinum asiaticum.

In Singapore, the caterpillars of *Calogramma festiva* (a moth), destroy the foliage of *Crinum asiaticum* completely. They live socially, devouring all the green parts of the plant, filling the angles between the leaves and elsewhere with their dejecta, where a mass of putridity arises, among which they may pupate. The putridity is due to the wet dejecta harbouring, in the climate of Singapore, fungi which attack and rot the leaf tissues below, in such a way as to cut off the upper part of the leaf from the bulb; and then the whole blade dies.

The eggs are laid in patches on the plant, covered with a buff felt from the mother moth's body. They are prettily ribbed to the apex. The caterpillars on hatching have a transparent skin with small black bristles arising from swollen bases; and after eating green tissue they look green. They feed by eating the surface of the plant, but seem at a great disadvantage if placed on an old leaf. When three days old, a transverse saddle mark appears behind the head and another on the back before the prolegs, while three faint longitudinal milky white lines become apparent. A day later, dark plum-coloured pigment appears elsewhere in the skin, and also fine milky white lines become apparent between the other lines; when five days old they are already half an inch long, and yellow pigment begins to appear in the dorsal line.

The caterpillars grow to a length of 1½ inches. They appear when full grown to have no hair at all, but in reality have the same kind of scattered small bristles which are present on emergence from the egg. They may be described then as follows:—The skin is black with a narrow median orange brown line down the back, and a nearly even white line down each side half way between the middle of the back and the spiracles. Irregular fine white lines ramify rather sparingly on either side of the straight white line, and every white line is interrupted (but not the orange line) in the segment between the legs and the prolegs, and less definitely on the last segment. Underneath the caterpillars are of a rich brown, and the head is of the same colour.

At maturity the caterpillar has a way when disturbed of raising the fore part of its body and of moving it by jerks.

The life cycle has been observed to occupy seventy five days, so that four broods occur easily within one year.

The moth, which was identified by Dr. R. Hanitsch, is figured in Moore's Lepidoptera of Ceylon, iii, plate 140, fig. 6, and described on page 21 of the text.

I. H. BURKILL.

THE BIG RUBBER TREE, SINGAPORE.

With the first number of the second volume of the "Agricultural Bulletin of the Straits and the Federated Malay States," 1903, a plate was published showing on the right, most of the oldest rubber trees of the Botanic Gardens, Singapore. Those which can be seen, counting from the extreme right, are numbers 1, 2, 3, 4, 5, 7, and 9 of the Gardens' trees: No. 6 and 8 stand a little back, and are not recognisable in the plate. The dimensions of the boles of these trees in the end of 1902, are given on page 1.

Death has spread down the line from No. 5, which was blown over and died in 1905. Between 1905 and 1909 No. 4 died. In 1910 No. 3 died. And now the largest of all, No. 2 is dead. *Fomes semitostus* seems to have been the cause of the trouble; but none of its fructifications have appeared.

The trees were received as seedlings in Singapore in the year 1877, and were planted out in their present place soon after their arrival. They began to seed in 1881. It seems (Bulletin, ix, 1910, page 213) that some of the trees were tapped as early as 1889. It is recorded (Bulletin, ii, 1903, page 112) that between 1893 and 1902, they were very heavily tapped on various occasions; but it is probable that we should not now call the tapping which they had heavy. Tree No. 2, was tapped again as follows:—

18 times between March 26th and May 2nd, and, May 20th and June 6th, 1903.

17 times between January 23rd and February 28th, 1905, by herring bones as a member of a group of trees called "Experiment VII."

73 times between January 22nd and June 1st, 1906, by spirals, yielding 14 lbs. 7½ ozs. of dry rubber and 1 lb. 8 ozs. of scrap.

24 times between November 2nd and November 28th, 1906, by spirals; but the weight of the rubber is not recorded.

26 times between January 7th and February 6th, 1909, by spirals, yielding more or less 8 lbs. 7 ozs. of dry rubber.

54 times between September 6th and October 4th, and, between November 11th and December 6th, 1909, by spirals, yielding 14 lbs. 3½ ozs. of dry rubber.

37 times between January 2nd and February 12th, 1913, by spirals, yielding 11 lbs. of dry rubber.

29 times between December 18th, 1913 and January 30th, 1914, by spirals, yielding 7 lbs. of dry rubber in sheets, 1 lb. of clot and 2 lbs. of scrap.

The tree, however, has never been tested as a rubber yielder, being wanted for seed-producing, and always since 1903 tapped lightly.

Its latex seemed to clot more readily in later years than in the earlier.

It is extremely probable that it was tapped between 1906 and 1909, but records have not been found.

A plate in the Agricultural Bulletin, Vol. vii. 1908, issued with the July number, shows the first spiral tapping of the tree and the old herring bone scars. Another illustration of it from a photograph taken a little later by Mr. H. Overbeck, occurs in Mr. E. Mathieu's "Para Rubber Cultivation," 1909, page 125.

Successive measurements of the bole of the tree at three feet from the ground have been recorded as follows:—

1904, 6th May	... ...	9	feet	1½ inches.
1905, 8th May	... ...	9	„	3¾ „
1906, 8th May	... ...	9	„	5¾ „
1909, 5th May	...	10	„	½ inch.
1910, presumedly in May	...	10	„	1½ inches.
1911, 4th July	... ...	10	„	3 „
1913, 7th May	... ...	10	„	5¼ „
1914, 8th May at removal after death	...	10	„	5 „

These figures indicate that its increase of growth during the last five years has been at the rate of one inch in circumference per annum, and that for the five preceeding years it was at the rate of about two inches per annum.

When uprooted it was found to be 105 feet in height, which is not unusual; but as regards its girth we must count it an abnormality.

I. H. B.

SEVENTEEN YEARS OF TAPPING IN THE WATERFALL GARDENS, PENANG.

In the Waterfall Gardens, Penang, there is a Para Rubber tree, now 28 years old which has been tapped yearly since 1896, a record being kept of its individual yield. A history of it is given on page 385 of volume I, 1901-02, of the Agricultural Bulletin of the Straits and Federated Malay States, together with a plate. As the

experiment is now being discontinued, to record the results is desirable. The weight of dry rubber each year has been as follows :—

	lbs.	*oz.*
1896	Not recorded.	
1897	1	0
1898	3	0
1899	5	12
1900	3	12
1901	2	2⅜
1902	2	13¼
1903	3	6
1904	3	14
1905	4	12¼
1906	4	4½
1907	2	0
1908	3	8
1909	8	4
1910	10	0
1911	13	0
1912	13	8
1913	13	0
Total ...	98	0⅜

MOHAMED HANIFF.

SELECTION OF RUBBER SEED.

The following is from the Bulletin de l'Association des Planteurs de Caoutchouc, v, 1913, page 305.

"Mr. W. T. Ruys, manager of the Plantation of the Company Rotterdam Tapanoelie, has made a very interesting experiment in selecting seeds of *Hevea*, the result of which the Company has been so good as to communicate to us. Mr. Ruys took 96 seeds in order to ascertain the influence of size on their germinative power and growth, and divided them into four groups, each of 24 seeds, by their size, which were weighed collectively. The seeds were sown on January 22nd, and the seedlings measured on the 11th of June, following, with these results :—

No. of Seeds.	Weight of same in grammes.	No. which germinated.	Stems produced collectively measured in cm.	Average length in cm.	No. of plants of different heights.								
					90 cm.	80 cm.	70 cm.	60 cm.	50 cm.	40 cm.	30 cm.	20 cm.	Less than 20 cm.
24	141.5	20	1271	65.5	1	1	5	4	5	4	–	–	–
24	116.5	18	997	55.5	–	–	4	4	4	4	1	1	–
24	86.5	13	545	42.0	–	–	1	2	1	2	5	1	1
24	42.5	4	96	24.0	–	–	–	–	–	1	–	2	1

The conclusion is that large seeds furnish by far the best results, both as regards germination and as regards growth of the seedlings. One should therefore, before planting seeds, go over them and selecting from them, count as inferior and throw out all which weigh less than five grammes."

THE POSITIONS OF THE AGRICULTURAL INDUSTRIES IN THE STRAITS SETTLEMENTS IN 1913.

In arranging the following statements, the first place is given to the territory of Malacca, because in it Para Rubber—the premier crop of the Malay Peninsula—is more developed than elsewhere.

Territory of Malacca.

If we compare the rubber produced and exported from Malacca with that produced and exported from the whole peninsula, we get the following figures :—

Date.	*Export of the Peninsula.*	*Crop of Malacca.*	*Percentage of the whole which the crop of Malacca makes.*
1911	23,615,417 lbs.	2,180,788 lbs.	9.23
1912	43,102,314 ,,	5,527,040 ,,	12.82
1913	77,836,945 ,,	9,342,997 ,,	12.00

Having interest to this considerable extent, the Malacca planters during 1913 made themselves leaders in dealing with the important question of wages, and with marked success. Such interest and such success fully justify in themselves the arrangement of material adopted here.

It was in 1898 that Mr. Tan Chay Yan planted 40 acres with Para rubber, mixed with *Ficus elastica*, on Bukit Lintang, near Malacca town, and then formed a Chinese syndicate to plant up more Para rubber (mixed with tapioca) on Bukit Asahan towards the north east corner of Malacca territory, becoming the first outside Negri Sembilan and the second in the whole peninsula to take up an industry which the Government had been putting forward as a possibility for some years. The Government of the Straits Settlements had at that time trees at Singapore, Penang, and near Malacca; the Government of Perak had trees at Kuala Kangsar and near Teluk Anson; and Mr. T. Hislop Hills—the first planter—had trees on his estate at Sungei Ujong. Other trees had been distributed and planted in District Officers' gardens but their history has yet to be collected.

From 1897 the extension of the planting in Malacca was as follows:—

1897	about 3 acres, all Government trees.	
1898	23 „ ,	twenty (or half of forty) belonging to Mr. Tan Chay Yan.
1899	233 „ ,	thirty-two belonging to Government.
1900	788 „	
1901	?	area returned together with that of gambier, etc.
1902	?	
1903	?	
1904	5,515 acres, including some *Ficus elastica.*	
1905	12,866 „	
1906	34,199 „	
1907	47,870 „	
1908	61,781 „	
1909	? „	
1910	72,530 „	
1911	80,424 „	
1912	95,440 „	
1913	117,200 „	

Of these 117,200 acres, 65,818 are in the hands of 40 considerable companies, and the rest, amounting to 51,382 is in private hands, being very largely in quite small blocks.

In computing these figures of acreage, catch crops have been taken into consideration; thus, an area planted with tapioca under rubber or an area planted with gambier under rubber, is credited between the two crops in the making up of the total, but as the catch crop is cut out, the whole is credited to the permanent crop, i.e., rubber. Therefore an increase of area may be due to two causes, either to actual planting of rubber trees or to the removal of a catch crop under them, and the great extension of the area under rubber in 1913 is due mainly to this removal of catch crops and not to new plantings, which account for but a tithe. On the figures, 6.7 per cent. of the whole present area is the increase of 1911, and 12.8 per cent. the increase of 1912, but 18.6 per cent. is the increase of 1913. Malacca's stake in the industry is represented by the figures; but what the stake really is, may perhaps be better put in the following table.

Area of the Territory of Malacca—461,120 acres.—

Year.	*Percentage uncultivated.*	*Percentage in rubber.*	*Percentage in other crops.*
1904	67.47	1.20	31.33
1905	66 86	2.79	30.35
1906	65.47	7.42	27.11
1907	64.27	10.38	24.35
1908	64 00	13 39	22.61
1909	62.50	14.00 ?	25.50
1910	54.12	15.73	30.15
1911	47.81	17.44	34.75
1912	47.81	2 .70	31.49
1913	43.32	25.42	29.26

They are satisfactory figures in that they leave the conclusion patent that rubber has led to an extension of cultivation instead of making room for itself at the cost of other crops.

It is of considerable importance that the extent of the private holdings in rubber in Malacca, should be borne in mind, because of the part that they might play in any outbreak of a serious disease. There were in Ceylon among the coffee estates similar small holdings with coffee on them, when the coffee-leaf disease broke out, and that they played an important part in causing planters to give up coffee is known; they harboured the disease that the planter was fighting and were an ever-present source of re-infection along his borders. So might these small holdings in rubber serve for mischief, if an epidemic of like nature were to break out in Malacca. Some kind of watchfulness over their state is desirable; and the intelligence necessary for it exists upon the company's estates, but it is uncertain how far, those who might arrange for keeping an eye on the little holdings are alive to the need; reference seems rarely if ever to be made to it from the chair at Company meetings.

So many of the Rubber-planting companies began by the acquisition of holdings, often small, planted with rubber, that a stimulus was given to planting with a view to sale: doubtless a not inconsiderable part of the ground so planted has come under the control of men with a permanent interest in the crop; but there is a little land which will not fall into some planting scheme and bears trees which the owner is not interested in tapping, such as would be more useful and less dangerous to the state if the trees were replaced by something else. The alternative of tapping or eradicating after a certain number of years, perhaps in some cases, might profitably be imposed.

It is certain that the protection belts devised several years ago have not been retained.

The planting companies in Malacca now possess about 105,000 acres, of which 37 per cent. is not yet planted. Some of the companies admit that they have too much land; thus, two are considering the getting rid of a not inconsiderable amount, and the Nyalas Company during 1913 surrendered 5,700 acres; two other companies on the plea that the blocks were detached, and inconvenient therefore, have surrendered 645 acres, and another company has surrendered 263 acres of genuinely sterile hill side. On the other hand four dollar companies which are paying dividends have judged it to their interest to acquire more land to the extent of about 815 acres; and as even with these additions these four companies make but small charges their further expansion would seem likely to be profitable.

The land surrendered or which it is desired to sell, happens to be considerably more than the land acquired by other companies; but it is in no case in rubber, whereas some of the land acquired is.

Taking the available figures of area held at the end of the year, giving attention to the Financial strength of the companies, and assuming an intention to plant if conditions permit, the following approximation has been worked out:—

Land in the hands of the 40 Companies.

Already in rubber	... ...	63 per cent.
Likely to be planted	... ...	31 „ „
Perhaps may be neglected	... ...	6 „ „
		100

If the companies achieve this,—their further planting of 31 per cent. of their holdings—and private planting ceases 32.3 per cent. of the land in the Territory of Malacca will come under rubber; and if private planting should proceed pari pasu (which is unlikely) 39.6 per cent.

The present general abstention from further rubber-planting, which is evident in Malacca as elsewhere, is a taking stock of all that appertains to the position. But it is clear that for the present the production of Plantation Rubber most undoubtedly gives a very good return for money invested in it. The Malacca plantations are well developed; the yield in Malacca seems to be quite satisfactory, and the Malacca estates are generally free from insect pests and fungus diseases. The cases in which they have not attained their estimate are uncommon.

As the Mycologist of the department of Agriculture, F.M.S., has recently said "Plantation rubber is one of the healthiest crops in existence"; it has to be kept so.

The yield per acre is at present something which, between the expert and the manager, can be calculated with considerable accuracy; but we do not know how the drawing off of so much latex is affecting the yield of the future. A tabulation of the forecasts of yield of twenty-seven Malacca companies, and the actuals realised during the estate-years ending in 1913 (estimated 6,974,250, realised 7,085,846), shews a discrepancy of but 1.6 per cent., thought some of the individual estates had a rather wide margin of difference, notably those whose tapping area was rapidly extending. Five of the estates had worked to within 1 per cent. of their estimate, and ten to within 5 per cent. These ten estates made 4,150,681 lbs. of rubber, or nearly half of the output of Malacca.

The yield on the best estates, as far as recorded, is about two pounds of dry rubber per tree per annum or about 300 lbs. per acre. But this average is worked out on trees which have many years to grow. We do not know yet their maximum yield any more than we know precisely the distance at which trees should be planted to attain this maximum, and the very best way of tapping.

We are suffering of course from disability, due to the circumstance that our crop has not yet been through even one generation under cultivation.

What the figures of yield show is this,—that, carrying out a certain programme of tapping on trees of a certain age planted at a certain number to the acre in the locality to which reference is made, it is possible to manufacture so much rubber and generally this is intended to be without apparent injury to the future. In the Company reports for 1913, or for 1912-13, readily available, the highest figure returned is at the rate of 337 lbs. per acre over 2,982 acres, including some of the oldest rubber in Malacca.

The steadying of prices is a great boon to the industry, though it indicates the approximation of production and demand. Although the long steady drop in prices through 1913 (on the London market from 4s. 8d. in January to 2s. 5½d. in December—highest prices for first quality), undoubtedly went below the natural limit which undisturbed supply and demand would have fixed, on account of strikes, floods and financial uncertainty in America (which country uses 60 per cent. of the world's output) and on account of political anxiety in Europe, where in addition all the markets received an extra quantity of the raw product in consequence of stagnation in America, the fall was certainly due to the increasing output; and the drop after the present recovery may be expected to be resumed. Recognising this all estates seem to have been making most serious efforts to ascertain every possible economy.

The one economy of which most has been heard is that of the reduction of wages. It cannot be denied that wages were excessive, especially when in 1910 "a boy of 12 could get 40 to 50 cts. per diem as a tapper and his work was over at 10-30 or 11 a.m." Meeting on August 10th, 1913, the Malacca planters decided to reduce wages from the 1st of October to 60 cents per diem for a Chinese coolie or 40 cents for a Tamil, Malay or Javanese coolie; the task for a tapper to be 400 trees, or for weeding an eight-hours day. With very little friction this change was brought about; and the labour force in the country was demonstrated obviously sufficient for the country's needs. It was estimated that the reduction in wages would save twopence on each pound of rubber.

Local selling, both in Singapore and Penang, is increasing, as it results in a considerable saving in certain cases, especially when direct shipment to the country of consumption follows. Freight to, and wharf charges in, London have been reduced also.

On the estates there is the natural economy due to the maturing of the trees under which they yield more to the same amount of labour, and further there are economies in cultivation thus: in Malacca there are clean-weeded estates and estates on which a thin

growth of certain grasses is encouraged; under either system the estates seem to have attained generally the object aimed at, and the maintenance in that state is less costly than the attainment. Disc-harrows are in more extended use having, since 1911, proved themselves useful; and steam ploughs are in use on the Devon Estate.

There is probably no estate in Malacca which has not brought down its expenses considerably; and the company reports mention reductions in cost of varying amounts.

The average London prices for first quality Plantation and the amount imported, are given by Messrs. Lewis and Peat thus:—

Year.	*Average price.*	*Amount.*
1911	5s. 6d.	9,500 tons = 21,280,000 lbs.
1912	4s. 10½d.	18,000 „ = 40,320,000 „
1913	3s. 1d.	22,400 „ = 50,176,000 „

Fine hard Para did not fall proportionately, but from 4s. 7½d. to 3s. 2½d., because it is better than Plantation for certain purposes, is controlled by few strong hands able to hold up supplies, and has not the promise of such enormous expansion as has Plantation. That it should have been sold per lb. below Plantation once when the price was high, is because its 18 per cent. of dirt at a high figure becomes so very expensive; but allowing for its impurities, rubber for rubber it has never been cheaper than Plantation. Malaya must make its best product as good as Fine Hard Para for all purposes.

It is admitted on the London market that the quality of the produce of Malaya has improved. Some of this improvement may be ascribed to the increasing age of the trees, but most of it is to the credit of the planter. Earnest endeavours must be made to make Plantation to sell equally with Para; but for the present Plantation more by its volume than its value, competes with Para.

Although low class rubbers have been less abundant on the market lately than formerly, the part which raw plantation has played in driving these out is quite uncertain, for much of their decrease may be due to reclaimed rubber as the industry in reclaiming is assuming enormous dimensions, curiously without any satisfactory figures in regard to it being available, and the product takes a place in direct competition with low class rubbers: and it is to be borne in mind by those interested in producing Plantation, that such improvements may be invented in reclaiming processes as to bring reclaimed rubber to a grade, where its volume will affect the price of the raw product.

The second crop of Malacca formerly was tapioca; it has been the mother crop of very much of the rubber from the time when Mr. Tan Chay Yan and his syndicate planted the Bukit Asahan Estate;

but, with the cutting out of catch crops, the area under it has fallen to the fourth place. Both the acreage and export figures show this fall.

Year.	*Acres.*	*Average price of flake tapioca as declared on export from Malacca.*
1902	67,546	$5.59 per pikul (133.3 lbs.)
1903	71,958	5.03 ,,
1904	68,762	4.80 ,,
1905	65,968	6.34 ,,
1306	67,399	8.91 :,
1907	16,753	9.22 ,,
1908	39,072	6.13 ,,
1909	—	5.92 ,,
1910*	18,135	6.35 ,,
1911	10,926	8.83 ,,
1912	16,643	8.89 ,,
1913	7,353	5.98 ,,

Excess of exports over imports of Malacca in pikuls (133.3 lbs.)

Year.	*Flake.*	*Pearl.*	*Flour.*	*Total excess.*
1909	66,727	64,567	6,830	138,124
1910	85,793	52,398	(import of 4,717)	137,474
1911	38,820	31,889	1,555	72,264
1912	28,157	31,873	1,690	61,420
1913	27,992	28,329	(import of 88)	56,233

The decrease of the crop has come at a time when prices have fallen very considerably; and it is a matter for congratulation that the Malacca estates in recent years have not only reaped the advantage of a return from the catch crop, but they reaped it when the return was good.

Along with the decrease in the growing of tapioca has come an enormous and most striking decrease in pig-raising. The following are the figures for the excess of the exports from Malacca territory of pigs over and above the imports.

Excess Exports over Imports.

1909	...	...	21,564 animals
1910	...	...	13,925 ,,
1911	...	...	7,640 ,,
1912	...	...	2,977 ,,
1913	...	...	106 ,,

The pigs used to go to feed the tin-mining towns chiefly, and also the adjacent parts of the Federated Malay States. They were raised by squatters who were allowed to establish themselves chiefly in the coconut plantations, and there, to fatten their swine with the 'ampas' or

*In this year under the Crown Lands Ordinance, 1886, the alienation of Crown Land for tapioca was stopped; but the use of tapioca as a catch crop for more permanent crops was not prevented.

refuse of the tapioca industry. Malacca used to have 'ampas' to spare, but now there is a small import of it, which is paid for through the higher price which pigs fetch in the local market. The rise in the price of pork in Malacca town has been about 43 per cent.

The following table gives the excess value of 'ampas' of either exports over imports or imports over exports, for the last five years.

Tapioca Refuse by Value.

Year.	*Excess Exports over Imports.*			*Excess Imports over Exports.*
1909	$12,269	...	...	—
1910	8,935	...	...	—
1911	4,958	...	...	—
1912	4,950	...	...	—
1913	...	...	...	$187

Gambier has not shown the same tendency to go down in area as has tapioca; on the contrary though many companies have been using it as a catch crop, and are talking about removing it, its area has been relatively steady. The excess exports over imports for the last five years have been as follows:—

1909	...	...	23,106	pikuls (133.3 lbs.)
1910	...	...	23.365	,,
1911	...	...	20,227	,,
1912	...	...	20,983	,,
1913	...	...	20,060	,,

It is stated that expert labour for the boiling it is now difficult to obtain, and that fuel for the purpose is not so conveniently handy as it was; moreover the price is falling. The price of gambier declared in Malacca for export has been on the average

1909	...	...	$12.33	per pikul (133.3 lbs.)
1910	...	...	12.78	,,
1911	...	...	13.93	,,
1912	...	...	13.53	,,
1913	...	...	10.29	,,

Coconuts have extended very little. They are so much grown mixed with fruit trees, that no separate return is possible; and the following figures are of the area under them, fruit-trees, pine-apples and other garden crops:—

1902	...	...	36,588	acres.
1903	...	...	37,397	,,
1904	...	..	40,256	,,
1905	...	...	40,767	,,
1906	...	..	42,861	,,
1907	...	...	44,766	,,
1908	...	...	45,747	,,
1909	...	...	46,439	,,
1910	...	...	45,584	,,
1911	...	...	47,355	,,
1912	...	...	47,650	,,
1913	...	...	46,348	,,

The Malays, who own most of the trees give them no cultivation, and so little interest that they generally require compulsion for the removing a diseased tree. It was reported, ten years ago that the appointment of an Inspector of Coconuts had brought about an improvement in the state of the holdings, but the position is still unsatisfactory.

Of crops from permanent planting, coconuts are rather unreliable— responding much to reasons, as the following figures of excess exports over imports of copra show :—

1909	...	...	...	39,542 pikuls.
1910	...	...	...	56,222 ,,
1911	...	...	...	51,932 ,,
1912	...	...	...	38.834 ,,
1913	...	...	...	37,022 ,,

The manufacture of Kabong sugar from the palm *Arenga saccharifera* is decreasing considerably ; and the trees, which are little cared for, although they give the black rope of the country as well as sugar, are much neglected, and often may be seen to stand dead in the Malay holdings along with coconut palms, long after their trunks should have been removed.

The excess exports over imports have been :—

1909	...	...	...	3,722 pikuls.
1910	...	...	...	1,912 ,,
1911	...	...	...	2,282 ,,
1912	...	...	...	1,934 ,,
1913	...	...	...	1,172 ,,

Sago is made but irregularly in Malacca; and though the raw product has been produced in sufficient quantities for export during the last three years, the manufactured product has been insufficient, as the following figures show :—

	Flour.		*Raw Sago.*	
Year.	*Excess of Exports over Imports.*	*Excess of Imports over Exports*	*Excess of Exports over Imports.*	*Excess of Imports over Exports.*
1909	1,442 pikuls.	—	No trade.	No trade.
1910	269 ,,	—	No trade.	No trade.
1911	387 ,,	—	920 pikuls.	—
1912	—	409 pikuls.	4,870 ,,	—
1913	—	480 ,,	680 ,,	—

The area under areca-nuts or betel-nuts has hardly changed; and the output has been fairly steady, except that 1911 was a rather bad year. That year proved a very good one for coconuts and for fruit trees in Jasin was a record year: it is therefore noteworthy that areca-nuts should not have been plentiful in it.

Excess exports of areca-nuts over imports:—

1909	...	...	...	10,282 pikuls.
1910	...	...	...	12,579 „
1911	..	...	...	9,176 „
1912	...	...	...	12,210 „
1913	...	...	...	11,085 „

Ginger, like betel-nuts, was in 1911 less, in the amount exported.

Excess exports over imports of ginger:—

1909	...	...	...	3,907 pikuls.
1910	...	...	...	1,771 „
1911	...	...	...	1,119 „
1912	...	...	...	2,069 „
1913	...	...	...	1,266 „

The export of Pepper has decreased much.

Year.	*Excess Exports over Imports.*	*Excess Imports over Exports.*
1909	159 pikuls.	—
1910	228 „	—
1911	68 „	—
1912	—	81 pikuls.
1913	20 „	—

Padi and coconuts happen fortunately to be the only crop plants which the locusts, *Pathytylus danicus*, have damaged as yet by eating, and this in Malacca only to a slight extent. The insects feed on the coconut leaves; but the padi, they nibble and damage, biting through the haulms but not devouring then; however, the result is as injurious. They were reported as doing damage in this way in the Alor Gajah District, in 1912, and they repeated it in 1913, locally. From other pests the padi has been relatively free. But the crop has suffered from the effect of the removal of forest about the sources of the streams, wherefrom these come in spate after heavy rain and then run low until the next storm. The result has been that the fields near to the central water course of each valley have been flooded out, and are now often in rough sedges. As a remedy it is intended to spend larger sums than usual in removing obstructions from the channels, so that the water may run off freely; but it is doubtful if anything short of tank-irrigation will make the crop what it might be. The extent of the crop has been narrowed, because of the Malay labour drawn off into the rubber estates, but the new reduction of wages operates against a continuance of this. In order to protect those who do plant against the ravages of vermin finding a harbourage on the fallows, pressure is being put on the owners of the holdings, under the Malacca Lands Ordinance, 1886, to make them to cultivate and to make them to keep clean the borders of their holdings. The effect of the pressure was not evident in the returns of area for 1913.

Year.	*Area under Rice.*	*Value of Padi as declared on export.*
1902	32,185 acres	—
1903	36,074 ,, ...	—
1904	37,369 ,, ...	—
1905	37,229 ,, ...	—
1906	38,201 ,, ...	$2.44 per pikul.
1907	39,067 ,, ...	2.57 ,,
1908	39,497 ,, ...	2.66 ,,
1909	41,198 ,, ...	2.29 ,,
1910	39,997 ,, ...	2.29 ,,
1911	40,410 ,, ...	2.53 ,,
1912	40,260 ,, ...	3.53 ,,
1913	39,040 ,, ...	3.23 ,,

The price of padi has been better than it used to be; and the demand vastly increased, so that export has ceased to be greater than import. This is shown in the following table :—

	Padi.		*Rice.*	
Year.	*Excess of Exports over Imports in pikuls.*	*Excess of Imports over Exports in pikuls.*	*Excess of Exports over Imports in pikuls.*	*Excess of Imports over Exports in pikuls.*
1906	20,617	—	—	251,612
1907	32,473	—	—	250,587
1908	23,309	—	—	279,283
1909	17,492	—	—	261,017
1910	10,606	—	—	316,460
1911	4,193	—	—	382,844
1912	—	8,364	—	462,875
1913	—	3,831	—	436,362

In the opinion of the writer, there is not a crop in Malacca offering more interest at present, than that of rice, nor a crop so deserving of whatever help can be given to it. It appears that hollows in rubber estates, the clean weeding of which costs more than the weeding of rubber land should, would be of greater use to the state as store places for water for rice lands than cultivated and under Hevea. The Malays of Malacca have tried no new crops.

Singapore Island.

The planting of fresh land in rubber continues in Singapore island on a small scale, the area being returned at 34,960 acres.

1904	78	acres.
1905	1,110	,,
1906	1,460	,,
1907	4,190	,,
1908	4,745	,,
1909	7,600	,,
1910	20,000	,,
1911	29,150	,,
1912	34,000	,,
1913	34,960	,,

The Singapore estates are much more completely planted than the Malacca estates; but their planting commenced on the whole so much later that they are less in bearing: indeed their planting mostly dates back to 1909, although the oldest rubber trees in the island are now in their thirty-fifth year. The year 1913, saw the tapping area on several of the estates increased by about 25-35 per cent., which is an indication that they are rapidly coming into bearing. Just about half of the total acreage in the island under rubber belongs to ten estates; therefore in Singapore, as well as in Malacca, there is a very large area of rubber in private hands. Privately owned rubber trees in Singapore are often packed away among coconuts and fruit trees, according to an oriental method of averaging the risk, and these count far less in the long run than properly planted trees. However, all are generally free from pests and plant diseases.

The ten larger companies hold about 18,260 acres, of which 93 per cent. is planted up.

A cessation from rubber planting appears probable leaving 25 per cent. of the land in the island under it.

Some of the Singapore estates in 1913, had difficulties in realising their estimates, but reached or came very near to them ultimately, though not always without departing from their tapping programme.

There is a little neglected rubber in the island as there is in Malacca.

The catch crop—nurse crop of the estates—has of course, been Pineapples, and now has come the time for cutting them out. The result is a planting of pineapples on new land outside the estates, often with rubber; but the pineapples are more meant than the rubber.

The year 1913, gave the largest crop of this fruit on record—so large that the canneries could not handle the supply, and offered but fifty cents per hundred for the fruit delivered at their doors. At other times in the year the price was as high as six dollars per hundred, similarly delivered. At fifty cents per hundred it hardly pays to cut the fruit. Some of the factories have not had full success with their machinery.

The waste goes to feed pigs—mostly to fatten for killing pigs imported lean from Bangkok and the Dutch Indies.

Tapioca has little hold in Singapore and its largest area in the agricultural statistics of recent years is but 150 acres; it is grown as a vegetable and not for use in mills.

The last indigo in the island, which was grown as a catch crop on the Bukit Sembawang Estate, is being removed.

Coconut palms in Singapore, in 1913, gave a very good crop; but unfortunately they were locally attacked by pests in the later six months, notably by *Brachartona catoxantha* in the north-east of the island. The damage done by these insects will tell on the 1914 crop, and the

Trafalgar Estate estimates a diminution in yield of about 12 per cent., as the consequence of the outbreak on their trees. The outbreak is described above on page 207.

In the centre of the island, and in a less degree towards the south-west, the Palm-weevil was more abundant than it should have been, as the result of the cutting out of coconut palms for rubber. The attack began in both places, in Chinese holdings, and upon the removal of young trees, whose trunks were not destroyed promptly.

The cultivation of coconuts is extending slightly.

In consequence of the extensive consumption of coconut oil in Singapore, the trade statistics do not yield figures showing in any simple way the position of the coconut industry. They show in the first place a diminution in the export of oil with a slight recovery in 1913, thus:—

Year.	*Imports.*	*Exports.*	*Excess of Exports over Imports.*
1906	41,191	168,498	127,307
1907	40,162	159,801	119,638
1908	32,138	149,078	116,940
1909	30,158	135,578	105,420
1910	23,987	99,211	75,224
1911	25,604	98,860	73,256
1912	25,649	81,499	55,850
1913	17,075	85,480	68,405

The price that has drawn the export has nevertheless been increasing since 1908.

Year.	*Price per pikul of the oil as declared on exporting.*
1906	14.89 per pikul.
1907	17.38 ,,
1908	13.49 ,,
1909	14.98 ,,
1910	17.81 ,,
1911	18.50 ,,
1912	19.49 ,,
1913	21.82 ,,

Of copra there is a greater import than export, the figures for the same period being:—

Year.	*Imports.*	*Exports.*
1906	635,385	427,506
1907	927,652	654,869
1908	1,171,039	968,658
1909	1,095,312	918,948
1910	1,335,477	1,319,644
1911	1,246,286	1,161,102
1912	1,122,587	991,448
1913	1,374,201	1,154,122

Assuming that 100 pikuls of copra yield 62 pikuls of oil, and calculating the excess exports of all as copra, we get the following figures :—

Year.	*Excess Imports of Copra.*	*less.*	*Excess Exports of Oil calculated as Copra.*	*leave.*	*Excess Imports calculated as Copra.*	*Excess Exports calculated as Copra.*
1906	207,879		205,334		2,545	—
1907	272,783		192,966		79,807	—
1908	202,381		188,613		13,768	—
1909	176,364		170,032		6,332	—
1910	15,833		121,329		—	105,496
1911	85,184		118,155		—	32,971
1912	131,139		90,981		41,058	—
1913	120,079		110,331		9,748	—

The figures indicate that only in exceptional years does Singapore island produce for export coconut products; but the variation towards either side is extraordinary. The average imports over the 8 years have been 1,113,492 pikuls of copra and of the 6 years, omitting 1910 and 1911, 1,054,362 pikuls; but in 1910—the most fruitful year—there were imported 220,000 pikuls above this—a circumstance to be attributed to the splendid crops, not only of Malacca (which have been mentioned on page 221 above) but of the whole of the east of the Peninsula and of many of the not-remote Dutch Indies. The equivalent of this 220,000 pikuls was re-exported either as copra or as oil, the excess of imports averaging 25,543 pikuls of copra disappeared, and an export equal to 105,496 pikuls occurred. In 1913, the registered imports were higher still; but the tremendous excess export of copra (as copra or as oil) has not been attained.

The average prices of copra declared for export from Singapore have been :—

1906	$8.47	per pikul of 133.3 lbs.
1907	9.79	,, ,,
1908	7.12	,, ,,
1909	8.31	,, ,,
1910	10.30	,, ,,
1911	10.02	,, ,,
1912	10.69	,, ,,
1913	12.73	,, ,,

The areca-nuts in Singapore yielded in 1913 better than in 1912, as the coconuts did, so that there has been an increase of exports; but on the whole they receive little attention. The figures for the last five years are :—

Year.	*Excess of Exports over Imports.*	*Average Price.*
1909	81,612 pikuls	$4.54
1910	136,492 ,,	5.45
1911	86,117 ,,	5.49
1912	18,803 ,,	5.58
1913	23,038 ,,	7.15

Gambier is disappearing from the island. Under Malacca the diminution of its price has been given; and from that cause arises its decrease in Singapore island. Pepper cultivation seems slightly to be increased. Sugar-cane cultivation, for eating only, is unchanged. Rice has not existed in the island for a very long time. The few nutmegs in the island produce a little fruit. A small experimental area has been planted with Cacao.

Durians yielded very well in December, 1913, and so did Rambutans; but the crop of Mangosteens was not good.

The amount of fruit which Singapore imports is now very considerable. The Muar river enjoys a large share of this trade, Sarawak and Siam a not inconsiderable portion in special lines.

The demand for vegetables is so great that their prices are very high. In the island there is a slight increase of vegetable growing—katiang, ladies fingers, brinjals, etc., and a little planting of bananas.

The planting of " Pisang Batu " for leaf plates, leaf wrappers and a substitute for string is extending.

Sweet potatoes are the chief root crop of Singapore; and they are less extensively grown than might be expected. The big alocasia comes next in importance.

With the intention of attempting the introduction into Singapore of a new root-crop the lesser yam (*Dioscorea aculeata*, Lamk. or *D. fasciculata*, Roxb.) was brought in 1913, into the Economic garden: it is a tuber, which constitutes a large part of the food of the labourers in some parts of India, and is, moreover, when suitably cooked good eating: but thereafter it was found that a Chinese cultivator on Holland Road had already commenced the growing of it. It is curious that this plant has not hitherto found a lodgement here, yet has been for a very long time an important food plant in the Eastern Archipelago, and in India. Rumphius, who lived in the Dutch Indies from 1653 to 1702, and became Governor of Amboyna, said, that in his time it was being grown about Batavia by immigrants, who had come from the East; yet Ridley was able to write two centuries later, in 1908, that he had never seen the species nor could find evidence of its occurence in the Malay Peninsula.

Lemon oil grass is still in cultivation and distilling is done on a small scale; but the interest in it has diminished considerably. The Java citronella oil, along with which the Singapore product should sell, is absorbed very readily on the market in Europe, though at a narrow margin of profit.

Penang and Province Wellesley.

The agriculture of Penang shows little change. Nutmeg and Clove cultivation is decreasing; the output of the year has been small.

The coconut and areca nut crops were fairly good. Mangosteens were produced freely, but not in the same plenty as in 1912, when the yield was remarkable. Their lowest price was 3.50 per hundred. An impression gained in Penang is that from planting a few years back, an increase in the production of this fruit will soon follow. Durians fruited normally in 1913. The cultivation of plantains is not increasing. The local vegetable crop seems inadequate, but there is no sign of extension within the island.

The rice crop of 1912-13 was not good; but that of 1913-14 is very good.

The last of the sugar-cane, grown for the manufacture of sugar, has disappeared from Province Wellesley; its place having been taken by rubber. Towards the end an experiment was made on the Central Factory plan, small areas of land being allotted to cultivators who were to cut the crop as required; but it failed, the cane been ill-grown. This is of great interest as illustrating the difficulty, that there would be, in establishing such an institution as a Central Factory in the Province—a difficulty illustrated also by the fact that small holders of the same class often turn out raw tapioca, which is hardly marketable; but such men seem to be more fortunate when they turn their attention to raising crops which require the gardener's skill only; and a considerable number of them, chiefly in the Central and Southern divisions, are raising pineapples, gourds, beans, brinjals, etc., as catch corps among very young rubber or coconuts. These men appear not to be tyring anything new; but in the northern division, in 1913, a small acreage was planted up by Malays with the lesser yam; (see page 227 above) and so great was the profit that it appears as if the culture will become established.

One most interesting new cultivation in the Province, is that of Arrowhead—*Sagittaria saggitifolia*—grown on an extending area of rice-land near Bukit Mertajam, by Chinamen for feeding pigs, and apparently profitable. About three crops are grown in the year.

The fruit trees in the Province in a very large measure want renewing; they are trees which were planted|round the country houses of well-to-do Chinese, from whose hands in some cases they have become company-property. But they are now of little value.

There is a trade from Penang to Calcutta of small dimensions in fruit, chiefly in mangosteens and the best plantains, which might be fostered and become something; pineapples, which squatters are growing in the Province, might be exported also.

Rubber in the Province and Penang is credited with the following increasing acreage :—

	Province Wellesley.	*Penang.*
1905	Nil	Nil
1906	4.009	Nil
1907	4,833	50
1908	7,894	550
1909	14,166	1,450
1910	15,501	2,648
1911	24,725	4,094
1912	30,530	5,800
1213	34,766	6,310

The estates of the island and in the Province together cover almost the same area as those of Singapore island, and are almost of the same age. A little later, comparisons will be interesting. But whereas we found a very large amount of privately owned rubber in Singapore, we find very little in Province Wellesley where 70 per cent. of the total area in rubber make parts of 18 estates there.

Only one of these estates is without coconuts: and some are extending by planting the one crop, and some by planting the other, in such a way that rubber has only a small preference over coconuts.

In reserve the estates hold 41 per cent. of their area. If we allow to rubber and to coconuts an equal extension out of this 41 per cent., that is 20 per cent. for each, not much more than 22 per cent. of the whole province seems likely to go into rubber.

The estates have been disappointed in the yield of Coconuts; one estate for instance with 33,000 trees almost all in bearing gave

in 1910-11	1,000,316 nuts.
in 1911-12	670,039 „
in 1912-13	713,658 „

when 900,000 were expected.

The differences are the effect of the seasons, and it is to be feared of conditions, probably chiefly connected with the soil water which we cannot easily control. These conditions make it very hard to estimate accurately the crop in advance; and unfortunately the good year of 1910, to which many of the current estimates date caused expectations to be inflated.

Estates beyond the borders of Province Wellesley have made the same complaint, that the years which followed 1910, disappointed them.

Estates built up out of old Chinese holdings are in some cases planted with different races of coconuts on no system.

Tapioca in the Province seemed at the beginning of 1913 to be extending as it had done in 1912, in spite of a falling price; but the price continued to fall and went so far as to make harvesting unprofitable. Such a large drop is rather calamitous, occurring within the growth of one crop, and the more so as the Province is not only not at the stage in its rubber plantations when catch crops can be generally dispensed with, but has a pig industry dependent largely on the tapioca refuse.

The following is the acreage returned under Tapioca :—

	Province Wellesley.	*Penang.*
1902	10,800	about 150
1903	11,145	about 80
1904	11,145	about 60
1905	12,035	about 60
1906	37,690	about 100
1907	39,165	— 130
1908	14,537	— 110
1909	14,101	— 120
1910	11,006	— 140
1911	9,700	— 170
1912	11,290	— 130
1913	7,785	— 180

The excess of exports over imports of tapioca from Penang have been :—

	Flake.	*Pearl.*	*Flake and Pearl together.*
1909	35,571 pikuls	236,765 pikuls	272,336 pikuls
1910	26,609 ,,	180,286 ,,	206,895 ,,
1911	10,891 ,,	248,755 ,,	259,646 ,,
1912	9,441 ,,	265,824 ,,	275,265 ,,
1913	8,645 ,,	309,841 ,,	318,486 ,,

The excess of exports over imports, or the reverse, of tapioca flour and refuse from Penang have been :—

	Flour.		*Refuse.*	
	Excess of Exports over Imports.	*Excess of Imports over Exports.*	*Excess of Exports over Imports.*	*Excess of Imports over Exports.*
1909	150,648 pikuls.	—	18,239 pikuls.	—
1910	44,948 ,,	—	8,339 ,,	—
1911	—	25,097 pikuls	7,212 ,,	—
1912	27,278 ,,	—	—	29,368 pikuls.
1913	4,332 ,,	—	1,027 ,,	—

So that latterly Penang and the Province Wellesley have used up most, if not all, of the refuse available from the tapioca manufacture.—Moreover the flour, the import of which has never been below 30,000 pikuls per annum, has been the more and more worked up into products for human consumption, thereby liberating more and more refuse for local use.

The pigs which are fattened on this refuse are chiefly exported to Ipoh and other centres of industry, by rail. The excess export over import of them has been :—

1909	...	...	... 2,527	animals
1910	...	...	... 5,768	,,
1911	...	...	... 10,802	,,
1912	...	...	... 17,423	,,
1913	...	...	... 16,849	,,

That the growth of this trade has marched with the diminution of the excess export of tapioca flour and refuse is evident ; and it is almost certain that the cessation of the abundant supply of tapioca refuse, which in Malacca caused to cease the export trade in pigs, will choke the trade of Penang also, where the price of pork has been rising, as it did in Malacca. Therefore it is earnestly to be hoped that the price of tapioca will rise enough to make its harvesting remunerative, for all three reasons, viz: (1) for the sake of a profit to the grower, (2) for the sake of a business to the manufacturer, and (3) for the sake of a cheap pig food from the refuse. The manufacture of material for industrial alcohol might make the tapioca to pay, where otherwise it does not.

The fall in price of tapioca may be thus illustrated from the Singapore market. The figures are of the price given in the first week of each month as they appeared in the "Straits Times," of December 31st, 1913.

1912.				1913.			
January	9.20	July	9.25	January	7.60	July	5.95
February	8.90	August	9.15	February	7.30	August	5.35
March	9.10	September	9.00	March	7.15	September	5.20
April	9.50	October	8.75	April	6.50	October	5.01
May	9.10	November	7.50	May	6.30	November	4.70
June	9.30	December	7.70	June	6.25	December	4.40

Sago refuse goes to fatten pigs along with the tapioca refuse; and the same absorption of what is available has been going on. The former considerable export of flour has been steadily reduced, as the second column of the following table shows :—

	Imports of Sago Flour.	*Export of Sago Flour.*	*Excess of Exports over Imports.*
1906	30	10,896	10,866
1910	1,672	5,799	4,127
1911	5,816	5,440	(Excess Imports of 376 pikuls).
1912	187	4,568	4,381
1913	83	2,057	1,974

The excess exports over imports of pearl sago over these years have been:—

1909	...	...	...	96,822	pikuls.
1910	...	...	...	69,707	,,
1911	...	...	...	79,487	,,
1912	...	...	...	93,273	,,
1913	...	...	...	91,124	,,

The excess import of sago flour occurred in the same year as the excess import of tapioca flour, i.e., 1911: it came through Singapore, apparently, as also did the major part of the excess import of tapioca flour, the local area under tapioca having been restricted somewhat. With the expansion again in 1912, of the local area, this excess import was replaced by an excess export.

The Penang poultry trade shows a slightly larger export but a greatly increased import. This import is largely from Kedah, the birds being exported to Port Swettenham, etc. The price of poultry is also rising.

Trade in Poultry Counted by Dozens.

	Imports.	*Exports.*	*Excess of Exports.*
1909	39,559	59,864	20,305
1910	40,318	66,477	26,159
1911	29,090	71,622	42,532
1212	35,646	67,881	32,235
1913	54,913	76,041	21,128

The area under coconuts is not separately returned, but the following figures of the area under fruit trees and gardens indicate both a wide extent and a slight increase in the Province accompanied by little change in the island.

			Province.	*Penang.*
1902	...	..	60,000	29,940
1903	...	...	60,186	29,946
1904	...	...	60,186	29,543
1905	...	...	61,295	29,751
1906	...	...	62,900	29,730
1907	...	...	64,101	29,430
1908	...	...	64,122	29,700
1909	...	...	63,743	29,226
1910	...	...	64,974	30,644
1911	...	...	65,692	29,703
1912	...	..	66,703	30,030
1913			69,218	30,630

Nineteen estates in Province Wellesley own 14,084 acres of coconuts, of which only just over one quarter is in bearing as yet.

Those apparently extraordinary fluctuations in the trade of Singapore, in coconut products, do not appear in the Penang trade statistics.

	Excess of Exports over Imports of Oil.	*The same calculated as Copra.*	*Excess Exports over Imports of Copra.*	*Excess Exports of Oil and Copra calculated as Copra.*
1909	27,385	44,169	95,280	139,449
1910	27,779	44,790	172,679	217,469
1911	26,433	42,634	126,780	169,414
1912	33,631	54,244	83,497	137,741
1913	29,826	48,106	92,636	140,742

The figures very well reflect the varying crop, which was excellent in 1910, and was again better in 1913 than in 1912. In addition to an export in oil and copra, Penang exports nuts in increasing quantities to Madras and other Indian ports.

Areca nuts which yielded so well in Malacca in 1910, when coconut palms did, behaved similary in Penang. Since then their excess export has fallen somewhat.

			Excess Exports over Imports.
1909	...	...	100,463 pikuls.
1910	...	...	114,854 ,,
1911	...	...	95,546 ,,
1912	...	...	97,688 ,,
1913	...	...	86,437 ,,

Although the area under nutmegs and cloves in the Province Wellesley is reported as unchanged, the last nutmeg trees on Bukit Mertajam are now dying; and there seems to be no llkelihood of fresh planting there. The plantations in the island of Penang have decreased considerably of late years, and the excess of exports over imports has narrowed, more than seasonal variation accounts for.

Area returned as under nutmegs and cloves :—

	Province Wellesley.	*Penang Island.*
1902	—	10,500 acres
1903	—	10,527 ,,
1904	—	10,270 ,,
1905	—	10,070 ,,
1906	—	9,866 ,,
1907	100 acres	9,410 ,,
1908	500 ,,	9,240 ,,
1909	664 ,,	8,930 ,,
1910	450 ,,	8,825 ,,
1911	550 ,,	6,750 ,,
1912	500 ,,	6,310 ,,
1913	500 ,,	6,000 ,,

	Import of Nutmegs into Penang.	*Export from Penang.*	*Excess Exports.*
1909	2,350 pikuls	5,154 pikuls	2,804 pikuls
1910	2,608 ,,	3,802 ,,	1,194 ,,
1911	2,988 ,,	5,064 ,,	2,076 ,,
1912	3,997 ,,	5,816 ,,	1,819 ,,
1913	3,643 ,,	4,409 ,,	766 ,,

Cloves, however, have latterly had fairly good years, so that trade has been :—

	Import of Cloves into Penang.		*Export from Penang.*		*Excess of Exports over Imports.*	
1909	944	pikuls	1,677	pikuls	733	pikuls.
1910	1,276	,,	1,419	,,	143	,,
1911	719	,,	2,323	,,	1,604	,,
1912	475	,,	3,981	,,	3,506	,,
1913	915	,,	2,305	,,	1,390	,,

Penang and the Province consume considerably more pepper than the little that they produce.

The area under rice has been returned as follows :—

	Wellesley.	*Penang.*
1902	48.500	7,700
1903	49.351	7,690
1904	49.351	7,660
1905	49,368	7,660
1906	48,478	7,650
1907	44,456	7,450
1908	45,808	7,530
1909	46,274	7,567
1910	46,138	7,120
1911	45,200	6,129
1912	44.950	6,320
1913	45,977	6,620

The crop of 1912-1913 was not good; but the crop of 1913-1914 proved excellent.

Dindings.

The rubber estates in the Dindings fall into two divisions: one is constituted by the Sandycroft Estate alone; the other consists of four smaller estates near the Lumut river. Sandycroft is celebrated for the large yields that some of its trees used to give, and its land within the Dindings is all planted up. The other estates are extending still. They have land to the extent of 6,079 acres, and have planted 55 per cent. of it.

One of these estates has been depending for development on the profit of tapioca as a catch crop; and that is failing it now. Tapping of young trees was started in 1912 on one estate, but stopped again when price of rubber fell.

Coconut-groves, land under fruit trees, and garden patches make up about 6,500 acres, nearly half of which is the young, and promising Dindings Coconut Company's Estate on the Bruas river. The seed nuts came from Penang.

The land round the District Officer's house has been used somewhat as an experimental ground to see how various plants grow; but the officers succeed one another at intervals too short for the purpose to be carried out to much effect. Cloves on this piece of land have grown satisfactorily.

Tamil labour is altogether prevalent in the Dindings, and the Tamils show some tendency to try crops of their own land; thus Sesamum, Ragi (*Eleusine Coracana*) and Chillies are to be seen in small patches near Lumut. This tendency seems to afford a possible opening for widening the very meagre list of crop plants of the peninsula.

Rice which was grown some years ago on the northern border, and which went out of cultivation, has been planted again to the extent of about one hundred acres.

CROTON SPARSIFLORUS, Morong,

an American Invader.

Close to the East Wharf in Singapore, near to the Lagoon Dock, and west of the Peninsula and Oriental Steamship Company's wharf, occurs in some quantity on waste ground an American plant by name *Croton sparsiflorus*, whose advent is of some interest. For several years it has been spreading in Bengal and Assam, from the coast inland, in a way which strikingly demonstrates its dependence on man, and also shows that without hooks or barbs on its seeds or stickiness or any other device for attaching them to objects, a plant with an abundant fertility, may get itself spread effectively through trade. Now that it has reached Singapore, and become established, we shall probably witness its steady spread from the new centre along trade routes in Malaya. Nothing eats it; its smell protects it from cattle; and apparently its natural enemies have been left behind in its migration. Fortunately it is not aggressive as a weed, but for the most part confines itself to waste places.

Its home is on the River Plate, and it was first described from Paraguay. Its appearance in the East was recorded in 1905, when Sir David Prain, in an account of the vegetation around Calcutta (Records of the Botanic Survey of India, vol. iii., page 276) stated that it was abundant in waste places to the south of the city, particularly about Diamond Harbour. From a paper published later by Professor P. J. Brühl, (Journal of the Asiatic Society of Bengal, new series, 1908, page 603) we learn that as early as 1901, one of these waste places was within six miles of the city (four miles from the docks), and that in 1903 or 1904, it advanced as far as the waste ground

between the Botanic Gardens and the Bengal-Nagpur Railway Company's goods sidings at Shalimar, whence there is a railway ferry service to the other side of the river Hughli, by which goods waggons are sent over to the docks.

At a later date than the first record, the plant was found to be abundant about Chittagong and to have been there at least since 1898, for Mr. D. Hooper, late Economic Botanist to the Botanic Survey of India, had preserved a specimen collected in October of that year; further Professor Brühl obtained information from one of his students that the plant had been seen ten years before 1907, on the railway line side between Chandpur and Akharara—two stations on the Assam-Bengal railway, which serves Chittagong. Examination of the line about Chandpur in 1908 showed that it had become abundant enough to indicate its establishment several years earlier.

After Calcutta, Chittagong is the second port at the head of the Bay of Bengal; Diamond Harbour and Chandpur are only river stations, where sea-going boats do not discharge cargo; Akharara is a little inland.

The abundance of the plant about Chittagong and Chandpur indicates the east side of the Bay of Bengal to be the one on which it obtained its first lodgement; and the way in which it was observed to approach Calcutta from Diamond Harbour forbids the belief that it was first established on the Hughli. Probably it found a home in the beginning at Chittagong; thence it reached Chandpur along the railway; from Chandpur it was brought to the Hughli by the Sundribans steamer traffic: and now it has reached Singapore, perhaps from Chittagong, but more probably from Calcutta.

Its further spread in India during the last few years has been recorded (Proceedings of the Asiatic Society of Bengal, 1910, page ci.; 1911, page cxxxii.; and 1912, page cxiii). It has appeared at intervals all along the Assam-Bengal Railway from Chittagong to one terminus at Gauhati and beyond the other terminus to Makum Junction, on the Dibru-Sadiya Railway, being always found at places where goods are unloaded: and it has reached Narayanganj near Dacca which is connected with Chandpur by a steamer service. It may be expected to travel along the railway from Narayanganj through Dacca to Jaganathganj slowly, because there is very little through traffic; it is sure soon to reach Goalundo and thereby the Eastern Bengal Railway system; from Calcutta it is likely to travel first towards Nagpur and Madras, and afterwards in other directions along the railways.

There is only one easy way of accounting for the travelling of its seeds; and that is by assuming that they get enmeshed in the gunny wrappings of packages. By reason of the greater use of gunny wrappings in India than in the Malay region, it is travelling faster there than it will in Malaya.

Croton sparsiflorus grows to a height of about two feet or sometimes to three feet. Its stems are woody and rather wiry, a single stem arises from the root, and at a height of about six inches branches into three or four, which again branch repeatedly candelabra-wise. The root system is not extensive; and the plant is easily dislodged. Its leaves are 1-2½ inches long, lanceolate, rounded below, with small blunt serrations, dark green, with stellate white hairs below. The smell of the plant is rather unpleasant.

The flowers are formed on upright open racemes, the females below, and the males above and much more numerous. The axis carries stellate hairs. The female flowers are 2-6 in number with five sepals and small orange-red glands within them, and a tri-carpellary ovary as is characteristic of its order—the Euphorbiaceae. The male flowers are along the axis in clusters of 3-4 or fewer, on short pedicels; they have five sepals, five small white petals, five glands and a bunch of about fifteen stamens rather conspicuous by reason of their white anthers. The seeds are about one sixth of an inch long, coloured and shaped rather like the seeds of the castor oil plant, with a white caruncle and a surface that is only microscopically rough.

I. H. BURKILL.

KENARI SEEDS.

The following Correspondence is printed here for record:—

Imperial Institute, London, S.W.,
16th October, 1913.

SIR,

The Imperial Institute has received a request from a firm of confectionery manufacturers in the United Kingdom for a sample of the fruits or kernels of *Canarium commune*, L., which are stated to be suitable for use as a substitute for almonds.

This tree is said to be grown in the Moluccas for the sake of its fruits, which are also stated to be commonly eaten in Java. It is possible that supplies of the fruits or kernels are obtainable in the Straits Settlements, and if so I shall be very much obliged if you will send me a sample of a few pounds.

I shall also be grateful if you can let me know whether any firm in the Straits Settlements can undertake to export the kernels or fruits, and if so at about what price the product would be quoted.

I am, Sir,
Your obedient Servant,
(Signed) WYNDHAM R. DUNSTAN.

The Director of Gardens, Singapore.

Botanic Gardens, Singapore,
31st January, 1914.

SIR,

In response to your letter No. 3102/1913, dated 16th October, 1913, I have the honour to send to you a small consignment of the seeds of *Canarium commune.*

These seeds are imported into Singapore and sold at one cent a piece for eating. It is unlikely that any firm of merchants here could find a trade in them to their profit. Nevertheless I should value any report that you care to make upon these seeds as we might try to bring in the tree as a fruit garden tree. Similarly I should value any report which you may be willing to make upon seeds, to follow, of *Canarium rufum* from those gardens, where it fruits freely and where the Chinese 'amahs' pick them up and eat them.

I have the honour to be, Sir,
Your obedient Servant,
(Signed) I. H. BURKILL,
Director of Gardens, S.S.

The Director,
Imperial Institute,
London, S.W.

No. 1110/1914.

Imperial Institute, London, S.W.,
7th April, 1914.

SIR,

I have the honour to enclose a report on a sample of *Canarium commune* seeds which was forwarded to the Imperial Institute by the Director of Gardens at Singapore, with letter dated 31st January, 1914

I have etc.,
(Sd). THOMAS A. HENRY,
for Director.

H. E. the Governor,
Straits Settlements.

IMPERIAL INSTITUTE.

Result of the examination of seeds of *Canarium commune* from the Straits Settlements.

Imperial Institute No. 52434, dated, 7th April, 1914.

REFERENCE.—Letter dated 31st January, 1914, from Director of Gardens at Singapore.

NUMBER OF MARK AND WEIGHT OF SAMPLE.—Seeds of Canarium commune. Weight 1½ lb.

DESCRIPTION.—Seeds or nuts measuring about 1⅜ inch in length and ⅞ inch in diameter, somewhat resembling Spanish chestnuts in shape, and pale brownish grey to dark brown in colour. The shells were about ⅛ inch in thickness, and very hard.

The nuts consisted of shell, 87.1 per cent.; and kernel, 12.9 per cent. Most of them contained at least 2 kernels (about 30 per cent. contained 3 kernels), but a few contained only one. The kernels had a chocolate-coloured coat, enclosing a cream-coloured interior which had a pleasant oily taste.

The kernels were analysed with the following results:—

RESULTS OF EXAMINATION EXPRESSED ON MATERIAL AS RECEIVED.—			
Moisture	per cent. ...	...	2.9
Crude proteine ...	„ „ ...	...	13.5
Consisting of			
True proteins ...	„ „ ...	12.9	
Other nitrogenous substances ...	„ „ ...	0.6	
Fat	„ „ ...	...	72.3
Starch, &c.	„ „ ...	...	7.4
Fibre	„ „ ...	...	trace
Ash	„ „ ...	...	3.9

NUTRITIVE VALUE.—Nutrient ratio:—(the ratio between the percentage of crude proteins and the sum of the percentages of starch and fat, the latter being first converted into its starch equivalent) ... 1 : 12.3

FOOD UNITS:—(the total obtained by adding the percentage of starch to 2.5 times the sum of the percentages of fat and crude proteins) ... 221.9

COMMERCIAL VALUATION AND REMARKS.—The kernels of these nuts have a very high food value, and the proportion of fat is large, viz., 72.3 per cent. as against 65 per cent. in the case of walnuts, filberts and hazel nuts. The difficulty of breaking the shells would, however, prevent the use of the nuts in Europe for dessert purposes.

If the nuts were shelled locally and the whole kernels alone exported in good fresh condition, the product might perhaps find a market in European confectionery; but the kernels have no special advantage in taste over the kinds already used for this purpose, and as the nuts yield only 13 per cent. of kernels, the extraction might be unremunerative at the price obtainable.

RAINFALL

at the Director's house, Botanic Gardens, Singapore, during the second half of the year, 1913.

Readings taken always at 8 a. m. and credited to the date in which the twenty-four hours begin.

Day.	July.	August.	September.	October.	November.	December.
1	...	...	...	0.10	0.37	0.42
2	0.81	0.01	...	...	0.07	0.27
3	0 02	...	0.17	...	0.84	0.27
4	...	0.24	..	0.01	0.32	...
5	0.20	Trace	0 82	1.38	Trace	0.26
6	...	0.07	1.02	...	Trace	0.16
7	0.31	...	1.03	0.06	...	0.12
8	0.36	...	0.20	Trace	1.30	0.49
9	0.11	0.64	...	...	0.62	...
10	0.20	0.30	0.40	...	0.29	0.01
11	...	Trace	0.78	...	0.21	0.05
12	...	0.27	0.76	0.03	1.73	0.20
13	1 08	...	...	0.58	0.02	0.27
14	...	0.14	...	0.03	1.25	0.49
15	...	...	0.33	0.96	0.21	3.20
16	...	0 08	0.71	0.27	1.47	Trace
17	Trace	...	0.02	0 21	0.07	0.33
18	...	...	0.30	0.76	0.24	Trace
19	0.11	...	...	..	1.83	...
20	0.02	...	0.03	1.76	Trace	0.06
21	...	0.43	0 32	1.27	..	0.10
22	...	...	0.03	0.22	0 23	0.01
23	...	...	0.06	0.06	0.13	1.04
24	...	0.04	0.72	. .	0 29	Trace
25	...	0.02	0.17	0.81	...	Trace
26	...	...	0.03	1.40	0.31	0 06
27	0.02	...	Trace	0.41	2 06	0.11
28	0.01	0.07	...	0.20	0.52	...
29	3.25	...	...	0.03	0 26	..
30	Trace	...	...	0.02	Trace	0.33
31	...	...		1 95		...

RAINFALL

at the head of the Waterfall Gardens, Penang, during the first half of 1913.

Rainfall read at 8 a m. and credited to the day in which the twenty-four hours begin.

Day.	January.	February.	March.	April.	May.	June.
1	0.02	...	...	0.03	...	0.23
2	0.03	...	...	1.15	2.90	0.18
3	...	...	0.07	0.18	0.98	0.16
4	1.21	...	0 04	...	1.59	0.05
5	...	...	...	0.19	2.10	0.64
6	...	...	...	...	2.05	0.01
7	...	0.07	...	0.58	0.42	...
8	...	...	...	0.28	0.15	0.03
9	...	...	...	0.18	2.40	2.13
10	0.05	0.42	0.10	0.04	1.54	0.04
11	1.67	...	0.39	0.84	0.34	...
12	0.41	...	0.04	...	...	...
13	0.35	...	0.15	...	2.50	...
14	0.03	...	1.33	...	0.02	...
15	0.10	...	...	...	0.58	...
16	0.50	...	0.32	0.19	1.72	...
17	...	...	0.41	0.17	...	...
18	0.14	. .	0.27	0.22	...	0.67
19	...	...	...	...	1.08	...
20	...	...	0.30	...	0.22	1.30
21	...	...	0.09	0.44	0.03	...
22	...	...	1.05	0.17	0.02	0.05
23	...	...	...	...	0.04	...
24	...	...	0.17	0.06	...	0.35
25	...	...	0.23	Trace	...	...
26	...	0.35	0.56	0.36	0.03	...
27	...	...	...	0.02	...	..
28	...	0.10	...	0.07	...	0.11
29	...		...	0.05	...	1.30
30	...		...	0.41	0.10	0.59
31	...		...		0.09	

RAINFALL

at the head of Waterfall Gardens, Penang, during the second half of 1913.

Day.	July.	August.	September.	October.	November.	December.
1	0.03	...	0.03	0.01	1.14	...
2	1.07	...	...	0.50	0.08	0.04
3	...	0.05	0.52	0.09	0.32	0.22
4	0.14	0.05	0.03	0.13	0.16	0 80
5	0.30	0.18	0.22	0.06	0.86	0.03
6	1.85	0.16	0.44	0.02	0.03	0.03
7	0.33	0.80	0.05	1.59	1.27	0.14
8	1.70	0.12	...	0.04	1.96	0.03
9	0.12	0.73	0.42	0.41	0.66	...
10	0.03	...	2.54	2.04	2.74	0.08
11	...	...	0.30	0.47	3.28	0.40
12	...	0.70	2.70	0.60	1.39	0.02
13	...	0.65	4.30	1.34	0.08	0.05
14	0.48	...	1.03	2.24	0.26	0.04
15	0.53	...	2.35	1.75	0.02	0.26
16	0.13	0.09	...	1.76	...	0.92
17	...	0.02	0.12	0.36	1.14	0.22
18	...	0.03	0.04	0.38	0.43	0.03
19	...	0.03	0.02	2.04	0.40	1.60
20	...	0 05	0.08	0.42	0.15	0.02
21	0.26	1.04	4.41	1.67	...	...
22	...	...	3.40	0.08	1.47	0.49
23	0.08	...	0.55	1.03	0.02	0.09
24	...	0.10	3.22	...	...	...
25	0.02	0.39	0.55	...	0.14	0.06
26	...	0.07	1.03	1.50	0.55	0.05
27	0.17	...	...	0.07	0.91	0.08
28	...	0.18	...	1.80	0.20	...
29	..	0.06	0.03	0.01	0.13	...
30	...	..	...	1.60	0.08	0.07
31	0.06	0.08		0.02		0.03

Registered by the

Municipality of George Town.

SUMMARY OF RAINFALL, 1913.

	SINGAPORE (See p. 198).			PENANG			Rain fall in 1911 and 1912, at the head of the Water fall Gardens, Penang.	
	No of rainy days.	Amount of rain in inches.	Longest Spell without rain.	No. of rainy days.	Amount of rain in inches.	Longest Spell without rain.	1911.	1912.
January - -	not recorded			11	4.51	19	2.19	1.37
February -	partly recorded.			4	0 94		1.47	1.38
March - -	18	18.70	3	16	5.52	5	6 27	3.33
April - -	17	9.99	3	21	5.63	4	9.52	5.57
May - - -	22	9.19	2	22	20.91	3	10.59	17.17
June - - -	25	16.46	1	16	7.84	7	10.10	10.67
July - - -	15	6.50	6	17	7.30	4	3.05	4.56
August - -	14	2.31	5	21	5.58	2	8.98	19.54
September -	20	7.80		24	28.35	2	12.41	17.36
October - -	23	12.51	3	29	24.04	2	12.49	16.65
November -	27	14.64	1	27	19.87	1	9.83	12.46
December -	25	8.25	2	25	5.80	2	4.22	6.87
Total in year	—	—	—	233	136.29	—	91.12	116.93
in 10 months	206	106.35	—	—	—	—	—	—

Greatest amount in 24 hours.	6.62	4.41
„ „ 48 „	10.87	7.81
„ „ 72 „	12.68	8.36

Excessively rainy periods, more than 5.00 having fallen in 72 hours. - - 1 (March)	5 (May, Sept., Oct., Nov.)
No. of days when condition existed - 3 „	13
Periods of Comparative drought, less than 0.02 having fallen in 120 hours - 6 (Feb., Jul, Aug., Sept., Oct.)	6 (Jan., Feb., Mar., Jun.)
No. of days when condition existed - 15	33

A SPADIX IN THE AXIL OF THE SPATHE OF XANTHOSOMA.

In making preparations of the flowers of *Xanthosoma ? violaceum*, Schott, for the Singapore herbarium, an interesting abnormality was detected, for in a large spathe two spadixes were found, the position of the second being that of a branch in the axil of the spathe. The spathe in question was 17 inches long; the normally present spadix 12 inches long: but the abnormally produced spadix was only three inches, being too short to pass beyond the constriction of the spathe which had forced it into a curve. Its flowers were younger than those of the normally produced spadix, but apparently normal. On their lesser age rests an argument supporting the view that the abnormally produced spadix is a branch in the axil of the spathe; for if were not of a lower order than the normal spadix its flowers ought to be of the same age.

The abnormal specimen is part of No. 276 now in the Herbarium of the Botanic Gardens.

I. H. BURKILL.

GRAMMATOPHYLLUM FLOWERING IN JANUARY.

In the Agricultural Bulletin of the Straits and Federated Malay States, VI., 1907, page 49, Mr. H. N. Ridley recorded the flowering of *Grammatophyllum speciosum*, Blume, in the Botanic Gardens, in January of that year, the usual flowering in August and September having been omitted in 1906. The same phenomenon has been repeated; for this orchid did not flower in 1913, but flowered in Singapore very freely in January and February, 1914. It was seen to be in flower in the Kukob district of Johore at the same time. In Penang it flowered as usual in July and August, 1913.

I. H. B.

SOME PERTINENT PUBLICATIONS.

THE IMPERIAL BUREAU OF APPLIED ENTOMOLOGY. "In the summer of 1911, when the Prime Ministers of the Self-Governing Dominions were present in England, they were invited by the Secretary of State for the Colonies to discuss with the Entomological Research Committee (appointed by the Colonial Office, in 1909), certain proposal for furthering and co-ordinating the investigation of injurious insects throughout the Empire. By this meeting it was unanimously agreed that the establishment of a central organisation for this purpose was desirable, and consequently a tentative scheme was submitted for the consideration of the Colonial Governments concerned.

At a further conference, held at the Colonial Office, in August, 1912, the matter took more definite shape and it was proposed to form an Imperial Bureau of Entomology, to be supported by contributions from the various Dominions and Colonies, as well as from the British Government. The principal functions of this Bureau were to be to collect and co-ordinate all information bearing upon injurious or useful insects; to organise a system for securing the authoritative identification, with reasonable promptitude, of all insects of economic importance submitted by officials connected with the Departments of Agriculture or Public Health throughout the Empire; to compile gradually a comprehensive card-index to the whole literature of the subject, and to publish monthly the "Review of Applied Entomology," which is intended to give an up-to-date epitome of the current literature." (Preface to the Review, No. 1.)

There has been issued newly a report on the work of the Committee, dated 17th December, 1913, which records great progress towards permanent utility. The Review in two series: Series A, Agricultural, and Series B., Medical and Veterinary—has now appeared for more than a year, the parts of series A. costing ninepence each and the parts of series B. sixpence. The working value in distant centres of this Review is very considerable.

HAMEL SMITH, H., AND PAPE, F.A.G., COCONUTS, THE CONSOLS OF THE EAST. Second edition, London (1914). Tropical Life Publishing Depot., Pp. lxviii and 644 with many illustrations. Price 11 shillings net, post free.

The first 400 pages of the second edition of this work are almost exactly as those of the first edition, but the remaining part of the book is much altered,—slightly by omissions, greatly by additions. Of the added matter the most interesting pages are those where the opinions of several competent authorities are brought together in a discussion of the cost of making copra. This industry to date in various lands is discussed. Recent developments such as the use of explosives in agriculture find a place; Dr. Friederichs coconut-beetle fungus is described. But the part of the book dealing with insect pests should have been made fuller and have been well illustrated.

ZIMMERMANN, A., DER MANIHOT-KAUTSCHUK, SEINE KULTUR, GEWINNUNG AND PRAPARATION, Jena (Gustav Fischer), 1913, pp. 1-342, with 151 figures in the text. Price nine marks, unbound; ten marks, bound. This book gives a very complete account of the rubber-yielding species of Manihot. The author is Director of the Imperial Agricultural Institute of Amani, German East Africa, in which country their cultivation has been taken up more than in any other, and where he has been at work on them for at least ten years.

The figures in the book are originals from the author's photographs or from drawings made for him. The text covers the

whole matter of Ceara rubber—the differences between the species, their rates of growth in all parts of the world, their enemies (chiefly in German East Africa), their tapping, the coagulation of the latex and the return.

On page 154, the author gives his opinion cautiously to the effect that the nutritive rôle of latex cannot be considered as proved; on page 224 he advises that trees should not be tapped until their girth is 40 cm. (nearly 16 inches); on page 33 he shows that in favoured localities this girth is reached in a little over a year, but even 3-4 year old trees should not be tapped oftener than 25-40 times in the year, meagre yields having apparently in the past been due to tapping in excess (page 230); and (page 308) the yield which may be hoped for is:—

in the fourth year,	50	kilogrammes per hectaire	or	44.6	lbs. per acre.
fifth ,,	100	,,	,,	89.2	,,
sixth ,,	150	,,	,,	133.8	,,
seventh ,,	200	,,	,,	178.4	,,
eighth ,,	200	,,	,,	178.4	,,

He records as actually obtained on the Kwamdoro estate, whose situation seems to be particularly favourable:—

Year.	*Kilos per hectaire.*	*lbs. per acre.*	*Grammes per tree.*	*lbs. per tree.*
4th	60	53.5	100	just under $\frac{1}{5}$ lb.
5th	120	107.6	200	$\frac{9}{20}$ lb.
6th	200	177.8	333	$\frac{7}{10}$ lb.
7th	220	196.1	367	just above $\frac{3}{4}$ lb.

The seed contains nearly 30 per cent. of oil.

KOORDERS, S. H., EXCURSIONSFLORA VON JAVA, UMFASSEND DIE BLUTENPFLANZEN, Jena, Gustav Fischer. Three volumes, pp. xxvi—412; 742; x-498; with figures in the text, 19 plates and 3 maps; 1911-1912. Vol. iv. to be complete in twenty parts, containing reproductions from photographs and line figures of the higher plants of Java, Part 1, 1913.

This work when complete will be the best substitute for a popular Flora of the Malay peninsula that can be recommended, provided that the possessor can read German. Having but little knowledge of botany it will be possible to ascertain the name with considerable ease of any Javanese flowering plant, and of most of the commoner plants of the peninsula. An unfortunately rather long list of corrections has been issued.

MESSRS. C. L. GATIN AND C. M. BRET in a paper in the COMPTES-RENDUS DE L'ACADEMIE DES SCIENCES DE PARIS, clvi. pp. 805-807, point out that all the varieties of *Elaeis guineensis*—the African oil palm—produce on the Ivory Coast (West Africa) two kinds of fruits, the lesser being empty. They say that these lesser sterile deceptive shells are constant in proportion for each variety, being most numerous in var. *ceredia*, so that they appear to be normal to the trees.

The

Gardens' Bulletin

STRAITS SETTLEMENTS,

into which is incorporated all that has been published as the third series of the Agricultural Bulletin of the Straits and Federated Malay States.

Vol. I. Issued June 22nd, 1915. No. 8.

CONTENTS.

To be purchased at the Botanic Gardens, Singapore from Messrs. Kelly and Walsh, Ltd., No. 32 Raffles Place and 194 Orchard Road; and the Straits Times Office, Cecil Street, Singapore.

DEPARTMENTAL NOTICE.

A few plants of the Avocado or Alligator Pear—*Persea gratissima,* and a few plants of the Brazil nut—*Bertholletia excelsa*—to be sold within the Peninsula at fifty cents each.

It is hoped within a few months to be able to supply—*Eucalyptus corymbosa*—at the same price.

Seeds of *Hevea brasiliensis*--Para Rubber—as available from little tapped trees, twenty-eight years old, to be sold at fifty cents per hundred.

THE

GARDENS' BULLETIN,

STRAITS SETTLEMENTS.

INTO WHICH IS INCORPORATED ALL THAT HAS BEEN PUBLISHED AS THE THIRD SERIES OF THE AGRICULTURAL BULLETIN OF THE STRAITS AND FEDERATED MALAY STATES.

The Gardens' Bulletin is published as material becomes available. Its price is fifty cents a copy, post free, or in advance for a volume of twelve numbers, post free,

Five dollars in the Straits and Federated Malay States.

Nine and a half rupees in India and Ceylon.

Thirteen Shillings in Europe.

Subscriptions paid to the third series of the Agricultural Bulletin, Straits and F. M. S., are counted as subscriptions to it.

SINGAPORE :
THE STRAITS TIMES PRESS, LIMITED.

Rubber Tree No. 2, Economic Gardens, Singapore.

THE

GARDENS' BULLETIN,

STRAITS SETTLEMENTS.

Vol. 1. Issued June 22, 1915. No. 8.

THE TREATMENT TO WHICH THE PARA-RUBBER TREES OF THE BOTANIC GARDENS, SINGAPORE, HAVE BEEN SUBJECTED.

An attempt is being made in the Botanic Gardens, Singapore, to mark down among the old trees the best that they may serve as parents for improved stock. The work of selection will cover many years, and be in some degree tedious; but there is every reason to expect that it will prove worth all the time that may be absorbed. *Hevea brasiliensis*, the Para-rubber tree, in Malaya, shows much variability, and therefore a promise that the general average of the trees can be raised; and moreover not only do we observe this variability here with our own eyes; but we have the assurance of Monsieur Labroy and others that in Brazil great variability can be seen. The work in hand commences with the comparison of tree with tree as judged by the amount of latex given. Were our trees all virgin, this comparison would be facilitated; but they have been subjected to treatment in various ways; and though we do not know as yet, what the effect of tapping is on the life and functions of a rubber-tree, it becomes necessary that in the task before us the past of the selected parents should be known. With this object in view the following record has been compiled from all available sources.

One tree in the Gardens, No. 27, in the year 1904, was recognised as yielding a far greater amount of latex than any of its neighbours, even than those which seemed to have a position quite as advantageous. But it has never been used as a special seed bearer. It and other good trees are now being picked out as parents for the next generation.

A large map of the rubber ground has been prepared, whereon is marked the position of every tree, and wherefrom whenever necessary it can always be ascertained if a selected parent has had an advantageous position or has not.

Unfortunately the tapping records have been unequally kept. In the early days, from 1889 to 1902, they were hardly kept at all. From 1902 to 1903, public interest having been aroused, notices of what was being done in the Botanic Gardens appeared in the local press. From 1904 onwards, they were almost completely kept. Using all the materials which have come to hand, a manuscript record has now been made which shows the nature of the tapping and how it was intermitted in the case of each tree; and the following account largely abridged therefrom avoiding details gives in one view what has happened in the plantation. It, together with the register of the trees and the map above named, serves as the basis in the work to be undertaken.

The failure in 1876, of the first consignment from Kew of Hevea seedlings, fifty in number, to reach the Botanic Gardens, Singapore, alive, has been asserted repeatedly, apparently on the ground of a statement in the Report of the Royal Gardens, Kew, for 1876, which says "the cases did not come into the hands of the Superintendent of the Botanic Gardens . . . . . until the plants were nearly all dead": but when the Report of the Royal Gardens, Kew, for the year 1877 is consulted part of a letter from the Superintendent of the Singapore Gardens is found stating that the Heveas sent in 1876 were making good growth (vide Petch in *Annals of the Royal Botanic Gardens, Peradeniya*, v., 1914, p. 440). So some were saved for at least a year: but no records exist showing their further history. If they lived, they introduced into the Colony plants whose origin was certainly from seed collected by Mr. Wickham on the plateaux between the rivers Tapajos and Madeira; for Kew was distributing these in 1876. Twenty-two seedlings, a second consignment, sent a year later, arrived safely in June, 1877, and more than half of the number were planted out in the Botanic Gardens,—the exact site unknown,—to be replanted in 1878 in what is now the Palm-valley of the Botanic Gardens, then the Economic Garden, where they made poor growth. The other nine were taken to Kwala Kangsar and planted there behind the Residency by Mr. J. H. Murton, the Superintendent of the Gardens in Singapore (vide *Annual Report, Botanic Gardens, Singapore*, for 1878, p. 3; and *Agricultural Bulletin of the Straits and F.M.S.*, ii., 1903, p. 3).

A third consignment is said on the authority of members of the staff of the Royal Botanic Gardens, Ceylon, (e.g., Wright in *Willis, Bamber and Denham, Rubber in the East*, 1906, p. 19) to have been despatched from Colombo for the Singapore Botanic Gardens, in 1877; but its arrival in Singapore is not recorded. Moreover as it was in 1878 and not in 1877, that Thwaites, then Director of the Royal Botanic Gardens, Ceylon, began to send out plants of his own

Photo by] [*H. Overbeck, Esq.*

Hevea brasiliensis, tree No. 174 in the Economic Garden, showing scars of tapping done in 1904.

Photo by] [*Mrs. E. M. Burkill*, 1913.

The path in the Economic Garden between the rubber trees planted in 1886 (on the left) and those planted in 1879. The two most conspicuous trees are Nos. 1 (behind the board) and 2.

propagation, the date appears to be too early for any consignment from those Gardens. That an entry of the despatch of rubber plants from Peradeniya exists in the departmental records seems a fact, but may it not relate to the second consignment from Kew which would pass through Ceylon on its way eastward?

To the charge of the Superintendent of Gardens in Singapore was added in 1879 by the Colonial Government the land which now is the Economic Garden. At the time of being handed over the low-lying part was an indigo plantation, and the hill-slopes above it vegetable gardens cultivated by Chinese, while the hill-top was a more-or-less neglected stretch of secondary jungle (blukar). To the junction of the indigo with the vegetable gardens, Mr. W. Fox, now acting for Mr. N. Cantley who had succeeded to the post of Superintendent but been taken ill, transferred from the Palm-valley the still surviving Para-rubber trees that had been planted by Murton, placing them in a single line. The reader should turn to the first plate in the *Agricultural Bulletin of the Straits and F.M.S.*, II., 1903, for an illustration of these trees at twenty-seven years of age, and to the opposite plate for those still standing in 1913. One of the central trees, No. 5, had died in 1904; and from it, death spread in either direction along the line until in 1913, four trees alone stood; and now there are but three.

It has always been accepted latterly that the parents of these trees grew, in Brazil, on the upland plateaux over the valley of the Tapajos river, whence the seed was collected for the Government of British India, by Mr. H. A. Wickham. But to those in authority in Singapore, in 1878, it was not known with certainty what had been the origin of the stock; and as another of the collectors of Para-rubber seed and plants, Mr. Cross, had officially recommended lands subject to inundation as suitable (vide his letter to the India Office, dated 29th. March, 1877, which may easily be read in Ferguson's *All About Rubber*, 2nd. edition, 1887, p. 59), his descriptions of the flooded lowlands where the Para-rubber tree grows in the Amazon valley were allowed to weigh in the selection of a damp site for the trees (*Annual Report, Botanic Gardens, Singapore*, for 1878, p. 3); and after Murton had expressed himself disappointed with the result, of this first transplanting, Mr. Fox gave them a still damper position. Mr. Fox, who had personal acquaintance with Mr. Cross, and had learned from him the condition of the country near Para, informs the writer that the growth of the trees was much improved by the second transfer.

Cantley at first had no great opinion of Hevea. He wrote in 1885 of the trees in his charge that they "grow well; but in a country where the best rubbers grow wild, it is somewhat superfluous to refer to foreign species, the ultimate success of which may be doubtful." Beyond giving to the trees a little general care, he did nothing to them; and as he was not supplied with funds for the cultivation of the Economic Garden, scrub began to swallow up the lands that had been in cultivation.

It was otherwise in Ceylon. Attention to rubber had been forced on to the Ceylon Botanic Gardens; for on the recommendation of Sir Joseph Hooker, and with the advice of Sir Dietrich Brandis, the India and Colonial Offices had agreed that a big nursery of Para-rubber seedlings should be made in Ceylon to save the situation for India, and enable experimental plantations to be established in Burma as well as in other parts of the Indian Empire. It may be explained that the climate of Calcutta had been tried and found unsuitable, with the first available seedlings, from seed collected for Mr. J. Collins by a Mr. Farris at Cameta, which is to the south-west of Para at some distance (vide *Agricultural Bulletin, Straits and F.M.S.*, ii., p. 2. and Petch in the *Annals of the Royal Botanic Gardens, Peradeniya*, v., 1904, p. 438): they had "utterly failed," Sir George King stated in his *Report of the Royal Botanic Gardens, Calcutta for 1880-81;* and thereupon, as India in other damp regions was ill-equipped with botanic establishments, and in order that the already big outlay should not be lost, Ceylon was asked to find in its humid lowlands some counterpart of the Amazon's forests, where the nursery could be established. Sir Clements Markham (vide *Peruvian Bark*, London, 1880, p. 466) accused the Government of India of being lukewarm, whereas other sources of information show that the India office tried to work apart from Kew, to collect seeds and despatch them independently, and not being competently staffed failed; but in taking the decision to utilise the resources of Ceylon there was nothing but wisdom; and Ceylon became by it at once a new source of wealth to the East.

Under the charge of a gardener named W. Chapman, 1919 seedling Heveas had been sent to Peradeniya in October, 1876, and in the next year the greater part of them were planted out in a purposely acquired plantation at Heneratgoda, on the railway, not very remote from Colombo. All these plants came from the seeds collected by Mr. Wickham on the plateaux over the Tapajos river.

Ceylon received in 1877 a further hundred plants from Kew. Dr. H. Trimen who two years later, *i.e.*, in 1879, succeeded in the post of Director of the Ceylon Gardens, wrote in 1881 (vide *Tropical Agriculturist*, of October 1st, 1881, p. 399) that of 1080 seedlings brought to Kew by Mr. R. Cross without soil, scarcely three per cent. were saved and one hundred of the number transmitted to Ceylon. It is assumed that Trimen in this place referred to the consignment of 1877; and if what Ceylon then received was from Cross' seedlings, then the Singapore consignment of the same date might also be of Cross' collecting, and not from Wickham's seeds. In which case the current view that the old Singapore trees had their origin over the Tapajos valley would be shaken, for Cross collected near the town of Para and on the island of Marajo. The then-Director of the Royal Botanic Gardens, Kew, quoted Trimen's statement without comment in 1898 (vide *Kew Bulletin*, 1898, p. 253); but there is strong reason for believing Trimen mistaken. In the first place Thwaites shortly before his retirement was hardly able to cope with the work which

fell to him and let the records fall into an incomplete state, so that corroboration for the statement cannot be found in Ceylon. In the second place the Kew records, which must be supposed accurate, show that Kew had not 100 plants from Cross' collection in a condition fit to send, and has recorded no such sending. In the *Kew Bulletin*, 1914, p. 164, Sir David Prain writes, that of the 1,080 seedlings without soil which Cross deposited at Kew, on November 23rd, 1876, 680 were sent to Mr. William Bull, the horticulturist, (and their condition on sending is carefully recorded) whereof he saved 14; and 400 were retained at Kew, whereof 3 per cent. were saved alive. Thus about 26 plants alone remained of Cross' collecting; and after recording this the Director of the Royal Gardens says, that there is no entry in the Kew archives which can be interpreted as implying that any of the saved plants ever grew strong enough to be sent to Asia.

It seems then that the accepted origin of our Singapore trees, viz., the plateaux over the Tapajos is correct; and not only is this so, but all seeds and seedlings subsequently obtained from Ceylon to augment the Singapore Gardens' plantation were no more than of the same stock; for Ceylon also had no other.

Thwaites, Director of the Botanic Gardens, Ceylon, in 1876, following a lead given by Kew found means of increasing his supply; for he discovered that he could take cuttings from the seedlings, by using the side branches; and it has been recorded that in 1878 and 1879 he raised and distributed a large number. Mr. Petch (*Annals of the Royal Botanic Gardens, Peradeniya*, v., 1914, p. 460) asks, however, whither went the 1500 plants from the original stock whose disposal in unrecorded unless they were sent out with (or as) cuttings; and it is evidently possible that the Conductor of the Heneratgoda plantation packed and despatched original stock, Thwaites living at a distance being under the impression that cuttings were going out and recording the despatch as such. Moreover Mr. Petch quotes a statement made by Trimen in 1881 to the effect that propagation by cuttings was "extremely difficult and that out of many thousand attempts a very small number" had "succeeded," which throws doubt upon the raising of such large quantities of cuttings as Thwaites' despatches would demand. It is recorded that he sent 500 of these cuttings (we may substitute the word plants for cuttings) to Mergui, a few to Perak, and others (but without success resulting in cultivation) to Madras, Calcutta and Assam. A few years later cuttings (? plants) were sent to the Andaman islands.

The same method of propagation was tried in Singapore and at Kwala Kangsar, but with small or no success (vide *Annual Report, Botanic Gardens, Singapore,* for 1878, p. 3; for 1879, p. 4; and for 1881, p. 4).

The following table gives the early wanderings of Hevea in Asia:—

Early distribution of Para rubber plants.

1876. 1,919 plants from Kew to Peradeniya, Ceylon; 18 plants to Buitenzorg; a consignment which may have failed ultimately to Singapore.

1877. The greater part of the consignment in Ceylon planted out at Heneratgoda. 22 plants to Singapore from Kew, of which some taken to Kwala Kangsar; 4 to Buitenzorg; 8 plants to Mergui, (from Kew) via Calcutta.

1878. Plants sent to Brisbane from Singapore; 500 from Ceylon to Mergui; others to Malabar.

1879. ? plants to the Malay Peninsula, from Ceylon.

1880. 2 plants from Ceylon to Travancore.

1881. 28 plants from Ceylon to the Andaman islands; others to Johor.

1882. Plants from Ceylon to British North Borneo.

1883. Seeds from Singapore to Sarawak and Kwala Kangsar: 27 stumps from Ceylon to Malabar; 12 to Mr. Davidson in Singapore.

1884. 26 stumps from Ceylon to Malabar, and also seeds.

1885. 300 seeds from Ceylon to Malabar; 400 to Singapore.

1887. Seeds from Ceylon to Mergui and to Malabar, and also to Penang and N. Borneo; seeds from Kwala Kangsar to Taiping.

1888. 11,500 seeds from Ceylon to Singapore and to Kwala Kangsar; 3,000 seeds from Ceylon to Central India.

The very first tree to flower in the East seems to have been one of those which were taken by Murton to Kwala Kangsar; for it is recorded that a tree there flowered in March, 1880, at the age of 3½ years.* Another flowered at Heneratgoda. In the next year one at Heneratgoda yielded nine seeds and in 1882 thirty-six seeds (Trimen in *Kew Bulletin*, 1898, p. 254). At Kwala Kangsar the tree which flowered first, flowered again, but without fruiting; however at its third flowering in 1881 it set fruit, and in doing so was accompanied by another tree which then flowered for the first time (Petch in *Annals of the Royal Botanic Gardens, Peradeniya*, v., 1914, p. 445). In 1882, nine trees flowered and fruited at Heneratgoda. Probably in 1883 † trees first fruited at Singapore; and seed was now sent from the latter place to Sarawak and Kwala Kangsar. But not until 1884 was there any flowering at Peradeniya and Mergui.

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* Equally early flowering was recorded in the *Agricultural Bulletin of the Straits and F.M.S.*, VI, 1907, p. 176; and yet earlier in the *Report of the Forest Department Ceylon*, for 1894.

† The date of the first fruiting of Hevea in Singapore cannot have been 1881 as stated in the *Agricultural Bulletin of the Straits and F.M.S.*, iv., 1905, p. 365, for Cantley in his *Annual Report on the Botanic Gardens, Singapore*, for the year 1882, p. 12, wrote ' an early crop of seed is looked forward to" as growth had been good in spite of the throw-back suffered from the poverty of the soil into which they had been transplanted in 1878.

Trimen when he succeeded Thwaites in 1880, found at Heneratgoda "about 300 of the original seedlings" grown to trees, "and at Peradeniya above 20 trees." By cuttings he raised his stock between 1880 and 1894, to 424 at Heneratgoda and 30 in Peradeniya (Trimen, in *Kew Bulletin*, 1898, p. 254).

The Ceylon seed crop, with such a large number of trees, soon reached considerable dimensions, so that it was above 20,000 in 1888; and out of it many places received supplies. The Singapore seed crop was at first used up between the Botanic Gardens, Sarawak, Kwala Kangsar, Kuala Lumpur and Malacca. In the Botanic Gardens, the old indigo ground was chiefly planted up, making a fine heritage to us who come after, and in 1894 some rubber was planted among the trees of the southern corner of the Economic Garden (vide *Agricultural Bulletin of the Straits and F.M.S.*, vii., 1908, p. 253). The smaller Kwala Kangsar crop increased the local plantation and supplied the seedlings which became widely distributed here and there over Perak and on the estates of Mr. T. Hislop Hill § and others in Selangor and Negri Sembilan; and in 1887, they were also the source of a small plantation at Taiping. One of Mr. Hill's estates was Linsum, which again in turn supplied seeds in 1899 to Deli, Sumatra. The Mergui seed crop was used up locally.

The first tapping of Hevea, done in the East, was done by Trimen in October, 1882, and was thus described by him.—"Five of the Hevea trees were prepared by scraping off on one side the rough outer surface of the outer bark; a few short cuts were then made with a knife and the rubber allowed to dry." The first tapping of Hevea by the herring-bone method was done by Dyaks (Wray says Malays) on Sir Hugh Low's request at Kwala Kangsar in the year

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§ At p. 213 of this Bulletin a very prominent place was given by Mr. Hislop Hill as "the first planter" of rubber in the Peninsula on the authority of Mr. Ridley. Subsequently the following letter from him to Mr. W. Egerton was discovered in the Botanic Gardens, being one of the very few on rubber which have escaped white ants. It is given here to show in what way Mr. Hill was a pioneer.

Bukit Nanas, Sungei Ujong,
1893.

Sir,

I have the honour to acknowledge your letter Misc. 1934/34.

I enclose you a small sample of rubber grown on Linsum Estate from the Hevea brasiliensis and shall be glad to hear what it is worth. The trees are 6 to 8 years old and the yield from one tree is about half a pound and, by the method of collection followed, costs abou 20 cents per pound to collect.

2. I have hundreds if not thousands of trees on my estates; and I shall be glad to supply any quantity of seeds that the Government may wish to buy.

3. The difficulty appears to me to be in collecting the rubber in a sufficiently pure state for the market at a reasonable price.

4. I have found the trees do as well on undulating ground as on the edges of swamps.

I have, etc.,
(Signed) T. H. HILL.

It is believed that the rubber was very inferior and that Mr. Hill got no further at this date than growing scattered trees for seed. But the possession in 1893 of trees 6-8 years old puts him far in front of any other private individual as a cultivator of Hevea.

1888. Collins (*Report on Caoutchouc of Commerce*, London, 1872, p. 36) had described herring-bone tapping as done "in Para, Guiana," etc., by making a vertical cut from high up the tree to the base and numerous short side cuts which were not reopened at all (or at least Collins makes no mention of reopening them). The Dyaks, however, borrowed no ideas from such a source. They tapped the trees rather in the way by which they sometimes draw birdlime or the Samangs draw the juice of the Ipoh tree—*Antiaris toxicaria,* Lesch. (vide *Kew Bulletin,* * 1891, p. 260 and also L. Wray in Ferguson's *All about Rubber,* 1899, p. ccxxxviii). They cut—perhaps one should say hacked—rough herring-bones, but were not exactly successful, it being reported "that scarcely any juice exuded from them." (*Agricultural Bulletin of the Straits and F.M.S.,* ii., 1903, p. 3).

Trimen's 1882 tapping was merely to see if he could get rubber, and in the years immediately following he did not repeat the experiment. But in 1888 he restarted experimental tapping by a modification of the Brazilian method of making numerous small incisions. It is recorded that he tapped but one tree; and that he continued his demonstrations upon it in the years 1890, 1892, and 1894, i.e., in alternate years. These tappings were done timidly for fear of injuring the tree, thus he made cuts in the tree on seventeen days only in the year 1888, seven being near the commencement of the year, in the months of January and February, six at the middle, in in July and August, and four at its close in December. The next tappings were like the first.

In 1889 at Mergui similar rather timid tappings were tried (*Kew Bulletin*, 1898, p. 266).

In 1888 Mr. H. N. Ridley became Director of Gardens, Straits Settlements, and visited the Ceylon establishments on his way to the East (*Agricultural Bulletin of the Straits and F.M.S.,* ix., 1910, p. 202).

When he took over charge in Singapore, there existed in the Economic Garden at least nine trees of the row transferred in 1879, twenty-one trees which had been planted in 1884 and were seedlings from the foregoing, or from Kwala Kangsar thirty trees which had been planted out in 1886, and probably in part came from the Ceylon seed imported in 1885 in a Wardian case, and 1,138 seedlings a year old, and again doubtless from the Gardens' own seed. He at once set to work to care for these, and raised another 8000 plants from a consignment of Ceylon seed.

He tapped to ascertain yield in 1889, (*Agricultural Bulletin of the Straits and F.M.S.,* ix., 1910, p. 202) one year after his arrival, and he reported that the trees "thrive in the damper spots, and those old enough to cut produce a considerable quantity of rubber" (*Annual Report, Botanic Gardens, Singapore*, for 1890, p. 4). Rubber produced from them was exhibited at the Agricultural Show held in 1890 (*Agri-*

* Sir Hugh Low had interested himself in the Ipoh tree in 1881, vide *Kew Bulletin,* 1891, p. 26.

cultural Bulletin of the Straits and F.M.S., ix., 1910, p. 202). To obtain it "the trees were tapped in the herring-bone method," and the latex was collected in cigarette tins and allowed to coagulate naturally "in the tins without the use of acid" (*Agricultural Bulletin of the Straits and F.M.S.*, ix., 1910, p. 202). A pruning knife and a narrow flat chisel seem to have been the implements used in tapping: with the knife the first cut was made, and the repeated shaving was done with the chisel, a wooden mallet being used to drive it forward. One piece of rubber made in these early tappings is preserved in the Botanic Gardens, Singapore, as well as a second of a slightly later date made when saucers were used for coagulation.

Again in the year 1889 an attempt was made to get rubber from the Kwala Kangsar trees, but with no greater success than before, apparently because the herring-bone incision was not wide enough and not reopened, being just an imitation of the method of tapping for Ipoh juice. The great success came in that year—not at Kwala Kangsar, but was Mr. Ridley's. His resort to reopening the wounds was indeed second only in importance as regards the planter to the actual introduction of Hevea into the Old World, and after it the greatest advance that had been made in rubber since the invention of vulcanisation.

As said above, Collins wrote in 1872 of herring-bone tapping extending high up the trees with a large number of side cuts; the plan of Ridley's first tappings seems to have been taken from those tappings, although the vertical channel was generally only two feet long, and to have been variable in extent and in the number of the side cuts; but fearing that the wounds would not heal he ceased the re-opening when the side cuts had a width of half an inch; and the next herring-bone was made in a new place (vide *Agricultural Bulletin of the Malay Peninsula*, No. 7, 1897, p. 136). Considerable experience seems to have been obtained between this commencement and the date (1897) of the Bulletin just quoted, which indicates a not inconsiderable amount of tapping.

This tapping used to be done in the evening, the cups being left on the trees through the night, after the fashion described by Collins on page 8 of his *Report on the Caoutchouc of Commerce.*

In 1895 Dr. J. C. Willis having succeeded Dr. Trimen, the course of the work in Ceylon changed. Dr. Willis tapped again without waiting a year, the tree which Dr. Trimen had been tapping in every other year, and reported that he judged it, at nineteen years, old enough to be tapped annually; he commented by estimating the yield of trees such as it at 100 lbs. per annum from an acre carrying fifty trees. Though bolder tapping was now coming in, the implements were "a ¾ inch chisel, a wooden mallet . . . . and a knife." Dr. Willis' method of tapping was described by him in a *Circular of the Royal Botanic Gardens* (No. 4, 1898, p. 30) thus:—" the tree is first carefully and lightly shaved with the knife from the height of six feet down to the ground; . . . . a clay gutter is next made round the tree about

six inches from the ground, so arranged as to catch the milk; . . . . incisions may now be made in the bark with the mallet and chisel, commencing near the top of the cleared portion. a V-shaped cut is made in two strokes . . . . . a second V-shaped incision should be made about a foot below the first and others at similar distances down to the gutter at the base of the tree. Another set of incisions may then be made parallel to the first at about 10-12 inches from them, and other vertical rows of cuts may be made if there be sufficient room for them." The subsequent tapping was by intercalating fresh V's.

A little later, when Mr. J. Parkin was associated with Dr. Willis, the Ceylon method was subjected to further experiment. The vertical rows of Vs were one foot apart, and the first Vs in the rows also one foot apart. The second incisions were made midway between the first, and thus more or less six inches from them. The third incisions were between the first and the second incisions in every other of the now doubled interspaces, so that the number of cuts was not increased. Thus was the tapping continued (vide Willis, *Circulars 12-14 of the Royal Botanic Gardens, Ceylon,* 1899, p. 133). One tree carried eight rows of these superposed V's; others fewer according to girth. The making of wounds in the form of an X was tried and other variations of the principal scheme; but never was excision or reopening of the wound tried: and the conclusion was reached that "if a double cut be made, the V form is the best (p. 123). A carpenter's chisel and a mallet were used: and to planters it was recommended that the chisel be 1-1½ inches wide, and wedge-shaped.

It is most interesting to observe that the Malayan method had not touched Ceylon yet; and also that either place held to its own course, though soon after this Singapore was advised to abandon the method which Mr. Ridley had so successfully devised. This was in 1898 when Mr. Wickham, returning west from a stay in Polynesia, visited Singapore, and recommended the incision method of tapping of the Amazons, so familiar to him (*Annual Report, Botanic Gardens, Singapore, for 1898,* p. 6); but he did not carry his advice, and there is no record of any use of the method resulting; instead on the other hand not long after the bias towards the herring-bone excision method was asserted afresh (vide *Agricultural Bulletin of the Straits and F.M.S.*, ii., 1903, p. 45). Remarks published on page 332 of the Bulletin of 1902, give one reason why.

In 1896, one tree in the Waterfall Gardens, Penang, came under tapping; and Mr. C. Curtis who tapped it, used a herring-bone with three cuts on each side. There is a plate of this tree in the *Agricultural Bulletin of the Straits and F.M.S.*, for July, 1902, showing it as it was in the year 1902; and, although not very distinct, the reader may, therein observe the nature of the herring-bones used; several can be seen, the last nearly vertically above two others.

The four posts around the tree carried the low platform on which the tapper stood to reach the top parts of the last herring-bone.

Curtis clearly described his method in the *Agricultural Bulletin of the Straits and F.M.S.*, i., 1902, p. 511, thus: "A small perpendicular channel a foot or more in length, and about one eighth of an inch broad, but not deep enough to obtain much rubber is first made, and at the base of this is affixed the tin or other receptable to receive the latex. The channel is not subsequently enlarged: . . . . leading to this channel diagonally are made two or three incisions on either side which supply the latex, and from the upper surface of which a thin shaving is removed every morning, or every alternate morning . . . . . thirteen times which, with the initial opening of the cuts make fourteen operations."

In 1897, Mr. L. Wray tapped at Taiping, (*Malay Mail* of January 19, 1898, quoted in Ferguson's *All about Rubber*, p. ccxxxxiii.) and Mr. R. Derry at Kwala Kangsar, (vide *Perak Museum Notes*, ii., part 2, p. 101, as well as the last reference), both using the herring-bone. Later tappings by Mr. Derry at Kwala Kangsar are recorded in the *Agricultural Bulletin of the Straits and F.M.S.*, i., 1901, p. 20.

Curtis' plate referred to, and the expressed statements of Messrs. Wray and Derry show that the side cuts were opposite, and Mr. Wray remarked that in healing this proved disadvantageous, (*Perak Museum Notes*, ii, 1897, p. 96, reprinted in Ferguson's *All about Rubber*, 1899, p. c), for the covering up of the wound was slow at the points where two side cuts made with the vertical channel an unusually wide wound. He suggested with a diagram that the side cuts should alternate.

Experimental tapping, commenced in 1900 at Tjikeumeuh in Java, by Dr. Tromp de Haas, was by excising the lower edges of oblique cuts in series by a chisel on nine successive days (vide *Agricultural Bulletin of the Straits and F.M.S.*, iv., 1905, p. 286).

Tapping in Singapore was done over all the years about this time for various purposes, often for the instruction of a visitor and to demonstrate rubber: these tappings went unrecorded; but one is mentioned in the *Annual Report of the Botanic Gardens*, for the year 1900, page 7, wherein an attempt was made on a single tree five feet five inches in girth, to ascertain how long it required to tap it dry, and its wounds were reopened on eighty-four successive days until this happened. It is a pity that the subsequent history of the tree is unknown.

It is evident that other trees received a much lighter treatment.

Right from 1889 tapping seems to have been done irregularly; and the number of trees used for it apparently exceeded 150 by little, of which number 134 were standing in 1904.

In 1901 Mr. Ridley went on long leave; and with this what may be regarded as the first period of experimental tapping in the Botanic Gardens, Singapore, came to an end.

In the same year Mr. Stanley Arden came out from Kew to take charge of the Perak rubber plantations, etc. In his experiments at Sitiawan, in Perak (1901-02), the form of the wound varied greatly, but it was always excised (*Report on Hevea brasiliensis*, Taiping, 1902). He used at first a carpenter's chisel and a wooden mallet, but entirely discarded these later in favour of a very sharp pruning knife. He experimented with straight cuts at an angle of 30° six inches apart, six inches long in a vertical series of twelve (to find out which part of the trunk should be tapped) reopened ten times, five each day over twenty-four days; and (2) V-cuts in series of five or of twelve, each limb six inches long and the angle as before, reopened five times or ten times over twenty-four days or twelve times over twenty-four days; and (3) herring-bone cuts at different heights, each vertical channel 2½ feet long draining six side channels in all, each one foot long, reopened on fourteen consecutive days; or (4) herring-bone cuts one foot long with three feeders two on one side and the third on the other, eight inches long and one foot apart, reopened on eight consecutive days.

The conclusion was reached that cuts or small herring-bone cuts on the lower part of the trunk not above six feet appear desirable (p. 11).

Mr. Derry at Kwala Kangsar in this year was using herring-bones with the "centre channel about four feet" long having "five oblique cuts on each side"; three herring-bones were made on each tree (Annual Report quoted in *Agricultural Bulletin of the Straits and F.M.S.*, i., 1902, p. 327).

When Mr. Ridley returned from leave in 1902, it appears that more regular tappings were instituted in the Botanic Gardens; and when on July 1st., Mr. A.D. Machado joined the department, the latter took charge of the work. Herring-bone incisions were used (vide *Agricultural Bulletin of the Straits and F.M.S.*, ii., 1903, p. 45): and in one or two they were carried up to an unusual height as is seen in the plate included in this number. The plate in question well shows how the side cuts were opposed in spite of Mr. Wray's excellent advice.

In February 1903, a Monsieur Bonnechaux, who had lived among the seringuieros of the Amazons, visited the Gardens, and advised against the excision method in use, saying that it would kill trees in the Amazon region very rapidly; and he recommended the incision method that he had used himself in Brazil. So far he carried his point that under his direction 150 trees were tapped (vide *Agricultural Bulletin of the Straits and F.M.S.*, ii., 1903, p. 45). Some of these trees were virgin, but many had been tapped before.

Scars of a Herring-bone tapping which was carried to an unusual height.

Economic Gardens, Singapore.

It is interesting that M. Bonnechaux only a few months after Mr. Arden had remarked on "the rapidity with which the wounds heal" *(Report on Hevea brasiliensis*, p. 13), should have insisted so strongly that the trees tapped by herring-bones "would in the Amazons be speedily destroyed by insects attacking the exposed wood" (l. c., p. 45) and obviously M. Bonnechaux's knowledge of Malayan conditions was slight. Nevertheless Mr. Arden had feared to reopen the cuts that were becoming wide, and had desisted from tapping in every case beyond the fourteenth time. But on the whole the remarks of both men really point us to the amount of damage that was done by the tapping implements used. *

After M. Bonnechaux's few days stay were over, Mr. Machado continued to tap as started by him, but using only 100 trees. He tapped from March 4th. to May 27th. *(Agricultural Bulletin of the Straits and F.M.S.*, ii., p. 47, 112, and 264). He made one cut only with the axe on each of the first five days, and then two cuts to each tree on each of the next four days, and then ten cuts four times on twenty trees or five cuts once on forty trees but thereafter four cuts for the most part on every other day up to twenty three repetitions.

These 100 trees so treated were certainly chosen from among the 150 tapped by M. Bonnechaux; and it is recorded that they all stood in the triangle of the plantation near to the entrance gate (l.c., p. 46), which we now call Block 1.

Tapping at this date was done no longer in the evening, but in the morning.

"Conjointly ten large trees growing under more favourable circumstances than the hundred were tapped eighteen times in seventy-five days" *(Agricultural Bulletin of the Straits and F.M.S.*, ii., 1905, p. 113, vide also p. 266) by M. Bonnechaux's method. These trees can only be those standing in a row which were the oldest that the Gardens possessed. It is recorded along with this information that in previous years they had been very heavily tapped by the herring-bone method (p. 112). "Very heavily" in this case would mean that they were abundantly scarred by reason of the repetition of tapping in different parts of the trunk, not that they had been submitted to any continued tapping.

Mr. Machado now set aside another 100 trees, and tapped them by M. Bonnechaux's method twenty-three times in thirty-three days, commencing on May 29th., (l.c. p. 265). One cut was made on the first day and on the four following days; two cuts were made on the next four days, then four, and after that more up to ten cuts. The reader by turning to the plate issued with the *Agricultural Bulletin of the Straits and F.M.S.*, for November, 1903, may note

* Many were fully aware of this. Mr. Ridley in 1897 (*Agricultural Bulletin of the Malay Peninsula*, No. 7, p. 136) and the writer of the article "rubber" in *Spon's Encyclopaedia* had alike suggested a guard on the knife put into a coolie's hand for tapping.

the ten cups on a tree. Mr. Machado also tapped a further lot of ten trees six times commencing May 29th. (l.c., p. 266) by M. Bonnechaux's method. In the *Straits Times* of April 16th, 1903, the cuts are said to have been 1½ inches long by ⅛ inch wide, and in the *Straits Echo*, (reproduced in the *Tropical Agriculturist* of September 1st, 1903, p. 154) it is said that the cuts made were two inches long.

Next, commencing on July 8th. 5 large trees were tapped fifteen times in nineteen days by herring-bones, a semicircular chisel being used for the reopening of the wounds. The reader will note the change in the shape of the chisel used: and it is interesting to record that on the Bukit Lintang Estate in Malacca, tapping in 1904 was done by means of a similar implement (vide *Tropical Agriculturist* for October 1st., 1904, p. 240).

At the end of July, 1903, Mr. Machado left, and Mr. C. Boden Kloss came. Tapping was continued and Mr. Kloss informs the writer that he corroborated Mr. Machado's results.

With Mr. Kloss' departure ended the second period* of tapping in the Singapore gardens.

During this short period it was realised that the trees are resistant enough for tapping much more prolonged than anything done previously, if only the tapping be wisely done. Machado had bled trees on every other day for six months (vide *Straits Times* of April 16, 1903, reprinted in the *Tropical Agriculturist* of June 1st, 1913, p. 839); and it was written "From 100 trees averaging from 12 to 15 years of age, and planted much too closely to admit of their being properly developed, Mr. Machado drew on an average about three pounds of dried rubber daily and he expects the supply to be maintained for six months working half the trees each day during that period. Then these trees will be given a rest of six months." Much in contrast with Machado's results is a statement made in *Teysmannia*, 1903, No. 8, to the effect that it had been possible at Soebang in Java to reopen half herring-bone cuts on alternate days only ten times and at Buitenzorg only fifteen times.

Four government trees in Malacca, fourteen years old, were tapped by herring-bones in 1903 by Mr. Gagliardi on eight days, and then by two herring-bones on fourteen days (*Agricultural Bulletin of the Straits and F.M.S.*, ii., 1903, p. 191).

With the coming of Mr. R. Derry to Singapore in the commencement of 1904 fuller records of tapping in the Botanic Gardens

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* In summary it may be stated that to this date the Garden's trees had been tapped thus:—

Tappings by Mr. Ridley,—number of trees unrecorded 1889-1903.
Tappings by Mr. Bonnechaux—150 trees for a few days.
Tappings by Mr. Machado—215 trees, 100 having been virgin.
Tappings by Mr. Boden Kloss,—a continuation of the last.

Greatest number of trees tapped as indicated by these records 250, being 150 by M. Bonnechaux and 100 virgin trees by Mr. Machado. How many over and above this figure had been tapped it is impossible to state, but it is believed that the number was small.

commenced. In the first place all the standing trees—1285—were numbered serially, and a record of their condition compiled. From this record we learn that the standing trees which had been tapped were 234; therefore at least sixteen had died in the last year. And from the same useful record we learn which trees were of 1877 and some of other years.

Under Mr. Ridley, Mr. Derry now set out "to experiment on the . . . . trees planted in 1886, 1887 and 1888" (*Agricultural Bulletin of the Straits and F.M.S.*, iii., 1904, p. 332), having before him a series of objects, one being for instance to ascertain in what part of the day tapping should be performed; another to demonstrate how incision after the Brasilian method is inferior to excision; a third to enquire into the relative value of distributing lines of excised cuts over the bark against making a single excised line, and so on. With the results on latex, we are not here so much concerned as with the amount of cutting that the experiments involved and the way in which it was done. By the end of 1904 Mr. Derry had tapped 850 trees.

Four reports were published on the experiments of the year. The first was over Mr. Derry's name and appeared in the September number of the *Agricultural Bulletin of the Straits and F.M.S.*, where despite the month given on the cover of the part, it carried the record of tapping into October; the second appeared as a continuation of the first in the November number of the Bulletin and prolonged the record to the middle of that month, and the third in the April and May, 1905, numbers; the fourth under the joint names of Messrs. Ridley and Derry was a Report to Government, dated 7th. November, 1905, which was printed separately and also in the *Agricultural Bulletin of the Straits and F.M.S.*, for November, 1905, vol. iv., 1905, p. 424. From the prefatory remarks to the last cited it is learned that tapping was done in March, April, May and June, but that this was not altogether satisfactory, so the recorded experiments actually were dated from July 4th.

Experiment I of 1904, had for its first object the ascertaining of the time of day—morning or evening—at which trees should be tapped; and it had as a second object the comparison of M. Bonnechaux's Brasilian method with excision along oblique cuts. Instead of the small axe after the Brasilian model which had been made for M. Bonnechaux, a half-inch carpenter's chisel was used; the cuts were distributed all over the lower part of the trunk of the trees set aside for the purposes. Ten cuts were made per diem. The same implement was used for making the oblique cuts on the trees of the contrasting part of the experiment. The tapping of these trees was by superposed converging or diverging cuts—the cuts in two series not near enough to make Vs or inverted Vs; in some of the trees the cuts converged downwards and in others diverged downwards. In a comment Mr. Derry described the design as "a herring-bone without a central channel;" but the description is

hardly good, regardless of its paradox, for the two series seem to have been separated by at least four inches of uncut bark. The lower edge of the cuts was excised at each tapping. Two excellent illustrations of this method of tapping were given on page 168 of the *India Rubber Journal*, for July 31st, 1905, the trees being No. 196 and another now dead; further, tree 152, similarly tapped, can be seen in one of the illustrations on page 166.

Experiment 2 also compared morning with evening tapping; and it compared Bonnechaux's Brasilian method, subject to the change above noted in the tool used, with tapping by ten long oblique cuts reopened at different intervals of time, and with herring-bone tapping.

Mr. H. Overbeck has very kindly put at the writer's disposal a photograph of tree No. 174 which shows the scars of the tapping after Bonnechaux, done on that tree in 1904. Tree 356, treated in the same way, was figured in the plates attached to the November, 1905, issue of the *Agricultural Bulletin of the Straits and F.M.S*, and tree 148 was excellently figured in the *India Rubber Journal*, for July 31st, 1905, page 166, as well as others now dead on page 169. Mr. Overbeck's photograph is here reproduced on plate 2 (p. 249). Ten of the little cuts seen in it were made daily in the experiment. The first contrast to it was of tappings by converging cuts superposed in a series—just as described under experiment I; and the second contrast to it was of herring-bone tapping. The herring-bone tapping of this year has been well illustrated. A plate showing a herring-bone scar of 1904 on tree No. 2 was given with the issue of the *Agricultural Bulletin of the Straits and F.M.S.*, for July, 1908: another plate of tree No. 2, is issued with this number which also shows a herring-bone scar of the same year. The plate issued with the number for June, 1905 of a tree now dead shows the scar of 1904 which has ten side cuts, as well as the ends of an earlier scar which has but eight. This tree was one of a row figured on page 167 of the *India Rubber Journal*, of July 31st, 1905, more of which are there seen to have been tapped in the same way in 1904. A plate prepared long ago, but only now issued with this number shows a scar of the year on the tree No. 7 with five cuts on one side and six on the other. It is on the whole evident that herring-bone tappings of this year had generally five cuts on each side. It also evident that in making the converging cuts of the contrast, there were five pairs of converging (or diverging) cuts, so to give approximately the same amount of cut surface in each case. But of course in the imitation brasilian tapping the cuts being short, very much fewer laticiferous vessels would be made to bleed than in the two contrasts; and naturally the method produced much less rubber; the experiment thus was a not quite fair one; but with the results in rubber we are here little concerned. In connection with the cutting resulting, the reader's attention is specially directed to the last quoted plate; for in it the pruning knife, used in making the first cuts and sometimes afterwards, is distinctly seen.


7

Experiment 3 may be called a variant of experiment 2; but 5 cuts only were made daily in those trees given over to the modifcation of M. Bonnechaux's method. Tree 342 which was one of the trees tapped by five cuts daily, can be seen in illustration 6 on page 163 of the *India Rubber Journal*, July 31st, 1905.

Experiment 4 while repeating the morning-versus-evening experiments, contrasted the results of daily and alternate day tapping by the use of the herring-bone method.

Experiments 5 and 6 were an elaboration of experiment 2.

The year's results were held to condemn afresh, the brasilian method of M. Bonnechaux, although, as said, from the point of yield it had a hardly fair trial; they indicated morning tapping as the right thing, and they suggested that alternate day tapping by herring-bones would yield more than daily tapping per unit of labour. Incidentally the inconvenience of multiplying the number of cups on the trees became evident, although the ten long cuts converging in pairs did yield at a high rate.

In no single case were the cuts reopened more than twenty-eight times; for it was feared that the tree might thereby be killed. It had become more clearly recognised that the tapping implements used were ill-suited to the purpose; and in the end of the first of the reports Mr. Derry pointed out that the danger lay in the depth of the incision and not in the quantity of surface removed; he added that the half inch carpenter's chisel "is not an instrument that can be commended, as apart from the possibility of punching too deeply, there is also the danger of raising the bark." It has been mentioned above that Mr. Arden discarded it.

The carpenter's gouge which at this time was being used on the Bukit Lintang Estate, was there too recognised as liable to cause injury and the tapping was limited to two short periods per annum of only fifteen days—fourteen reopenings.

The year 1905 was hardly an experimental-tapping year as regards the trees in the Botanic Gardens, Singapore, used in 1904; for though the trees were tapped, they were treated in a tapping rotation; and they were all cut in herring-bones, but with varying periods of reopening. A report appeared in the *Agricultural Bulletin of the Straits and F.M.S.*, v., 1906, p. 439.

The trees which had made experiment I, in 1904, were all tapped alike, and twice within the twelve months—just a little more boldly than were the trees of the Bukit Lintang Estate, for there were twenty-four and twenty-one reopenings of the wound at the respective periods. The trees of experiments 3, 4, 5 and 6, at a different time for each group, were tapped alike. But as there had been a considerable number of deaths among the trees either by wind or by *Fomes* or by other causes, new trees were put into the tapping rounds to

make up the numbers. The trees which had made experiment 2 in 1904 only, were not all treated alike,—this not by varying the tapping but by deferring it in the case of a part of the trees so that the resting intervals became unlike.

There was, however, an experiment in tapping, which was called 7, but which will be called Experiment U here to distinguish it from a later experiment 7. Experiment U was an attempt to estimate the relative values of daily and alternate day tapping, and is to be regarded as the conclusion of the experimental work of 1904.

But besides the working of these trees by Mr. Derry into a tapping rotation, there was other tapping done in the Plantation in the early part of the year. In the first place Mr. Ridley tapped about 24 trees for various purposes; and in the the second place, Mr. Burgess, then Government Analyst in Singapore was allowed the free use of a considerable number of trees, whence he drew latex for experimental work in factory processes. There is no record of the way in which these trees were tapped, but reason to believe that new tapping tools were used and designs of cuts were tried.

Tapping knives were not used as far as is known, in Mr. Derry's tappings of the year; but the tapping was done as before with the pruning knife and chisel. The Ceylon Gardens at the time were using tapping-knives, for Mr. Herbert Wright who was then in charge of rubber work at Heneratgoda, which he had systematised in October, 1904 (*Tropical Agriculturist*, xxv., 1906, p. 309), was employing the Northway-Bowman knives in his tapping. And already on the Culloden Estate on seven trees from 1891 "every known method of tapping" had been tried (*Tropical Agriculturist*, May 2, 1904, p. 764). The first record of the use of tapping knives in the Singapore Botanic Gardens in Mr. Derry's experiments was early in 1906, when several sets of this particular knife (the set is of three knives) were procured from Ceylon, and tried, but it is believed without finding favour; and when a little later a tapping knife, was definitely adopted in the Singapore Gardens, after various trials, it was of the farrier's knife pattern as described in the following statement * by Messrs. Ridley and Derry, (*Agricultural Bulletin of the Straits and F.M.S.*, v., 1906, p. 460)." The implement capable of making the cleanest and quickest incision is the ideal one. This we have found in an English . . . . modified farrier's blade adjusted by a screw in a sliding socket . . . . Nearly all invented knives or tools have been experimented with at the Botanic Gardens; some have been found unhandy, others unsuited for coolie use, and some much too fragile."

The application of the farrier's knife to rubber has a long record. As for back as 1872, Collins had described and figured a form of it

* The statement occurs in the report on the Tapping experiments of 1905, but was written towards the end of 1906.

Photo by] [*H. Overbeck, Esq.*

Photo by] [*H. Overbeck, Esq.*

Spiral tappings of trees Nos. 2130 (on the left) and 2. The scars of an older herring-bone tapping may be seen on tree No. 2.

used for marking timber in Germany, suggesting that it should be tried for tapping rubber trees. His suggestion however did not bear fruit and was forgotten as planters had no need of tapping knives. History repeated itself and the same idea came forward again when Wray to help on his experiment at Taiping made what was but a small modification of the same knife. Later, it seems quite independently, Mr. F. A. Stephens, then manager of the Jebong Estate in Perak, reproduced the device. Though we call it the Jebong knife now, the principle and its application to rubber are much older than rubber on the Jebong Estate. Its simplicity is the chief cause why it has found favour in the Malay Peninsula: whereas ingenious patents have generally been the produce of Ceylon.

In 1906, experimenting was renewed in the Botanic Gardens, at Singapore, the trees which had served for experiments 4 and 5 in 1904 being used, while those which had made the other experiments were tapped in rotation as in 1905. To all groups additional trees were added where death had made gaps. These additional trees were a very mixed lot: some had been tapped before 1904; some had been tapped by Mr. Ridley in 1905; some had been tapped by Mr. Burgess in 1905; some had been part of experiment U; and some were virgin. Added to the experiments now was an experiment 7 a comparison of herring-bone tapping with spiral tapping and at the same time a trial of the pricker. Spiral tapping was also done on other trees in two forms, one a genuine spiral or "full spiral," the other intermediate between spiral and long oblique tapping or "half spiral." These two forms of tapping, both of which in the Gardens' records and in Ceylon were alike called "spiral," are illustrated in plate 5 herewith published. The reader with that before him will for himself realise how very much more the descending sap current is interfered with in the one than in the other. Tree No. 2 which is that in the right hand figure had seven five and a half feet long cuts made in it: these are shown and also there may be seen herring bone cuts of 1905 and 1906 made when the tree was in experiment U or in experiment 6. The same tree was figured in an earlier stage in the plate published with the July 1908 number of the *Agricultural Bulletin of the Straits and F. M. S.* The tree again makes plate 4 of this issue, as it was at its death in 1914, which may be compared with the tree figured in the *Tropical Agriculturist*, xxv., 1906, opposite p. 724: and the plate of the full spiral may be compared with that opposite p. 644.

In 1907, Mr. Ridley took leave on April 22nd, Mr. Fox replacing him, and Mr. Derry proceeding to Penang. Mr. Fox thus took charge of the rubber work, being aided from August to November inclusive, by Mr. C. Boden Kloss who returned to the Gardens for this short time. Mr. Fox maintained the tapping: and the records which he kept are a monument to his diligence. One new experiment was instituted by Mr. Boden Kloss, a comparison of single and twin basal cuts. This experiment was described in the *Singapore Free Press* of

November 7th, 1907, under the title of "Base tapping for rubber trees." The basal tappings were contrasted with herring bone tappings. In the Gardens' records this experiment was called 8 but because there was framed later by Mr. Derry another experiment 8, the basal tappings will be called here V and W according to their degree, V for the single and W for the twinned basal cuts. Other trees which had been experimented with earlier were tapped in their groups, not exactly experimentally, but in a tapping rotation, in connection with which Mr. Fox started and Mr. Boden Kloss kept up a most extensive series of daily observations on the amount of latex which they yielded.

For some reason these valuable and extensive records were kept on separate sheets instead of in the usual books, or they were written up in books which became separated from the proper records, and it was only after weeks of search that the writer found among waste paper all those now recovered. It may be that some are lost, and if so this is a great pity, for the individual tree record is just what is wanted for the work now in hand.

Mr. Ridley returned early in 1908; and to the existing staff was added in April, Mr. T. W. Main, Mr. Derry being now on leave. Mr. Main took charge of the rubber-work together with other duties, which seem to have had preference so that the tapping recorded as having been done in 1908, is very meagre. Mr. Main informs the writer that one record which he kept, was destroyed by white ants. There is an incomplete record of an experiment done in the year on the trees which had served for the experiment 2 of 1904, in which half were tapped by a herring bone and half by basalV: but unfortunately it is unrecorded which trees were treated in the one way and which in the other.

Mr. Derry resumed charge of the tapping work in 1909.

First of all in that year, perhaps by mistake, a few trees, from among those which had made experiment 1 of 1904, were tapped twenty-seven times in thirty-one days. This tapping is here called Z. It did not extend to more than a small portion of the trees of either of the halves into which experiment 1 had been divided: but took some virgin trees.

After this, shortage by reason of deaths was made good by adding new trees to the groups: many of those added were from among trees tapped by Mr. Ridley and Mr. Burgess in 1905.

This done, tapping was recommenced on the old rotation, and into it two new groups of trees called 9 and 10 were introduced.

One real experiment, and one only, was done in this year, a comparison on the "chain gamma" method of making a herring bone which Mr. Boden Kloss had invented, with the ordinary herring bone.

This "chain gamma" was illustrated in the *Agricultural Bulletin of the Straits and F.M.S.*, vi., 1907, p. 389. In it the side cuts as of the herring bone alternate and each is prolonged downwards until it meets the next cut of the other side, its lower part thus serving as the conducting channel, the course of the latex flowing down to the cup being thus along a zig-zag which has feeders at each of its elbows.

"A third report on the experimental tapping of para rubber" was issued by Messrs. Ridley and Derry in the year, wherein (p. 2) it was observed that "tapping on alternate days showed an advantage over tapping daily" and which advocated tapping by a half herring bones following basal tappings. The report further contains much outside the subject of the treatment of the trees.

Although tapping knives had now been adopted in the Gardens and the damage to the trees had become very much less, the tapping periods were still kept short under the argument that the "crop of seeds was . . . . of the first importance . . . . and heavy tapping" might be "detrimental to seed production" and ought to be avoided. Therefore to carry through 30 successive tappings—sometimes a few more and sometimes a few less—was the course pursued; and after the tappings a prolonged rest was given.

In 1910 the last real tapping experiment was done on the Singapore trees. It was a comparison of the full herring bone with the half herring bone, and was done on the trees which had served for experiment 7 in 1906 and 1907. Whether it influenced planting opinion or not, it coincided with a breaking away from the old practice of many cuts.

In this year all the other tapped trees were tapped in a rotation, some of course at a season favourable for a large flow of latex, others at an unfavourable season. Comparisons of yield under such circumstances are not worth much and do not concern us: what does is that the trees were not being *tapped* in tapping experiments.

From the year 1911 to the end of the first quarter of the year 1914 the tapping rotation has been continued. In 1914 it was abandoned as it entailed unproductive work.

Mr. Derry's attention was meanwhile diverted to coagulating experiments, and in 1912 the retirement of Mr. Ridley gave him wider administrative duties, in consequence of which subordinates were left to carry out the tapping and to enter the results. The records of the years 1911 and 1912, have many mistakes in them. These mistakes the writer considers as cases of the copying of wrong numbers and not of the tapping of wrong trees, for it ought not to have been possible by carelessnees for these men to tap wrong

trees seeing how thoroughly Mr. Derry has numbered them: rather, a fault lay in neglecting to verify the written record after it had been made; and it is fortunate that it is no more, for had wrong trees been tapped the result would have been to render of little value the present attempt at constructing the past tapping-history of each tree. Instead the writer believes that he has been furnished with a fairly accurate record of how each of his possible seed-parents has been bled in the past. To have this knowledge is especially important if it be true that tapping interferes with the germinative power and perhaps other functions of the seed. In any case the knowledge of what has happened to the trees is a desirable adjunct to the work now in hand.

The following tables bring into one view the tappings as far as known. There are in all 156 variations, which can be briefly expressed by symbols. The serial tappings under Mr. Derry, Mr. Boden Kloss, Mr. Fox and Mr. Main are denoted in them by consonants thus:—

B. Denotes experiment 1 of 1904 and the rotation tappings which followed it.

C. Denotes experiment 2 of 1904 and the rotation tappings which followed it and also the incompletely recorded experiment 2 of 1908.

D. Denotes experiment 3 of 1904 and the rotation tappings which followed it

F. Denotes experiment 4 of 1904, the rotation tapping which followed in 1905, the experiment 4 of 1906, and the subsequent rotation tappings.

G. Denotes experiment 5 of 1904, the rotation tapping which followed in 1905, the experiment 5 of 1906 and the subsequent rotation tappings.

J. Denotes the experiment 6 of 1904, and the rotation tappings which followed in all subsequent years.

K. Denotes the experiment 7 of 1906 and of 1907 and 1910 with the subsequent rotation tappings.

M. Denotes the experiment 8 of 1909 and the subsequent rotation tappings.

N. Denotes the rotation tappings which were called "experiment 9" from the year 1909.

P. Denotes the rotation tappings which were called "experiment 10" from the year 1910.

R. Indicates the tapping of tree No. 2 which was intermediate between spiral and long oblique, practised on it in the years 1906, 1909, 1912 and 1913.

S. Indicates the true spiral tapping done on several trees in 1906.

Numerals after these letters denote the modifications of the experimental tapping to which the trees were submitted.

Vowels are used to denote the odd tappings which were done from time to time irrespective of any rotation, thus :—

A. Denotes tappings done before 1904.

E. Denotes tappings done by Mr. Ridley in 1905.

O. Denotes tappings done by Mr. Burgess in 1905.

U. Denotes an (apparently mistaken) tapping done in 1905 on twenty trees.

V. Denotes a single basal line cut in 1907.

W. Denotes a pair of these cuts at the same time.

Z. Denotes a mistaken tapping of a few trees done in 1909.

Q. Denotes the tapping of trees in block 2 in 1913.

In cases where a tree was not subjected to one of the rotation treatments from the very beginning, a small letter instead of a capital letter is used to denote its treatment, thus "b from 1906" means that the tree received treatment B from the year 1906: then "Ab from 1906" means that it was tapped before 1904 (A) and that it was put into rotation B in 1906 to make up the number of trees: OWMI, means that the tree was tapped by Mr. Burgess in 1905 (O), by two basal cuts by Mr. Boden Kloss in 1907 (W), and was put into "experiment 8" (M) by Mr. Derry in 1909 being one of the trees tapped by a half herring-bone (MI).

The total number of tappings under the different treatments comes out at a small number with regard to the days which elapsed between July 4th, 1904 and March 14th, 1914, when the old order of tapping was abandoned, *i. e.*, 3650; that is to say it was light treatment an regards removal of latex, but up to 1906 it was associated with considerable damage to the cambium in consequence of the nature of the tools used in tapping. All trees with the vowel A, E and O in their symbol are likely to have suffered from other injurious cutting. But such cutting is not associated with the later consonants of the alphabet M, N, P, Q, R, S and Z. But it is associated for two years with the earlier letters B, C, D, F, G, J, K and L.

TABLE

Understand "Days" after

Symbol.	Tapped before 1904.	Tapped in 1904.	1905.	1906.	1907.	1908.
AB1	Yes	Ten oblique cuts superposed in 2 series 15 in 18 with 394 rest	Complete HB. 25 in 25 with 73 rest: 22 in 22 with 174 rest	Complete HB. 25 in 26 with 366 rest	Complete HB. 31 in 44 with 594 rest	...
AZB1	do.	do.	do.	do.	Tapping same, but with 504 rest	...
B1	...	do.	do.	do.	as AB1	...
AB2	Yes	Ten Scattered not-reopened cuts, 15 in 18 with 394 rest	do.	do.	do.	...
AZB2	do.	do.	do.	do.	as AZB1	...
B2	...	do.	do.	do.	do.	...
Eb	...	...	Burgess	...	...	...
Ub.	...	...	Complete HB. 17 in 37 with 271 rest: 22 in 22 with 174 rest	as AB1	as AB1	as AB1
A f3b	Yes	as F3	as AB1	do.	do.	do.
AC1	Yes	10 Rather Long oblique cuts 16 in 52 with 354 rest	Complete HB. 21 in 41 with 43 rest: 24 in 25 with 279 rest	Complete HB. 25 in 51 with 278 rest	Complete HB. 28 in 82 with 205 rest	Either complete HB. or basal V. 34 in 65 with 229 rest
C1	...	do.	do.	do.	do.	do.

1.

each Numeral.

1909.	1910.	1911.	1912.	1913.	1914
Complete HB 30 in 35 with 150 rest: 30 in 34 with 89 rest	Complete HB. 32 in 33 with 82 rest: 31 in 31 with 75 rest: 29 in 34 with 118 rest	Half HB. 30 in 33 with 141 rest: 30 in 34 with 36 rest	Half HB. 59 in 66 with 152 rest: 30 in 33 with 138 rest	Half HB. 31 in 35 with 154 rest: 31 in 31 with 71 rest: 31 in 34	...
Complete HB. 27 in 31 with 59 rest: 30 in 35 with 150 rest: 30 in 34 with 89 rest	do.	do.	do.	do.	...
as AB1	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...
as AZB1	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...
Complete HB. 30 in 64 with 122 rest: 24 in 27 with 91 rest	Half HB. 33 in 36 with 106 rest: 31 in 32 with 170 rest	Half HB. 30 in 30 with 121 rest: 30 in 32 with 150 rest	Half HB. 59 in 66 with 112 rest: 30 in 33 with 138 rest	Half HB. 31 in 35 with 156 rest: 31 in 31	...
do.	do.	do.	do.	do.	...

TABLE

Understand "Days" after

Symbol.	Tapped before 1904.	Tapped in 1904.	1905.	1906.	1907.	1908.
AC2	Yes	10 Long oblique, cuts 18 in 21 or 22 with 384 or 385 rest	Complete HB. 21 in 41 with 43 rest: 24 in 25 with 279 rest	Complete HB. 25 in 51 with 278 rest	Complete HB. 28 in 82 with 205 rest	Either complete HB. or basal V. 34 in 65 with 229 rest
C2	...	do.	do.	do.	do.	do.
AC3	Yes	Complete HB. 18 in 22 with 384 rest	Complete HB. 21 in 41 with 72 rest: 25 in 27 with 250 rest	do.	do.	do.
C3	...	do.	do.	do.	do.	do.
AC4	Yes	Five Scattered not-reopened cuts, 14 in 17 with 389 rest	as AC1	do.	do.	do.
C4	...	do.	do.	do.	do.	do.
Ec1	...	...	Director: Complete HB. 21 in 41 with 43 rest: 24 in 25 with 279 rest	do.	do.	do.
Ec3	...	...	Director: Complete HB. 21 in 41 with 72 rest: 25 in 27 with 250 rest	do.	do.	do.
Oc	...	...	Burgess	...	...	...
Uc	...	...	Complete HB. 17 in 37 with 1541 rest	...	...	...
AD1	Yes	Long oblique, 15 in 33 or 34 with 347 or 348 rest	Complete HB. 18 in 35 with 61 rest: 25 in 25 with 260 rest	Complete HB. 25 in 51 with 280 rest	Complete HB. 28 in 68 with 215 rest	Complete HB. or Basal V. 27 in 64 with 234 rest
D1	...	do.	do.	do.	do.	do.

I.—*Continued.*

each Numeral.

1909.	1910.	1911.	1912.	1913.	1914.
Complete HB. 30 in 64 with 122 rest: 24 in 27 with 91 rest	Half HB. 33 in 36 with 106 rest: 31 in 32 with 170 rest	Half HB. 30 in 30 with 121 rest: 30 in 32 with 150 rest	Half HB. 59 in 66 with 112 rest: 30 in 33 with 138 rest	Half HB. 31 in 35 with 156 rest: 31 in 31	...
do.	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...
...	do.	do.	do.	do.	...
...	do.	do.	do.	do.	...
Complete HB. 30 in 60 with 257 rest: 28 in 33 with 273 rest	Complete HB. 30 in 32 with 155 rest	Half HB. 30 in 34 with 131 rest: 25 in 28 with 75 rest	Half HB. 59 in 66 with 112 rest: 30 in 33 with 138 rest	Half HB. 31 in 35 with 156 rest: 31 in 31	...
do.	do.	do.	do.	do.	...

TABLE

Understand "Days" after

Symbol.	Before 1904.	1904.	1905.	1906.	1907.	1908.
AD2	Yes	Complete HB. 18 in 20 or 21 with 360 or 361 rest	Complete HB. 18 in 35 with 61 rest: 25 in 15 with 260 rest	Complete HB. 25 in 51 with 280 rest	Complete HB. 28 in 68 with 215	Complete HB. or Basal V. 27 in 64 with 324 rest
D2	...	do.	do.	do.	do.	do.
AD3	Yes	Scattered not-reopened cuts, 23 in 26 with 355 rest	do.	do.	do.	do.
D3	..	do.	do.	do.	do.	do.
AD4	Yes	Complete HB. 15 in 32 with 348 rest	do.	do.	do.	do.
D4	...	do.	do.	do.	do.	do.
Ed.	...	...	Director: complete HB. 18 in 35 with 61 rest; 25 in 25 with 260 rest	do.	do.	do.
AOd.	Yes	...	Burgess	...	..	...
Od.	...	...	Burgess: Complete HB. 25 in 25 with 260 rest	as above	as above	as above
Ud.	...	...	Complete HB. 17 in 37 with 1545 rest	...	...	...
ACid.	Yes	as C1	..	as D	as D	as D
AF1	Yes	Complete H.B 18 in 21 with 358 rest	Complete HB. 25 in 25 with 117 rest	omplete HB. 25 in 25 with 251 rest; 25 in 27 with 310 rest	Complete HB. 41 in 60 with 222 rest	Complete HB. 31 in 38 with 331 rest
F1	...	do.	do.	do.	do.	do.

I.—*Continued.*

each Numeral.

1909.	1910.	1911.	1912.	1913.	1914.
Complete HB. 30 in 60 with 257 rest; 28 in 33 with 273 rest	Complete HB. 30 in 32 with 155 rest	Half HB. 30 in 34 with 131 rest; 25 in 28 with 75 rest	Half HB. 59 in 66 with 112 rest; 30 in 33 with 138 rest	Half HB. 31 in 35 with 156 rest; 31 in 31	...
do.	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...
...	...	...	...	...	...
Complete HB. 32 in 33 with 97 rest; 21 in 24 with 93 rest	Complete HB. 26 in 28 with 63 rest; 29 in 30 with 161 rest	Half HB. 30 in 31 with 113 rest; 30 in 33 with 106 rest; 30 in 34 with 39 rest	Half HB. 59 in 66 with 138 rest; 30 in 31 with 155 rest	Half HB. 30 in 31 with 155 rest; 30 in 57	...
do.	do.	do.	do.	do.	...

TABLE

Understand "Days" after

Symbol.	Before 1914.	1904.	1905.	1906.	1907.	1908.
AF2	Yes	Complete HB. 18 in 21 with 358 rest	Complete HB. 25 in 25 with 117 rest	Half HB. 25 in 25 with 151 rest; complete HB. 25 in 27 with 310 rest	Complete HB. 41 in 60 with 222 rest	Complete HB. 31 in 38 with 331 rest
F2	...	do.	do.	do.	do.	do.
AF3	Yes	Complete HB. 18 in 39 or 40 with 117 or 118 rest	do.	as AF1	do.	do.
F3	...	do.	do.	do.	do.	do.
F4	...	do.	do.	as AF2	do.	do.
Ef	...	...	Director	...	...	...
Of	...	...	Burgess	...	as above	as above
Uf	...	...	Complete HB. 17 in 37 with 379 rest	Complete HB. 25 in 27 with 310 rest	do.	do.
AF3d	Yes	as AF3	as D	as D	as D	as D
AG1	Yes	Complete HB. 15 in 34 or 35 with 311 or 312 rest	Complete HB 25 in 25 with 169 rest	Complete HB. 25 in 26 with 235 rest	Complete HB. 32 in 33 with 133 rest; 31 in 44 with 770 rest	...
G1	...	do.	do.	do.	do.	...
G2	..	Complete HB. 17 in 38 or 40 with 298 or 300 rest	do.	Half HB. 25 in 26 with 235 rest	do.	...
G3	...	Complete HB. 19 in 44 or 46 with 301 or 302 rest	do.	Complete HB. 25 in 26 with 235 rest	do.	...
AG4	Yes	Complete HB. 24 in 52 or 58 with 282 or 284 rest	do.	do.	do.	...
G4	...	do.	do.	do.	do.	...

I.—*Continued.*

each Numeral.

1909.	1910.	1911.	1912.	1913.	1914.
Complete HB. 32 in 33 with 97 rest; 21 in 24 with 93 rest	Complete HB. 26 in 28 with 63 rest; 29 in 30 with 161 rest	Half HB. 30 in 31 with 113 rest; 30 in 33 with 106 rest: 30 in 34 with 39 rest	Half HB. 59 in 66 with 138 rest; 30 in 31 with 155 rest	Half HB. 30 in 31 with 155 rest; 30 in 57	...
do.	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...
as D	as D	do.	do.	do.	...
Complete HB. 30 in 30 with 88 rest.	Complete HB. 30 in 31 with 148 rest; 30 in 30 with 128 rest.	Half HB. 30 in 30 with 136 rest; 30 in 33 with 133 rest.	Half HB. 59 in 66 with 191 rest; 30 in 35 with 133 rest.	Half HB. 30 in 36 with 233 rest; 30 in 44	...
do.	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...

TABLE

Understand "Days" after

Symbol.	Before 1904.	1904.	1905.	1906.	1907.	1908.
AG5	Yes	Complete HB. 24 in 52—58 with 282—284 rest	Complete HB. 25 in 25 with 169 rest	Half HB. 25 in 26 with 235 rest	Complete HB. 32 in 33 with 133 rest; 31 in 44 with 770 rest	...
G5	...	do.	do.	do.	do.	...
Og	...	...	Burgess	...	do.	...
AUG	Yes	...	Complete HB. 17 in 37 with 858 rest	...	do.	...
Ug	...	...	Complete HB. 17 in 37 with 236 rest; 25 in 25 with 169 rest	as above	do.	...
AJ1	Yes	Complete HB. 21 or 23 in 32 or 33 with 307-315 rest	Complete HB. 28 in 59 with 128 rest	Complete HB. 25 in 26 with 246 rest	Complete HB. 25 in 25 with 94 rest; 31 in 44 with 811 rest	...
J1	...	do.	do.	do.	do.	...
AJ2	Yes	Complete HB. 23 in 61 with 270 rest	do.	do.	do.	...
AZJ2	Yes	do.	do.	do.	do. except rest 503	...
J2	...	do.	do.	do.	as AJ1	...
AJ3	Yes	Complete HB 28 in 43 with 286 rest	do.	do.	do.	...
AZJ3	Yes	do.	do.	do.	do. except rest 503	...
J3	...	do.	do.	do.	as AJ1	...
Ej	...	...	Director	...	...	...
AOj	Yes	...	Burgess	...	...	...
Oj	...	...	do.	...	..	...

I.—*Continued.*

each Numeral.

1909.	1910.	1911.	1912.	1913.	1914.
Complete HB 30 in 30 with 88 rest	Complete HB 30 in 31 with 148 rest; 30 in 30 with 128 rest	Half HB. 30 in 30 with 136 rest; 30 in 33 with 133 rest	Half HB. 59 in 66 with 191 rest; 30 in 35 with 133 rest	Half HB. 30 in 36 with 233 rest; 30 in 44	...
do.	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	..
do.	do.	do.	do.	do.	...
Complete HB. 31 in 32 with 94 rest	Complete HB. 30 in 32 with 47 rest; 30 in 31 with 114 rest; 30 in 31 with 155 rest	Half HB 31 in 34 with 153 rest; 30 in 32 with 53 rest	Half HB. 59 in 66 with 191 rest; 30 in 35 with 138 rest	Half HB. 30 in 37	...
do.	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...
Complete HB. 27 in 31 with 277 rest; 31 in 32 with 94 rest	do.	do.	do.	do.	...
as AJ1	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...
as AZJ2	do.	do.	do.	do.	...
as AJ1	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...
do.	do.	do.	do.	do.	...

TABLE

Understand "Days" after

Symbol.	Before 1904.	1904.	1905.	1906.	1907.	1908.
Uj	...	...	Complete HB. 17 in 37 with rest; 28 in 59 with 138 rest	Complete HB. 25 in 26 with 246 rest	Complete HB. 25 in 25 with 49 rest: 31 in 44 with 811 rest	...
K1	...	...	...	Spiral without pricker 25 in 35 with 257 rest	Spiral 14 in 31 with 1042 rest	...
OK2	...	...	Burgess	Complete HB. 24 in 34 with 257 rest	Complete HB. 30 in 33 with 1040 rest	...
UK2	...	...	Complete HB. 17 in 37 with 1887 rest	...	...	..
K2	...	...	...	as OK2	as OK2	...
K3	...	...	...	Spiral with use of pricker, 25 in 25 with 267 rest	Spiral 30 in 33 with 1040 rest	...
EK4	...	...	Director	Complete HB. 25 in 25 with 267 rest	Complete HB. 30 in 33 with 1040 rest	...
OK4	...	...	Burgess	do.	do.	...
K4	..	...	...	do.	do.	...
EK5	...	...	Director	Double spiral with use of pricker, 25 in 25 with 267 rest	Double spiral 30 in 33 with 1040 rest	...
OK5	...	...	Burgess	do.	do.	...
K5	...	...	...	do.	do.	...

I.—*Continued.*

each Numeral.

1909.	1910.	1911.	1912.	1913.	1914.
Complete HB. 31 in 32 with 94 rest	Complete HB. 30 in 32 with 47 rest; 30 in 31 with 114 rest; 30 in 31 with 155 rest	Half HB. 31 in 34 with 133 rest; 30 in 32 with 53 rest	Half HB. 59 in 66 with 191 rest; 30 in 35 with 138 rest	Half HB. 30 in 37	...
...	Half HB. 26 in 29 with 160 rest; 31 in 33 with 150 rest	Half HB. 30 in 32 with 143 rest; 32 in 35 with 372 rest	...	Half HB. 31 in 34 with 250 rest: 30 in 41	...
...	Complete HB. 26 in 29 with 160 rest; 31 in 33 with 150 rest	do.	...	do.	...
..	do.	do.	...	do.	...
...	do.	do.	...	do.	...
...	Half HB. 26 in 29 with 160 rest; 31 in 33 with 150 rest	do.	...	do.	...
...	Complete HB. 26 in 29 with 160 rest; 31 in 33 with 150 rest	do.	...	do.	...
...	do.	do.	...	do.	...
...	do.	do.	...	do.	...
...	Half HB. 26 in 29 with 160 rest; 31 in 33 with 150 rest	do.	...	do.	...
...	do.	do.	...	do.	...
...	do.	do.	...	do.	...

TABLE

Understand "Days" after

Symbol.	Before 1904.	1604.	1905.	1906.	1907.	1908.
AK6	Yes	...	...	Complete HB. 20 in 33 with 267 rest	Complete HB. 17 in 33 with 1040 rest	...
EK6	...	...	Director	do.	do.	...
OK6	...	...	Burgess	do.	do.	...
K6	...	...	...	do.	do.	...
VM1	...	...	...	...	Basal Single cut. 30 in 33 with 8 rest; 33 in 41 with 663 rest	...
OWM1	...	...	Burgess	...	Basal pair of cuts 15 in 32 with 8 rest; 15 in 26 with 663 rest	...
WM1	...	...	...	...	...	...
M1	...	...	...	...	...	...
M2	...	...	...	...	...	...
VM3	...	...	...	...	Basal Single cut 30 in 33 with 8 rest; 33 41 with 663 rest	...
M3	...	..	...	...	...	...

I.—*Continued.*

each Numeral.

1909.	1910.	1911.	1912.	1913.	1914.
...	Complete H.B. 26 in 29 with 160 rest; 31 in 33 with 150 rest	Half HB. 30 in 32 with 143 rest; 32 in 35 with 372 rest	...	Half HB. 31 in 34 with 250; 30 in 41	...
...	do.	do.	...	do.	...
...	do.	do.	...	do.	...
...	do.	do.	...	do.	...
Half H.B. 30 in 33 with 35 rest; 28 in 30 with 114 rest	Complete H.B. 26 in 27 with 122 rest; 31 in 31 with 208 rest	Half H.B. 30 in 31 with 143 rest; 30 in 32 with 150 rest.	Half HB. 59 in 66 with 134 rest; 31 in 33 with 162 rest	Half HB. 30 in 36 with 203 rest	Half HB. 30 in 32
do.	do.	do.	do.	do.	do.
do.	do.	do.	do.	do.	do.
do.	do.	do.	do.	do.	do.
Two basal cuts, 30 in 33 with 35 rest: 28 in 30 with 114 rest	do.	do.	do.	do.	do.
Chain 30 in 33 with 35 rest: 28 in 30 with 114 rest	do.	do.	do.	do.	do.
do.	do.	do.	do.	do.	do.

TABLE

Understand "Days" after

Symbol.	Before 1904.	1904.	1905.	1906.	1907.	1908.
N	...	...	...	...	...	...
P	...	...	..	...	...	...
Q	..	..	...	...	...	...
AUR	Yes	...	Complete HB. 17 in 37 with 327 rest	Seven long oblique cuts, half spiral, 31 in 31 with 29 rest; 30 in 30 with 29 rest; 12 in 12 with 153 rest; 24 in 24 with 801 rest	...	...
S	...	...	...	Spiral 31 in 31 with 29 rest; 30 in 30 with 29 rest; 12 in 12	...	...
Z	...	...	...	..	...	...

I.—*Cotninued.*

each Numeral.

1909.	1910.	1911.	1912.	1913.	1914.
Complete HB. 34 in 40 with 152 rest; 29 in 37 with 60 rest; 26 in 31 with 102 rest	Complete HB. 30 in 30 with 139 rest; 30 in 30 or 31 with 199 or 200 rest	Half H.B. 30 in 30 with 138 rest; 30 in 31 with 109 rest	Half HB. 59 in 66 with 115 rest; 31 in 33 with 181 rest	Half HB. 30 in 36 with 207 rest	Half HB. 30 in 32
Two basal oblique cuts, 34 in 34 with 35 rest; 31 in 33 with 88 rest; Half H.B. 24 in 24 with 108 rest	Half H.B. 30 in 32 with 202 rest; 31 in 33 with 120 rest	Half H.B. 30 in 30 with 216 rest; 30 in 31 with 105 rest	Half HB. 59 in 66 with 234 rest; 32 in 33 with 162 rest	Half HB. 30 in 31 with 211 rest	Half HB. 30 in 30
...	...	...	...	Half HB. 37 in 45 with 225 rest	...
Seven long oblique cuts, 26 in 31 with 1,402 rest	..	...	Seven oblique long cuts, 20 in 20 with 348 rest	Seven oblique long cuts, 29 in 40	...
...	...	...	...	..	...
Presumedly complete HB. 27 in 31	..	...	..	...	...

Table II.

B. 1.	15 times tapped by two series of 5 superposed oblique cuts	
	255 times by a complete Herring-bone 242 times by a half Herring-bone ...	Total 612 days
B. 2.	15 times by scattered short cuts tree per diem, and after the first year, as B. 1	Total 612 days
C. 1.	16 times by two series of 5 superposed oblique cuts	
	98 times by a complete Herring-bone 34 times either by a complete Herring-bone or by Basals cuts	
	54 times by a complete Herring-bone 275 times by a half Herring-bone	Total 477
C. 2.	18 times by long Oblique cuts and after the first year, as C. 1 ...	Total 477
C. 3.	117 times by a complete Herring-bone 34 times either by a complete Herring-bone or by basal cuts	
	54 times by a complete Herring-bone 275 times by a half Herring-bone ...	Total 478
C. 4.	14 times by scattered slashes and after the first year, as C. 1 ...	Total 475
D. 1.	15 times by long Oblique cuts 86 times by a complete Herring-bone 27 times either by a complete Herring-bone or basal cuts	
	88 times by a complete Herring-bone 206 times by a half Herring-bone ...	Total 422
D. 2.	101 times by a complete Herring-bone 27 times either by a complete Herring-bone or basal cuts	
	88 times by a complete Herring-bone 206 times by a half Herring-bone	Total 422
D. 3.	23 times by scattered slashes and after the first year, as D. 1 ...	Total 430
D. 4.	15 times by a complete Herring-bone and after the first year, as D. 1.	Total 422
F. 1. & F. 3.	273 times by a complete Herring-bone 239 times by a half Herring-bone ...	Total 512

F. 2. & F. 4.	43 times by a complete Herring-bone	
	25 times by a half Herring-bone	
	205 times by a complete Herring-bone	
	239 times by a half Herring-bone ...	Total 512
G. 1.	218 times by a complete Herring-bone	
	209 times by a half Herring-bone ...	Total 427
G. 2.	42 times by a complete Herring-bone	
	25 times by a half Herring-bone	
	153 times by a complete Herring-bone	
	209 times by a half Herring-bone ...	Total 429
G. 3.	222 times by a complete Herring-bone	
	209 times by a half Herring-bone ..	Total 431
G. 4.	227 times by a complete Herring-bone	
	209 times by a half Herring-bone ...	Total 436
G. 5.	29 times by a complete Herring-bone	
	25 times by a half Herring-bone	
	153 times by a complete Herring-bone	
	209 times by a half Herring-bone ...	Total 416
J. 1.	251 or 253 times by a complete Herring-bone	
	180 times by a half Herring-bone ...	Total 431 or 433
J. 2.	253 times by a complete Herring-bone	
	180 times by a half Herring-bone ...	Total 433
J. 3.	258 times by a complete Herring-bone	
	180 times by a half Herring-bone ...	Total 438
K. 1.	39 times in a Spiral	
	190 times by a half Herring-bone ...	Total 229
K. 2.	111 times by a complete Herring-bone	
	123 times by a half Herring-bone ...	Total 234
K. 3.	25 times by a Spiral, a pricker used after the knife	
	30 times by a Spiral	
	57 times by a complete Herring-bone	
	123 times by a half Herring-bone ...	Total 235
K. 4.	112 times by a complete Herring-bone	
	123 times by a half Herring-bone ...	Total 235
K. 5.	25 times by a double Spiral a pricker used after the knife	
	30 times by a double Spiral	
	190 times by a half Herring-bone ...	Total 245

K. 6.	94 times by a complete Herring-bone 123 times by a half Herring-bone ...	Total 217
VM. 1.	63 times by a single basal Oblique cuts 58 times by a half Herring-bone 57 times by a complete Herring-bones 210 times by a half Herring-bone ...	Total 388
WM. 1.	30 times by a apair of basal Oblique cuts the rest as above, i. e., after the first year, as VM. 1 ...	Total 355
M. 1.	As VM. 1 and WM. 1, but without the first line	Total 325
M. 2.	30 times by two basal cuts 57 times by a complete Herring-bone 210 times by a half Herring-bone ...	Total 297
VM. 3.	63 times by a single basal cut 30 times by a chain-gamma 57 times by a complete Herring-bones 210 times by a half Herring-bone ...	Total 360
M. 3.	As VM. 3, but without the first line	Total 297
N.	179 times by complete Herring-bones 210 times by half Herring-bones ...	Total 389
P.	65 times by two basal Oblique cuts. 296 times by half Herring-bones ...	Total 361
Q.	37 times by half Herring-bone ...	Total 37
VR.	17 times by complete Herring-bones 172 times by seven long Oblique cuts	Total 199
S.	61 times by Spiral	Total 61
Z.	27 times by (it is believed) a complete Herring-bone ...	Total 27

As is common knowledge to readers of the Gardens' Bulletin, rubber seed is sold from the Gardens from little tapped trees. The seed bearers are the trees of the letters above, Q excepted. The maximum amount of tapping—on B—comes to less than 17 in every 100 days.

The old tapping rotation has been swept away. It entailed a great deal of unnecessary labour because the trees simultaneously tapped were scattered all over the rubber ground. It was stopped in March, 1914; and instead from May, 1914, the trees of the Gardens have been and will be tapped by blocks or fields as nearly as possible equal. The new arrangement was put into force when in 1914,

Mr. J. J. Bradbery temporarily joined the staff of the department, his planting knowledge peculiarly fitting him for the work. Another change was also initiated; the half herring-bone had always been to the right of the drainage channel; but from 1914 as far as the bark of the trees permits, it has been transferred to the left.

Block 1, as now constituted contains trees numbered between 23 to 416, and intercalations numbered, 1289, 2143 to 2145, 2160 to 2189, and 2505 to 2508. The trees with numbers up to 416 were planted in 1884-1887, except No. 362 and the intercalations which are much younger. Losses by death have been considerable in it. Of the now standing older trees, rather more than one half were tapped before 1904, seventeen were tapped by Mr. Burgess, in 1905 and five were tapped in the group called U. Very few trees escaped tapping in 1904, and those that were tapped fell into every possible group of tapped trees. Of the few trees which were not tapped in 1904, most were tapped in 1905 in one way or another and later (if tapped by Mr. Burgess) incorporated in a rotation. The trunks are much burred and tapping is now difficult. The block is on the left of the path in the lower figure of plate opposite page above.

Block 2, contains trees numbered 2509 to 3004, 3010 to 3042, 3045 to 3048 and 3051 to 3052. All were planted in the year 1904 and so are eleven years old. None were tapped before 1913, when they entered the rotation under the number 11, which in the tables 1 and 2 is indicated by the letter Q. In 1913 groups of trees received artificial manure in different ways, and the whole block was limed as a preparation. Except for the manuring, in age and treatment all the trees are exactly alike; they are evenly spaced, the lines intersected by ditches.

Block 3 contains trees numbered 832 to 1211 with the exception of trees 998 and 999, and contains also 2132, 2140 and 2141, 2134, 2137 to 2139, 3006 to 3008 and 2043 to 3049, as well as a few yet some way from flowering and not yet numbered. The trees with the lower numbers were planted in 1887 both rather irregularly and very much too closely. Only two of the now standing trees were tapped before 1904. A considerable number were tapped by Mr. Burgess (48) and the Director (20) in 1905. About one hundred went into rotation K, and nearly eighty into rotation J. At first no trees went into the rotations lettered B, C and D; but when trees were wanted to replace deaths in these some of them were taken from this Block. Very few went into G. In a general way it may therefore be said that the tapping of the block commenced only in a small way in 1904, chiefly in the rotation J, and a little in F, and that of the many trees untapped in that year, most were tapped either by Mr. Burgess or Mr. Ridley or in rotation K in the next year. In 1907 there was a fresh distribution of the trees not in any rotation, some going to rotation M, and others to various of the rotations and in 1907 another distribution occurred. The number of trees which have died is proportionately half of that in Block 1.

Blocks 4 and 5 are parallel to one another, and contain trees diverse in age. At the south and north ends of block 5 are irregularly placed old trees, the middle part being occupied by isolated older trees among young trees which except for unreplaced deaths are fairly regularly placed. The numbers lie between 435 and 686, 830 and 831, 1290 and 1681 excluding 1480 and 1674 to 1678. The older trees, those with numbers between 435 and 686 were planted—a few in 1884, the majority in 1887: trees 830 and 831 are of 1887. Exact records are lacking in regard to other trees, but their ages vary greatly. Very many trees have been lost from among the oldest. Of those still standing, only four were tapped before 1904. In that year about thirty went into rotation D, rather more into rotation F, twice as many into rotation G, and a few into J. In 1905 a few trees were tapped by Mr. Burgess. In 1909 nearly one hundred and twenty trees were put into rotation N. At the present date there are many trees still unripe for tapping.

Block 5 bears trees numbered between 687 and 828 with the exception of trees 809 to 819, and again between 1674 and 1996 except 1843 and 1844. There are many more old trees on the block than on block 5, the lower numbers among them being all recorded as planted in 1887. The planting is more irregular than anywhere else, and a large number of Casuarinas, Lagerstroemias, Sagos and Caryotas have been left intermixed until lately. Death has occurred extensively among the older trees, and especially from wind. Only one of the still standing trees was tapped before 1904. In 1904 sixty of the trees went into rotation F, G and J. In 1905, Mr. Burgess tapped a dozen other trees. In 1906 a few trees were tapped in rotation K, and in 1907 a few more in rotation M. One hundred more came into tapping in 1910, in rotation N and P. While over the years 1905 to 1912 various trees went into all the rotations except B and C for the replacing of others that had died. The tapping of the block has therefore been very diverse.

Block 6 is a small area with a slight slope containing all that are left of the oldest trees, intermixed with a great variety of other trees; in fact it is not a rubber block. The trees are numbered between 1 and 20, 1287, 2130, 2306, and 2826. The old trees had a variety of tapping, being the first used experimentally.

Block 7 like the last is not a rubber block, but contains scattered trees of Hevea, which bear the numbers 1220 to 1231, 1843 to 1844, 1860, 2114 and 2115, 2348 to 2350. They were seedlings either from seed beds or self sown. Several were tapped in 1907 as experiment W versus V, and then they went in 1909 into rotation M, where also others not tapped in the experiment were placed.

Adjoining block 5, with block 7 on its south side and block 12 on the east is a part of the Lower Garden kept under sago for the present, which will be used for rubber cultivation soon, and will then be divided into four blocks, Nos. 8-11. Scattered rubber trees have

been planted or sprung up self sown on its north side, which bear the numbers 807 to 819 and 1997 to 2113 and younger unnumbered trees are in its South-east conrer. Six were placed in 1908 in rotation M and two used in 1910 for replacing losses in rotation J.

Block 12 was planted up with Hevea in 1913 and has not been tapped yet. The trees bear the numbers between 3101 and 3511. Between every two rows is a ditch. The planting is regular. In 1913 the trees row by row were manured in different ways, otherwise they have all had the same treatment and are all of the same age.

Block 13 contains two rows of old rubber trees, bearing numbers between 1232 and 1254, and between 2116 and 2129, as well as some quite young trees. The old trees were planted in 1896 and 1897. All of them were tapped for 1909, in rotation M, but a few had been tapped in 1907, in the experiment W versus V.

Hevea trees occur in three groups on the Arboretum slopes. There are trees 1212 to 1215 close to the Economic Garden office, trees among which are Nos. 1255, 1256 and 2191 near the Dalvey road, and trees Nos. 1257 to 1281 and 2215 to 2248 near the Assistant Curator's quarters. There is also one numbered tree in the Botanic Gardens in the part nearest to the last, No. 1283. The number of then scattered trees used to be larger for very many associated trees were removed in 1911, on the building of the Assistant Curator's house. Most of such as still stand were tapped by Mr. Burgess in 1905. One was in rotation J from 1904 of another was used to replace a lost tree in rotation J from 1905, a third to replace a lost tree in rotation B from the same year, a fourth from 1909 in rotation G, and a fifth from 1912 in rotation M.

The number of trees in the Garden, which have been registered was about three thousand and three hundred, but the standing trees are now about three thousand. Latterly in trying to improve the plantation the removals have been considerable. In the following table an attempt is made to bring into one view the changes which have occurred in the number of trees of ten years and upwards. As regards most of the trees the age is fairly well known; it was recorded by Mr. Derry in a book, in the year, 1904, as stated in the *Annual Report of the Botanic Gardens* of that year; and similarly the age is known of the youngest trees; but there are a number of self-sown trees the age of which is uncertain. Judging from the girth measurements recorded in 1904, 1906, 1907 and 1909, these trees for the purpose of the table have been assigned to probable years; and though as regards individual trees the error may be considerable, as regards the trees taken collectively it is probably small. The deaths were not recorded before 1904, and are known approximately only for the year 1903. Allowance has been made for a fair proportion. From these trees seed crops have been collected as stated in tables.

TABLE IV.

The Gardens' Seed-Bearers.

Age.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.	1911.	1912.	1913.	1914.	1915.
10 years ...	1310	4	2	4	5	5	23	13	24	71	53	41	34	34	44	16	27	15	11
11 „ ...	95	1300	4	2	4	5	5	23	12	24	71	53	41	34	34	44	16	27	14
12 „ ...	—	90	1290	4	2	4	5	5	22	12	24	71	53	41	34	34	44	16	23
13 „ ...	42	—	85	1280	4	2	4	5	5	22	12	24	70	53	41	34	34	44	16
14 „ ...	—	40	—	80	1270	4	2	4	5	5	22	12	24	70	50	41	34	34	44
15 „ ...	—	—	38	—	75	1260	4	2	4	5	5	22	12	24	70	45	41	34	33
16 „ ...	—	—	—	36	—	70	1250	4	2	4	5	5	22	12	23	70	45	41	30
17 „ ...	—	—	—	—	34	—	60	1231	4	2	4	5	5	22	12	23	70	45	36
18 „ ...	—	—	—	—	—	32	—	35	1127	4	2	4	5	5	22	12	22	70	30
19 „ ...	—	—	—	—	—	—	30	—	34	1119	4	2	4	5	5	22	12	22	63
20 „ ..	9	—	—	—	—	—	—	23	—	34	1106	4	2	4	5	5	22	12	20
21 „ ...	—	9	—	—	—	—	—	—	20	—	32	1088	4	2	3	5	5	22	11
22 „ ...	—	—	9	—	—	—	—	—	—	15	—	32	1084	4	2	3	5	5	14
23 „ ...	—	—	—	9	—	—	—	—	—	—	11	—	32	1072	4	2	3	5	5
24 „ ...	—	—	—	—	9	—	—	—	—	—	—	11	—	32	1036	4	2	3	5
25 „ ...	—	—	—	—	—	9	—	—	—	—	—	—	10	—	32	1014	3	2	3
26 „ —	—	—	—	—	—	—	9	—	—	—	—	—	—	10	—	31	1072	3	2
27 „ ...	—	—	—	—	—	—	—	8	—	—	—	—	—	—	10	—	31	963	3
28 „ ...	—	—	—	—	—	—	—	—	8	—	—	—	—	—	—	9	—	31	863
29 „ ...	—	—	—	—	—	—	—	—	—	7	—	—	—	—	—	—	3	—	29
30 „ ...	—	—	—	—	—	—	—	—	—	—	6	—	—	—	—	—	—	2	—
31 „ ...	—	—	—	—	—	—	—	—	—	—	—	6	—	—	—	—	—	—	2
32 „ ...	—	—	—	—	—	—	—	—	—	—	—	—	6	—	—	—	—	—	—
33 „ ...	—	—	—	—	—	—	—	—	—	—	—	—	—	6	—	—	—	—	—
34 „ ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	6	—	—	—	—
35 „ ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5	—	—	—
36 „ ...	—	—	—	—	—	—	—	—	%	—	—	—	—	—	—	—	5	—	—
37 „ ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4	—
38 „ ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3
Total ..	1447	1434	1428	1406	1403	1391	1392	1353	1267	1324	1357	1378	1408	1430	1436	1419	1397	1400	1270

Only approximate.

TABLE V.

The Gardens' Seed-Crop.

YEAR.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
1897 ...	...	...	1,400	2,400	1,260	3,100	2,600	2,200	4,175	2,300	900	...	20,335
1898 ...	7,250	35,550	32,505	13,600	1,750	1,200	...	...	2,950	15,200	3,300	...	113,305
1899 ...	2,150	850	3,500	2,150	600	...	100	3,900	121,970	21,850	...	500	157,570
1900 ...	...	8,200	13,500	3,000	...	1,000	...	2,200	46,300	57,000	8,100	2,400	141,700
1901 ...	7,500	15,600	44,200	3,200	...	...	...	2,000	19,000	49,675	10,000	1,000	152,175
1902 ...	...	...	..	4,050	6,300	14,400	...	3,000	22,700	55,390	20,170	900	126,910
1903 ...	...	400	32,400	14,680	3,950	...	...	...	1,575	5,650	19,100	17,150	94,905
1904 ...	9,654	7,500	19,450	500	2,000	1,500	500	2,700	22,250	75,000	21,250	3,875	166,179
1905 ...	2,200	3,000	...	1,400	...	...	6,550	34,900	86,600	37,000	1,000	...	172,650
1906 ...	...	2,170	5,030	3,360	25,025	6,750	3,075	12,175	49,450	16,720	10,350	11,250	145,355
1907 ...	38,850	52,400	36,900	7,250	1,400	750	...	12,000	73,300	105,000	38,000	1,000	366,850
1908 ...	...	...	...	...	...	3,000	...	12,000	12,000	128,000	120,000	40,600	315,600
1909 ...	...	15,000	40,100	29,000	...	...	...	10,600	6,000	70,200	67,200	46,300	284,400
1910 ...	21,000	71,400	61,200	...	2,400	1,600	...	30,000	9,600	38,600	...	83,050	318,850
1911 ...	73,900	28,800	43,800	...	...	...	5,400	64,800	57,600	40,000	5,400	5,500	325,200
1912 ...	600	3,000	...	2,000	5,000	...	...	...	18,800	101,100	38,000	30,600	199,100
1913 ...	...	...	...	6,600	...	6,000	...	2,400	5,400	3,800	16,200	38,400	78,800
1914 ...	40,800	188,100	21,400	...	...	...	...	...	20,400	41,100	49,000	...	360,800

The average crop calculated on the whole of the eighteen years was 196,143 seeds. To eliminate the variation due to seasons, we may take the average of each five years, and then we get :—

Table VI.

Average of years	1897-1901	...	...	117,017
,,	1898-1902	...	...	138,172
,,	1899-1903	...	...	134,472
,,	1900-1904	...	...	136,194
,,	1901-1905	...	...	142,384
,,	1902-1906	...	...	141,020
,,	1903-1907	...	...	189,188
,,	1904-1908	...	...	233,327
,,	1905-1909	...	...	256,971
,,	1906-1910	...	...	286,211
,,	1907-1911	..	...	322,180
,,	1908-1912	...	...	288,630
,,	1909-1913	...	...	241,270
,,	1910-1914	..	...	256,530

The later figures show crops consistently larger figures than the average, the change commencing as table V shows with 1907.

It is not clear to what the increase is to be ascribed, though something may have been done by means of more thorough collecting ; and as commencing in 1904 the grass under the trees was cut over more often in order that the collecting might be better, the trees obtained a little more cultivation than they had, which increased, until now they are clean weeded, except in Blocks 6 and 8.

The yield of the years from 1907 forwards was at the rate of 281,200 seeds per annum, which at 144 seeds to the pound would be nearly 2000 lbs. per annum from about 1,400 trees, or of kernels about 1,200 lbs : and if these yield 42 per cent. of oil the return in oil amounts to just over 500 lbs. It is not convenient to write of the worth of this oil here :—a discussion on that subject with more details will be given in a later issue of this Bulletin. But meanwhile the Gardens records are useful in furnishing a rough estimate of what might be collected of this secondary product from matured rubber estates, where of course tapping would be more extensive than in the gardens, but the spacing of the trees much more appropriate.

That the trees, as is quite to be expected, tend to exhaust themselves in seeding, is evident from the way in which a particularly large cups is generally the sequel of a failure to seed, and is generally followed by a failure in the next seeding season falling about half a year later.

This is how the crops followed one another in the Economic Gardens, Singapore as shown by the records used in drawing up Table VI.

Year.	Early crop.	Late crop.
1897 ...	Insignificant	Small
1898 ...	Rather small—80,000	Small
1899 ...	Insignificant	Rather large—140,000
1900 ...	Small	Rather large—100,000
1901 ...	Rather small—60,000	Rather small—75,000
1902 ...	Small	Rather large—100,000
1903 ...	Rather small	Small
1904 ...	Small	Rather large—120,000
1905 ...	Insignificant	Large—150,000
1906 ...	Rather small	Rather small—90,000
1907 ...	Large—110,000	Very large—200,000
1908 ...	Insignificant	Very large—250,000
1909 ...	Rather small—70,000	Rather large—140,000
1010 ...	Rather large—140,000	Rather small
1911 ...	Rather large—140,000	Large—160,000
1912 ...	Insignificant	Rather large—140,000
1913 ...	Insignificant	Rather small—50,000
1914 ...	Very large—240,001	Rather large—110,000

I. H. B.

The

Gardens' Bulletin

STRAITS SETTLEMENTS,

into which is incorporated all that has been published as the third series of the Agricultural Bulletin of the Straits and Federated Malay States.

Vol. I. Issued August, 31st, 1915. No. 9.

CONTENTS.

To be purchased at the Botanic Gardens, Singapore; from Messrs. Kelly and Walsh, Ltd., No. 32 Raffles Place and 194 Orchard Road; and the Straits Times Office, Cecil Street, Singapore.

DEPARTMENTAL NOTICE.

Plants of the Avocado or Alligator Pear—*Persea gratissima,*—a few plants of the Brazil nut—*Bertholletia excelsa,*—and a few plants of *Eucalyptus corymbosa* to be sold within the Peninsula at fifty cents each.

Seeds of *Hevea brasiliensis*--Para Rubber—as available from trees, twenty-eight years old, to be sold at three dollars per thousand up to the number of ten thousand, and at two dollars and fifty cents for every further thousand on the same order.

THE

GARDENS' BULLETIN,

STRAITS SETTLEMENTS.

INTO WHICH IS INCORPORATED ALL THAT HAS BEEN PUBLISHED AS THE THIRD SERIES OF THE AGRICULTURAL BULLETIN OF THE STRAITS AND FEDERATED MALAY STATES.

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THE

GARDENS' BULLETIN,

STRAITS SETTLEMENTS.

Vol. 1. Issued August 1915. No. 9

SOME NOTES ON PHILIPPINE YAMS, AND THE RESULTS OF CULTIVATION OF THREE INDIAN RACES IN 1914.*

I. Dioscorea alata, Linn.

By the kindness of Professor C. F. Baker, of the University of the Philippines and of the Department of Agriculture, Manila, through Mr. O. W. Barrett, the Botanic Gardens received in January, 1914, upwards of eighty yam-tubers for experimental cultivation. For the most part there was one tuber of each supposed race that the two Institutions had.

To accomodate the consignment five trenches were prepared two and a half feet deep in the yellow soil of the Botanic Gardens just behind the Director's house, and filled with alternating layers of the soil and manure.

The tubers from Manila was planted in these trenches at a distance from each other of two feet, in the month of January; and along with them were planted a few yams of local origin. The shoots began to appear above ground in March and continued to do so until May was in. The whole crop was dug in October; the new tubers were examined and weighed; and notes made upon them.

In the current year, 1915, experiments are being made on a larger scale, for which purpose the tubers of the whole crop of 1914 were cut up into sets, each of about 2 lbs. weight or 810 grammes, and has been planted.

* A report on Philippine yams may be found in the Philippine Agriculturist and Forester, III, 1915, pages 205-209.

The largest yam produced in 1914, was one of local origin, the parent tuber having been found in the deserted garden of the Government bungalow on the top of Bukit Timah; it weighed 17 lbs. 8 oz. or almost 8 kilogrammes; and as it was still in full growth, when dug, it would have attained considerably more, say, by January in which month the plant of 1913 was still green. Next to it in weight was a yam of Philippine origin which weighed 16 lbs. 9 oz. or 7513 grammes (see page 299 figure 2.) The third tuber in size was also of Philippine origin and weighed 12 lbs. 6 oz. or 5613 grammes. In appearance it was almost exactly as the tuber of the Bukit Timah plant, but there was this difference between the plants that the stem of the Bukit Timah plant produced a profusion of bulbils, whereas that of the Philippine plant did not. The tuber which came fourth in weight was from a Philippine plant numbered 1054, (page 299 figure 1); it differed from the preceeding a little in the surface of the tuber and in its foliage; its weight was 9 lbs. 13 oz. or 4450 grammes. Plant no. 1042, (page 299 figure 5) produced a not altogether dissimilar tuber weighing 7 lbs. 7 oz. or 3373 grammes. All these big bulky tubers except no. 1057, (page 299 figure 2) were without purple sap.

Attention may be called to the slight difference in shape between the tubers 1054 (page 299 figure 1) and 1042 (page 299 figure 5) in order to make the comment that it has been man's endeavour in selecting yams to obtain something which does not give great labour in digging, i.e. something surface-rooting. From such a point of view no. 1042 (page 299 figure 5) is an improvement on no. 1054 (page 299 figure 1), and both are an improvement upon the Bukit Timah race which buried itself to a depth of 28 inches.

Some of the deep burying yams are however very tender, and are thought, by jungle tribes particularly, a much desired food, so that they laboriously dig them out. One object therefore which man must have had in view in his work of selecting would be the preservation of the delicacy of substance while getting rid of the deep burying. Rumpf relates that in his time (1653-1720) in Celebes the inhabitants had a way of circumventing the yams which was by compelling them to grow through horizontal bamboos placed in the surface of the soil. The modern use of such a device is unrecorded; but the Philippine yams possess, in one little group, no tendency to bury, though elongating considerably. For instance no. 956 (page 301 figure 3) recurved back and actually extruded the tip of its tuber from the soil. No. 943 (page 301 figure 4) behaved similarly. Nos. 935 (page 301 figure 5) and 945 (page 301 figure 6) while differing slightly also extruded their tuber-tips, and Nos. 1095 (page 301 figure 1) and 960 (page 301 figure 2) instead of growing down, elongated more or less horizontally, the larger to a length of 20 inches.

Because of their great interest, all the tubers raised of this type are here figured, though we may not have among them more than three races. It may be remarked further that they all had purple sap.

Dioscorea alata—Philippine races, which descend more or less into the earth.

The largest, from no. 945 (page 301 figure 6), weighed 8 lbs., 14 oz. or 4025 grammes and out of the whole collection, among those containing purple sap was the third in weight. No. 655 (page 301 figure 5), which differed in very little, weighed 8 lbs. 5 oz. or 3770 grammes. These two, being apparently of one race, will be kept in mind specially on account of their combination of surface production and productiveness; but of their comestible qualities we know nothing as yet.

Figures 3 and 4 on page 299 (of tubers numbered 3790 and 1056) are reproduced to call attention to the way in which tubers vary in rootiness. Both the two tubers are deeply penetrating, the longer being 14 inches (35½ cm.) long. Another penetrating tuber was grown, intermediate in rootiness and therefore not reproduced here, (no. 1692), which with a length of 24 inches (61 cm.) had a weight of only 3 lbs. or 1361 grammes. On the other hand no. 1055 (page 1 figure 9) while penetrating only 8 inches (20 cm.) produced 4 lbs. 11 oz. (2125 grammes) of tubers, and no. 3793 penetrating 12 inches (30½ cm.) produced 10 lbs. 5 oz. or 4678 grammes.

The last mentioned had a prickly stem, and so had no. 3790 and another very similar plant, no. 1019. It may be remarked that the prickliness is not associated with any particular form or colour of tuber, or any particular form of foliage.

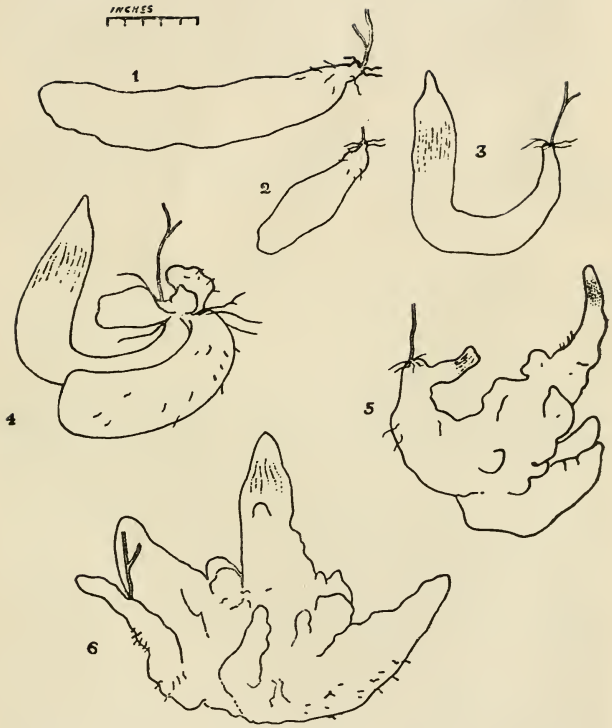
The lesser tubers grown were for the most part fingered in various ways, e.g. nos. 1019, (page 299 figure 8) and 931, (page 299 figure 7); and for the most part they carried purple sap. The relation of the extent of surface to flavour, etc., if any, has yet to be determined; but it is quite probable that there is some relationship.

The Oebi merah of the Singapore markets, grown along with the Philippine yams, ranked with the largest of the fingered ones; but it differed in foliage very markedly, and yet more by producing a great abundance of bulbils.

There were among the Philippine yams two tubers (nos. 1040 and 1046) forked rather than fingered, 12 and 15 inches long, (30½ and 38 cm.) respectively, without purple sap, of a form which leads from the simple elongated shape to the flat condition wherein branching occurs in one plane only. Of flat tubers no. 1031 (page 299 figure 10) was an example. This flattening is probably to be considered as a fasciation.

Two tubers only with uprising fleshy shoots were found. One is figured which was received as "alata from Manila" (page 299 figure 6). These uprising shoots appear in the end of one season, grow thick and store food, to shoot out in the following season; they are cases of growth such as is usually made after the resting period being made in advance of it. In the figure two fleshy shoots may be seen by the side of the old dying stem of the finished season.

One of the plants with uprising shoots had purple sap and the other had not.



Dioscorea alata—Philippine races, which do not descend into the earth.

Some of the Yams showed themselves earlier than others both in sprouting and in the withering of their shoots: but further investigations are necessary in order to demonstrate what races are early and what are late, especially as in the start of the season much depends upon the part of the parent tuber used as a set (see pp. 306-307).

2. *Dioscorea aculeata*, Lamk., *the lesser yam.*

In this Bulletin on page 227 attention was called to the appearance in Singapore island of the lesser yam, and on the following page to its appearance in the Province Wellesley. Since those lines were printed, the yam has been found in the garden of a Kling at Durian Tunggal, Malacca.

With the advent of cultivators other than Malays into the Colonies, there is considerable probability that it will attract more and more interest, and that small patches will appear elsewhere. The Kling at Durian Tunggal said that he had himself brought the parent tubers from India.

This lesser yam in the eastern tropics has a rather general cultivation from India to Papua. In India its chief centres are the Nerbudda valley, the Behar plains, and upper Assam; but it is by no means uncommonly grown in the south. It may be found in Burma, the Shan Hills, and French Indo-China; in the Philippine islands it is quite an important article of food, and in north-eastern New Guinea it is said to be the most important of all roots. South-westwards from the Philippine islands and New Guinea it is met with. It was stated by the celebrated Rumpf that in his time (1653-1720) it had rather recently acquired an extension from the east of the Archipelago to the neighbourhood of Batavia where men, chiefly immigrants from that direction had a penchant for growing it. Despite this extension upon the west, north and east of the Peninsula, despite the going and coming between India and Malaya, Siam and Malaya, despite the Bugis invading and the Dutch and Portuguese trading from islands where it is commonly cultivated, it seems not to have obtained a place between the Isthmus of Kra and Singapore until recently: and this can only be ascribed to a want of interest in its cultivation as from so many of the adjoining lands there must have been thousands of opportunities of bringing it had Malay cultivation but room for it. It had not however. But with the advent of settlers whose cultivation is deeper—Kling and Chinese—there would seem to be room for more yams and especially for the lesser yam. Under this impression experiments were commenced at Singapore in 1912 when three races of *D. aculeata* received from India were first planted in the Economic Garden.

These races from India were,

Goradu from Akola, Berar	...	No. 33,346
China alu from Jorhat in Assam,		No. 34,383
Pora alu from Chittagong.	...	No. 34,125

A root of each had been received from Major A. T. Gage, Superintendent of the Royal Botanic Gardens, Calcutta, in the end of 1912, and the tubers were planted in the Economic garden.

Thirty plants in all were grown. Seven were raised from tubers of Goradu, ten from China alu and thirteen from Pora alu.

The seven plants of Goradu gave in turn 4½ lbs. of tubers, the ten of China alu 5¾ and the thirteen of Pora alu 31¼ lbs.

These sown again in 1914 returned:—

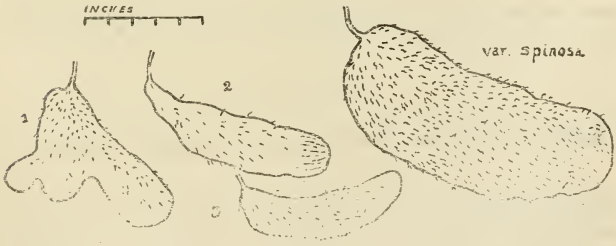
No. 34,125	311	yams weighing	154½	lbs.	or 70	kilogrammes.
No. 33,346	100	,, ,,	46	,,	or 21	,,
No. 34 383	200	,,	28	,,	or 12½	,,

The tubers of the first ran up to 3 lbs. or 1460 grammes, those of the second to 2¾ or 1,247 grammes, but those of the third were not above 1 lb. or 454 grammes in weight.

The rate per acre works out at:—

No. 34,125	21,851	lbs. per acres or	9,932	kilogrammes.
No. 33,346	13,011	,, ,,	5,902	,,
No. 34,383	7,820	,, ,,	3,593	,,

The greatest yield is greater than the best expected of potatoes in particulary fertile districts of Europe. But then the plot was very small (28 feet by 22 feet) containing four rows of plants sown in well manured trenches.



Dioscorea aculeata—four Philippine races.

Along with the greater yams from the Philippine islands, described in the preceeding pages, were grown four races of the lesser yam from the same sources, typical roots of which are figured here in outline.

Collectively the races are there called in the Tagalog language Tugui a name like that, Tu-cu, used in Annam.

They occur both wild and cultivated and those that are wild produce copious thorns on the roots. Thorns, however, are not a sure distinguishing mark of wild races, for at least elsewhere some cultivated races possess them, e.g. one which is in favour in Central Burma and is there called Wet-ka u or Pig-cut-off yam because of the way in which the thorns protect the tubers from the depredations of the wild pigs.

The plants of the first Philippine race,—whether of wild or cultivated origin I have not been informed,—produced the large tubers (as figured on the right) and with these such thorny roots. These tubers however were diffuse and placed far beyond the protection of the thorns present, a circumstance suggesting that we have in it a cultivated race, the thorns left being indications of a not remote origin from the wild state. The tubers were few in number but attained as much as 5 lbs. 6 oz. (2439 grammes) in weight. The other three races were without thorny roots and distinguished as follows:—

a. Tubers elongated, with a slight tendency to be diffuse, reaching in weight 1 lb. 8 oz. (640 grammes).

b. Tubers small, many, closely bunched, attaining in weight 4 oz. only (113 grammes).

c. Tubers lobed, few, and some of them rather large, attaining in weight 1 lb. 5 oz. (596 grammes).

The figures given are drawn exactly to scale: *a* is numbered 2; *b* is numbered 3; and *c* is numbered 1.

The races will be the subject of further experiments in 1915, when they will be tested against those brought from India and against others newly received from Saigon.

PREPARATION OF YAMS FOR THE TABLE.

Europeans in the East do not know, how to cook yams: therefore the following recipes are reproduced from one of the publications of the Imperial Department of Agriculture for the British West Indies.

Roasted Yams.—Lay a yam before the grates of the stove or in the oven, turning it occasionally until cooked, scrape off the outer skin, cut into pieces or mash with butter; serve hot.

Baked Yams.—Pare a yam, put it in the oven and bake until soft, take it out of the skin, mash with butter, put back into the skin; cut in pieces and serve hot.

Boiled Yams.—Pare a yam, put it into boiling water, cook until tender; serve whole.

Yam Chips.—Pare a yam and boil until tender, cut it in chips; fry in boiling lard and serve hot.

Yam Rice.—Pare a yam and boil until tender; press through a colander onto a hot dish; shaking the colander lightly every few seconds, to cause the yam to fall off in short grains like rice; serve very hot.

Yam Rissoles.—Pare, boil and mash a yam with pepper and salt, and if liked, a little minced parsley; shape into rissoles, cover with egg and bread crumbs, and fry until a light brown.

Yam Border.—Pare, boil and mash a fairshaped yam, about two pounds in weight, and add to it two tablespoonful of butter, half a cup of boiling milk, one tablespoonful of salt, the yolk of two eggs (well beaten); beat the mixture until very light; butter a border mould, pack the yam in it, and let it stand for eight minutes, beat the whites of the eggs to a froth, add salt, turn out the yam, cover with the whites and put in an oven to brown; take from oven and fill the centre with meat or flesh heated in a sauce.

Yam au Choux.—Take one pound of boiled yam, one boiled cabbage, two tablespoonful of cream, one ounce of butter, with salt and pepper to taste; rub the yam and cabbage through a wire sieve, mix together with butter, cream and seasoning; pile upon a dish, and serve with fried croutons of bread around. Serve very hot.

Porcupine Yam.—Take two pounds of yam, boil and mash with one egg and salt to taste; shape and roll in beaten egg and vermicelli; fry. Serve hot with parsley.

Yam Fritters.—Pare and boil half a pound of yam until soft, beat lightly with a fork; beat the yolks of four and the white of three eggs, add two tablespoonful of cream, two tablespoonful of wine, one dessertspoonful of lemon juice and half a teaspoonful of grated nutmeg; beat all altogether until extremely light, put plenty of lard into a frying pan and drop a tablespoonful of the butter at a time into it, and fry the fritters to a nice brown. Serve with wine sauce (served separately), or only sprikle powdered sugar over them.

Yam Pudding.—Take half a pound of yam, two eggs, one lemon, two ounces of butter, two ounces of sugar; pare and boil the yam, and rub it through a sieve while hot; beat the butter and the yam together, and allow the whole to cool; break the eggs and separate the yolks from the whites; beat the yolks until light, and add sugar, the juice of a lemon as well as the grated rind, and the yam. Whisk the whites to a stiff froth and stir lightly in before baking; put in a well buttered dish and bake in a brisk oven for twenty minutes.

Yam en Brun.—Cut up one pound of yam already boiled, and fry to a light brown; sprinkle thickly with chopped parsley and shalat or mushroom, pepper, salt and lime juice; serve very hot.

DIFFERENT PARTS OF THE TUBERS OF DIOSCOREA ALATA SPROUT AT DIFFERENT RATES.

In the Journal of the Asiatic Society of Bengal 1911, p. 467. I gave an account of observations on the bulbils *Dioscorea bulbifera*, Linn., showing that shoots are more freely formed from the basal part of the bulbil than from the apical; and that if the bulbil be halved the shoots are generally produced towards the base on either half but, that sprouting is quickest on the lower halves. I here give some observations made on the tubers of *Dioscorea alata*, which show that in them the older parts more quickly sprout than the younger. The result is as would be expected, but to demonstrate it was desirable, in connection with observations in hand on the earliness or lateness of various races under study; for when we have recognised that sets cut from different parts of a tuber send out shoots relatively quickly or relatively tardily according to the position from which they have been taken, we are one step forward from the danger of comparing the unequal in attempting the separating out of precocious and late races.

The observations have been made in this way. Taking all the tubers reported on in the preceeding note pp. 297-302, they were cut up into sets of about two pounds weight each, and planting was done on December 2nd, 1914, in such way that the oldest part of each tuber was towards one end of the trenches dug for the crop, and the youngest parts towards the other end. The sets, which had previously been treated carefully with potassium permanganate and dried until the cut surfaces were hard, were earthed over to a depth of about four inches and then the appearance of their shoots above ground was watched for and recorded in the number of days which on their emergence had elapsed from planting. The following table details the result: in the first column is the number or name under which the race has been grown, in the other columns are the number of days between planting and the appearance of the shoots above ground. The reader will see that a lesser period is generally recorded in the second column than in the others and that the period lengthens towards the right, i.e., towards the tip of the tuber. As some of the tubers were branched e.g., that figured as No. 2 on page 299, the order in which the parts were placed could not he made in every case to represent exactly the actual tuber, but nevertheless the general result is quite obvious, namely, that the more or less woody top of the tuber is the most ready to sprout and the tip least. As man usually keeps the top for propagation and eats the tip, which it the most esculent, in so doing he gets the advantage for his planting of using that part which nature has most ready for the purpose.

There is evidence in the table that races vary considerably in precocity or lateness, thus the latest named yam showed itself most distinctly earlier in sprouting than the one immediately before it: and the yams which were figured on page 301 showed themselves late; but these and other similar observations will be the subject of another report, when more statistics are available.

Number of days from December 2nd. which elapsed before Shoots appeared above Ground.

Registration Number of root.	Top Set.	Lower sets, more or less in descending order.												
940 Philippines...	30	23	55	78	—	—	—	—	—	—	—	—	—	—
947 „ ...	24	48	51	—	—	—	—	—	—	—	—	—	—	—
938 „ ...	40	40	—	—	—	—	—	—	—	—	—	—	—	—
1,025 „ ...	58	35	64	89	—	—	—	—	—	—	—	—	—	—
1,019 „ ...	14	94	81	64	106	—	—	—	—	—	—	—	—	—
1,387 „ ...	49	52	—	—	—	—	—	—	—	—	—	—	—	—
2,712 „ ...	25	27	62	—	—	—	—	—	—	—	—	—	—	—
958 „ ...	61	76	78	78	78	110	—	—	—	—	—	—	—	—
824 „ ..	23	44	—	—	—	—	—	—	—	—	—	—	—	—
1,031 „ ...	53	52	—	—	—	—	—	—	—	—	—	—	—	—
"Unknown," from Manila ...	82	89	106	108	—	—	—	—	—	—	—	—	—	—
1,044 Philippines...	43	61	—	—	—	—	—	—	—	—	—	—	—	—
963 „ ...	43	41	81	64	—	—	—	—	—	—	—	—	—	—
329 „ ...	17	51	24	25	77	—	—	—	—	—	—	—	—	—
3,790 „ ...	90	108	—	—	—	—	—	—	—	—	—	—	—	—
937 „ ...	47	68	49	75	—	—	—	—	—	—	—	—	—	—
1,023 „ ...	21	61	75	—	—	—	—	—	—	—	—	—	—	—
1,042 „ ...	15	23	23	53	—	—	—	—	—	—	—	—	—	—
1,055 „ ...	90	63	61	—	—	—	—	—	—	—	—	—	—	—
3,793 „ ...	24	23	24	23	82	48	96	—	—	—	—	—	—	—
1,054 „ ...	20	37	39	39	40	—	—	—	—	—	—	—	—	—
955 „ ...	13	41	108	79	—	—	—	—	—	—	—	—	—	—
1,095 „ ...	46	106	45	—	—	—	—	—	—	—	—	—	—	—
1,056 „ ...	40	52	—	—	—	—	—	—	—	—	—	—	—	—
1,692 „ ...	23	89	82	64	—	—	—	—	—	—	—	—	—	—
No Number, from Manila ...	37	79	23	—	—	—	—	—	—	—	—	—	—	—
1,057 Philippines..	94	40	52	52	51	53	60	51	64	56	53	55	—	—
1,046 „ ...	84	85	103	—	—	—	—	—	—	—	—	—	—	—
1,040 „ ...	85	110	124	—	—	—	—	—	—	—	—	—	—	—
945 „ ...	39	94	54	112	130	—	—	—	—	—	—	—	—	—
943 „ ...	90	90	58	110	106	—	—	—	—	—	—	—	—	—
956 „ ..	94	110	110	—	—	—	—	—	—	—	—	—	—	—
960 „ ...	20	37	—	—	—	—	—	—	—	—	—	—	—	—
330 „ ...	20	38	—	—	—	—	—	—	—	—	—	—	—	—
Oebi merah of Singapore ...	63	89	125	89	85	90	64	*	110	37	—	—	—	—
Oebi from Bukit Timah ...	13	13	11	13	13	12	23	20	14	12	37	23	35	35

* Destroyed by slugs.

I. H. BURKILL.

THREE LEPIDOPTERA WHICH ATTACK DIOSCOREAS IN SINGAPORE.

In the course of two years observations on Dioscoreas in Singapore, the caterpillars of three lepidoptera have attracted attention. They are:—

Theretra nessus, Moore

Loxura atymnus, Horsf. and

Tagiades gana, Butl.

The second is the most injurious.

Theretra nessus is a Sphingid, already recorded as attacking the common yam (*Dioscorea alata*, Linn.). Owing to the large size which the caterpillar attains, the number of leaves consumed is considerable; but as the eggs are laid singly, the injury to a plant is generally restricted to what is required to satisfy the appetite of one individual.

Offered a choice of food-plants of the genus Dioscorea, the caterpillars refused none; but they ate the leaves of *D. alata*, Linn., *D. pyrifolia*, Kunth, *D. bulbifera*, Linn., *D. pentaphylla*. Linn., and of a Philippine ally of the last which is thought to be *D. Cumingii*, Prain and Burkill, in preference to those of *D. aculeata*, Lamk., and *D. triphylla*, Linn. It is known that dioscorine is present in the leaves of the last named; but the surface is covered with small bristly hairs; and it is likely that the hairs deterred to caterpillars from feeding readily more than any dioscorine present.

The moth of *Theretra nessus* is figured in Moore's Lepidoptera of Ceylon, (1882-83), plate 86, and there is a description of it on p. 22 of volume II.

Across the fore wings the moth is 11 cm. The general colour is dull red and olive green above, but below orange. The fore wings are nearly white at the tip, and white on the fore margin; behind this are diagonal belts of olive green, smoky grey and dull salmon. The caterpillar is of a pale green, streaked with white down the back and obliquely on the sides, the streaking ill-defined; and it has two defined white spots forward, which when it has been disturbed and has drawn in its head, have somewhat the position in which eyes might be expected. It attains a length of 14 centimetres (5½ inches). At maturity it spins a cocoon of a rather small amount of silk among leaves, drawing them together; and when it turns into a chrysalis is upwards of 11 cm., long, streaked in various shades between buff and claret.

The caterpillar of *Loxura atymnus* is a green slug-like object which eats the very young parts of the plant. So far it has only been found on *Dioscorea alata*, on *D. anguina* Roxb., and on an imported African yam. The eggs are laid singly, but many to a plant, on the tips of growing shoots, and the caterpillar devours by preference the

upper parts of the just expanding leaves, or less freely the tip of the stem. When a caterpillar on a rapidly growing shoot has found food in a pair of leaves for some days during which growth has carried the other softer parts far beyond; it does not wander up the shoot, but attacks the stem close at hand and eats the surface into small pits, which turn black; at times the shoot may be so much eaten as to break or to die above the place.

The caterpillar attains a length of 2.25 cm., with a maximum width forward of about 7 mm. The body is somewhat flattened towards the tail. The legs are entirely hidden by the overlapping sides, and the head is similarly hidden. The colour of the caterpillar is a rather light leaf-green with a pair of magenta markings, or with two pairs, on the back near the middle, the ground colour rather yellowish-green between them. Towards the head and the tail the green colour darkens a very little. And near to the tail are two retractile processes, withdrawn more often than exserted, very small and white, with papillae.

Ants commonly run over the caterpillars seeking for something that they cannot find. As formic acid is present in the caterpillars of some allied lepidoptera, it might possibly be a smell of this which attracts them; but evidence is lacking.

When the caterpillar is mature, it attaches itself to the stem and pupates, forming a chrysalis buff over the wings and along a broad streak down the back, elsewhere of the brightest green. The tail is very broad.

The butterfly has dark orange wings with a black border, and the hinder are provided with a broadish tail which is pale towards the extremity, and curves out of the plane of the wing. The black border runs from the middle of the anterior rounded edge of the forewing to the posterior angle of the hinder wing. Further the hind wings are slightly suffused with black. Below the wings are of an orange ochre, with a faint line across them parallel to the outer margins. The diameter across the expanded wings is 5 cm. It is figured in Distant's Rhopalocera Malayana (1882-86), plate xxxix., figure 2.

Tagiades gana feeds on the mature leaves of *D. alata,* and has also been observed on *D. cirrhosa,* Lour. It cuts into the leaf until it can fold over a piece of it and so manufactures with a little silk a covering for itself; or sometimes it fastens two leaves together. From within its covering it feeds on the foliage, making a new case as often as may be necessary. It is smooth skinned and narrow behind the head, which is bilobed behind. The chrysalis is hazel coloured, and rests in the last leaf-wrapping that the caterpillar has constructed.

The butterfly which is figured in Distant's Rhopalocera Malayana (1882-86), on plate xxiv, figure 7, is 9 cm. across the wings. These

wings are umber brown above, the hinder pair bluish white in the posterior third.

All three insects are Indian as well as Malayan, and one, if not the others, occurs in China.

I. H. BURKILL.

FRAGMENTS OF MALAYAN GEOGRAPHIC BOTANY.

No. I. Enumeration of Pahang plants collected by the late A. M. Burn Murdoch.

On a journey of inspection down the Pahang river in June, 1913, the late Mr. A. M. Burn Murdoch, took with him a collector from the Botanic Gardens, Singapore, and obtained the species here enumerated.

The collecting began near Temerloh, which is 75 miles in a straight line from the coast, and was continued down the tortuous course of the river to its mouth, whence again northwards, it was carried up the coast to Balok.

Nos. 151-179 came from Temerloh and its neighbourhood. Nos. 180-192 came from places on the first 60 miles of this river's course below Temerloh. Nos. 193-200, and 301-311 came from the neighbourhood of the Chenik river where is a forest reserve. Nos. 312-332 were collected below the Chenik river, chiefly about Kwala Pahang. Near Kuantan, Balok and Beserah were collected Nos. 201-224 and Nos. 333-350.

There is a paper by Mr. H. N. Ridley on the flora of this part of the Peninsula in the Transactions of the Linnean Society of London, 2nd Series, Botany, iii., pp. 267-408, enumerating very many more plants than are here recorded; but nevertheless Mr. Burn Murdoch's bundles add much information towards a knowledge of the distribution of plants in the Peninsula.

There is a further brief notice of the flora of the lower part of the Pahang river in the Journal of the Straits Branch of the Royal Asiatic Society, part 25 (1894) pp. 33-37.

Mr. Ridley has kindly described the novelties of the collection in the Journal of the Straits Branch of the Royal Asiatic Society, No. 68 (1915), pp. 12-14.

Here after each name an indication is given of the dispersal which that plant has in the Peninsula: and unfortunatey the scantiness of our knowledge of the flora of the Eastern side is made evident in it.

Unona longiflora, Roxb. Chenik, No. 197.
Distr: A northern plant extending southwards, at any rate all down the west side, to Singapore, now first obtained on the east side.

Polyalthea Teysmanni, King. Temerloh, No. 154.
Distr: Selangor and Pahang, southwards.

Nymphaea stellata, Willd. Semantan road, No. 156: Tasek Chenik, No. 308.
Distr: Here and there in the Peninsula; but hardly recorded from the southern parts.

Crataeva macrocarpa, Kurz. Tasek Chenik, No. 302.
Distr: From the north to Malacca on the west coast and in Pahang.

Pittosporum ferrugineum, Ait. Kwala Pahang, No. 326.
Distr: Probably throughout the Peninsula, though at present unknown from the east coast except at Kwala Pahang.

Xanthophyllum glaucum, Wall. Tasek Chenik, No. 307.
Distr: From the north to Perak and Pahang.

Sida cordifolia, Linn. Kwala Pahang, No. 332.
Distr: In places chiefly near the coast as a weed.

Elaeocarpus paniculata, Wall. Temerloh, No. 162.
Distr: Apparently throughout the Peninsula.

Elaeocarpus stipularis, Blume. Pahang river between Lubok Paku and Binking, No. 189.
Distr: Apparently throughout the Peninsula.

Hiptage madhablota, Gaertn. Kuantan, No. 219.
Distr: From the north southwards to Kuala Lumpur and the Pahang river.

Aglaia cordata, Hiern. Kwala Bera, below Temerloh, No. 173.
Distr: From Perak to Singapore on the west side; from the east now for the first time collected.

Chailletia setosa, King. Balok, No. 214.
Distr: Perak to Malacca, and on the Pahang river.

Cansjera Rheedei, Gmel., var. Tanjong Tembeling near Kuantan, No. 222.
Distr: Mangrove swamps round the coast.

Euonymus javanicus, Blume. Kwala Pahang, No. 320.
Distr: Apparently general in the Peninsula.

Trigonachras acuta, Radlk. Kuantan, No. 3 7.
Distr: Singapore, Pahang and Malacca.

Allophyllus Cobbe, Blume. Chenik reserve, No. 301.
Distr: A very common plant in the Peninsula.

Jagera speciosa, Blume. Chenik, No. 199.
Distr: Selangor and Pahang.

Dodonaea viscosa, Jacq. Kwala Pahang, No. 328.
Distr: Around the Peninsula at rather widely spaced places.

Desmodium polycarpum, D.C. Kuantan, No. 335; also var., *ovatifolium*, Wall. Kuantan, No. 334.
Distr: Common throughout the Peninsula.

Desmodium umbellatum, D.C. Basrah, No. 202.
Distr: All round the coasts of the Peninsula.

Uraria crinita, Desv. Binking, No. 192.
Distr: Very general in the Peninsula.

Pueraria phaseoloides, Benth. Pulau Rusa, No. 315.
Distr: From the north, southwards to Negri Sembilan.

Canavalia lineata, D.C. Karang river at Basrah, No. 217.
Distr: Around the coasts.

Canavalia obtusifolia, D.C. Semantan road, No. 159.
Distr: Around the coasts and up the Pahang river.

Dunbaria Scortechinii, Prain. Pulau Rusa, No. 314.
Distr: Southern Siam to Perak, and the Pahang river.

Flemingia congesta, Roxb. Pulau Rusa, No. 316.
Distr: From the north to Malacca and the Pahang river.

Derris sinuata, Thwaites. Kwala Pahang, No. 331.
Distr: Around the coasts of the Peninsula.

Cassia nodosa, Ham. Temerloh, No. 153.
Distr: From the north to Malacca and the Pahang river.

Cassia siamea, Lamk. Kwala Bera, below Temerloh, No. 180.
Distr: From the north to Malacca and the Pahang river.

Cassia mimosoides, Linn. Tasek Chenik, No. 312.
Distr: Throughout the Peninsula.

Bauhinia integrifolia, Roxb. Lubok Paku, No. 182.
Distr: Throughout the Peninsula.

Saraca triandra, Baker. Foot of Bukit Basrah, without number.
Distr: From the north, southwards to Malacca and the Pahang river.

Acacia pennata, Willd. Binking, No. 191.
Distr: From the north to Malacca and the Pahang river.

Parinarium nitidum, Hook. f. Kwala Pahang, No. 325.
Distr: Setul to Malacca, in Singapore and on the Pahang river.

Carallia lucida, Roxb. Pahang river between Lubok Paku and Binking, No. 188.
Distr: All down the west side of the Peninsula, and now first collected on the east side.

Combretum ?stenopetalum, Heurck and Muell. Arg. Pahang river between Lubok Paku and Binking, No. 190.
Distr: Probably an addition to the known flora of the Péninsula.

Barringtonia spicata, Blume. Chenik, No. 195.
Distr: Trang to Malacca on the west side, Pahang on the east side.

Barringtonia fusiformis, King. Chenik, No. 198.
Distr: Perak and Selangor on the west side, Pahang on the east side.

Pternandra coerulescens, Jack. Chenik, No. 196.
Distr: General through the Peninsula.

Memecylon dichotomum, C. B. Clarke. Temerloh, No. 164.
Distr: Kedah to Malacca on the west side, on the east side along the Pahang river, whence it has been brought twice before.

Sarcocephalus subditus, Miq. Pahang river between Lubok Paku and Binking, No. 185.
Distr: From Perak, southwards to Singapore, and on the Pahang river.

Sarcocephalus Junghuhnii, Miq. Kuantan, on Bukit Galing, No. 340.
Distr: Known hitherto from the western side of the Peninsula and from Singapore, but its wide distribution outside made probable its occurence on the eastern side.

Mussaenda mutabilis, Hemsl. Vern.—Balik Adap as in Sungei Ujong. Temerloh, No. 170.
Distr: Known to occur all down the east of the Peninsula and in Pahang.

Gardenia carinata, Wall. Vern.—Laca Hutan. Temerloh, No. 169.
Distr: Penang and Perak to Malacca; now also obtained in central Pahang; recorded as obtained by Murton in Singapore (? cultivated only).

Gardenia tubifera, Wall. Bukit Berhala, Tasek Chenik, No. 304.
Distr: General throughout the Peninsula.

Gardenia tentaculata, Hook. f. Tasek Chenik, No. 311.
Distr: Apparently general throughout the Peninsula from Penang, Province Wellesley, and Tringganu southwards. It has been obtained before twice on the Pahang river.

Diplospora ?velutina, King and Gamble. Bukit Galing, Kuantan, No. 344.
Distr: Hitherto recorded for Perak only.

Canthium didymum, Roxb. Pulau Lantai, No. 306.
Distr: General throughout the Peninsula.

Canthium parvifolium, Roxb. Bukit Ubi, Kuantan, No. 349.
Distr: General throughout the Peninsula.

Ixora stricta, Roxb. Temerloh, No. 158; Kwala Pahang No. 319.
Distr: General throughout the Peninsula.

Ixora humilis, King and Gamble. Balok, on Bukit Kapis, No. 215.
Distr: Penang, Temerloh, Perak and Selangor, and on the east coast in Pahang.

Ixora cf. *concinna*, R. Br. Chenik reserve, No. 200.
Distr: *I. concinna* occurs generally through the Peninsula.

Pavetta humilis, Hook., f. Balok, on Bukit Kapis at 300 ft., No. 211.
Distr: From the west coast at Malacca to the east coast at Balok.

Prismatomeris albidiflora, Thwaites. Temerloh, No. 179.
Distr: General throughout the Peninsula.

Vernonia arborea, Buch.-Ham. Bukit Galing at Kuantan, No. 339.
Distr: General along the west side of the Peninsula, and probably also along the east side; but so far only collected on the Pahang river and at Kuantan.

Plumbago zeylanica, Linn. Semantan road, No. 157.
Distr: In most parts of Peninsula apparently.

Ardisia crenata, Roth. Balok, No. 209; Kwala Pahang, No. 330.
Distr: General throughout the Peninsula.

Ardisia littoralis, Andr. Kwala Pahang, No. 329.
Distr: General around the Peninsula; but not necessarily on the coast.

Sideroxylon ferrugineum, Hook. and Arn. Kwala Pahang, No. 317.
Distr: All down the western side of the Peninsula; on the eastern side only known from the mouth of the Pahang river and Pulau Tiuman.

Symplocos Curtisii, Oliv. Balok, on Bukit Kapis, No. 216.
Distr: Occurs in Penang, Perak, Selangor, Negri Sembilan and Pahang.

Symplocos spicata, Roxb. Pulau Lantai, No. 305.
Distr: From the north to Malacca and in Pahang.

Jasminum bifarium, Wall. Pahang river between Lubok Paku and Binking, No. 184.
Distr: All down the west side of the Peninsula, and general apparently in Pahang (and probably down the east side).

Ervatamia malaccensis, King and Gamble. Temerloh, without number.
Distr: All down the west side of the Peninsula; now first collected on the eastern side.

Pausonsia spiralis, Wall. Balok, No. 205.
Distr: Down the west coast of the Peninsula; now first collected on the eastern side.

Aganosma marginata, G. Don. Pahang river between Lubok Paku and Binking, No. 187.
Distr: Apparently in all parts of the Peninsula.

Tylophora sp., very near to *T. asthmatica*, W. & A. Kwala Pahang, No. 327.
Distr: This species of Tylophora occurs from Tringganu to Kwala Pahang.

Hoya latifolia, G. Don. Chenik, No. 194.
Distr: Pahang, Johore and Singapore.

Fagraea fragrans, Roxb. Pulau Berhala, No. 303.
Distr: In several parts of the Peninsula, chiefly near the coast (vide Burn Murdoch, Trees and timbers of the Malay Peninsula, ii., 1912, p. 3).

Norrisia malaccensis, Gardn. Bukit Galing at Kuantan, No. 348.
Distr: In Perak and Malacca; and now also known from Pahang.

Ipomoea pes-caprae, Roth. Karang river at Basrah, No. 218.
Distr: Probably all round the coasts.

Ipomoea littoralis, Boiss. Tanjong Tembeling near Kuantan, No. 221.
Distr: On the coast near Malacca and near Kwala Pahang.

Merremia hastata, Hallier f. Balok, No. 207.
Distr: General through the Peninsula.

Cordia premnifolia, Ridl., in Journal R. Asiatic Society, Straits Branch, No. 68, p. 12. Pahang river between Lubok Paku and Binking, No. 186.
Distr: An addition to the Malay Flora, known from Kwala Lipis and the Pahang river.

Didymocarpus crinita, Jack. Temerloh, No. 165.
Distr: Through the Peninsula.

Justicia ptychostoma, Nees. Temerloh, No. 167 and 168.
Distr: From the north southwards to Negri Sembilan and Pahang.

Justicia remotiflora, Ridl., in Journal R. Asiatic Society, Straits Branch, No. 68, p. 12. Temerloh, No. 175.
Distr: An addition to the known Malay Flora.

Vitex trifolia, Linn. Kwala Pahang, No. 313.
Distr: On the coast at Penang, Malacca, Singapore and Pahang.

Clerodendron neriifolium, Wall. Tanjong Api at Kuantan, No. 220.
Distr: On the coast round the Peninsula.

Nepenthes ampullaria, Jack. Kuantan, No. 338.
Distr: Throughout the Peninsula, south of Penang and Perak.

Alseodaphne peduncularis, Hook. f. Temerloh, No. 166.
Distr: From Penang and Perak to Negri Sembilan on the west side; now also in Pahang.

Litsea johorensis, Gamble. West of Temerloh, No. 171.
Distr: Johore, and now also known from Pahang.

Litsea amara, Blume. Temerloh, No. 161.
Distr: General throughout the Peninsula.

Neolitsea zeylanica, Merrill. Kwala Pahang, No. 321.
Distr: Down the east side to Singapore; but from the west side only as yet collected in Pahang.

Loranthus grandifrons, King. Temerloh, No. 151.
Distr: Down the east side to Malacca, and in Pahang.

Henslowia varians, Blume. Kwala Pahang, No. 318.
Distr: Throughout the Peninsula.

Glochidion littorale, Blume. Sungei Balok, No. 204.
Distr: Down the east coast to Singapore and in Pahang.

Glochidion laevigatum, Hook. f. Sungei Balok, No. 206.
Distr: Penang to Singapore, and in Pahang.

Ostodes macroplylla, Benth. & Hook. f., var. Semantan road station, No. 160.
Distr: Perak, Malacca, Singapore and Pahang.

Mallotus sp. Very like some Philippine specimeus of *M. ricinoides*, Muell. Arg. Male flowers only. Basrah, No. 201.

Thismia racemosa, Ridl., in Journal R. Asiatic Society, Straits Branch, No. 68, p. 13. Six miles south east of Temerloh, No. 178.
An addition to the known Malay Flora.

Thrixspermum Calceolus, Reichb. f. Tanjong Tembeling at Kuantan, without number.
Distr: From Penang to Singapore, and in Pahang.

Renanthera alba, Ridl. Balok, No. 208.
Distr: Singapore and Pahang.

Tropidia squamata, Blume. Bukit Galing near Kuantan, No. 345.
Distr: From Kedah to Singapore on the west side; in Pahang on the east side.

Gastrochilus plicatus, Ridl. Balok, Bukit Kapis, No. 212.
Distr: Known from the central range in Perak, from Kuantan, and now from the Pahang coast.

Gastrochilus biloba, Ridl. Balok, Bukit Kapis, No. 210.
Distr: Known from the central range in Perak, Pahang and Selangor; and now from the Pahang coast.

Amomum ochreum, Ridl. Bukit Galing at Kuantan, No. 347.
Distr: Selangor and Pahang.

Amomum uliginosum, Koen. Bukit Galing at Kuantan, No. 342.
Distr: From Penang and Perak to Johore, and in Pahang.

Hornstedtia megacheilos, Griff. Bukit Galing at Kuantan, No. 341.
Distr: From Penang and Perak to Singapore, on the west side; also in Pahang.

Donax arundinastrum, Lam.; (Clinogyne grandis, *Benth.*), Kwala Bera, below Temerloh, No. 181.
Distr: Throughout the Peninsula.

Xyris anceps, Lam. Kuantan, No. 333.
Distr: In most parts of the Peninsula.

Iguanura geonomaeformis, Mart. Kwala Bera, below Temerloh, No. 174.
Distr: From Perak to Singapore, on the west side; and also in Pahang.

Calamus Guruba, Buch.-Ham. Chenik, No. 193.
Distr: From the north southwards to Perak and Pahang.

Amorphophallus sp. Bukit Galing at Kuantan, No. 343.

Homalonema rostratum, Griff. Semantan road, No. 155.
Distr: Selangor and Pahang to Johore.

Cryptocoryne cordata, Griff. Balok, on Bukit Kapis, No. 213.
Distr: Malacca and Pahang.

Eriocaulon sexangulare, Linn. Tasek Chenik, No. 310.
Distr: Penang, Negri Sembilan, Malacca, Pahang, Johore, Singapore, and probably wider.

Lepironia mucronata, Rich. Tasek Chenik, No. 309.
Distr: Dindings to Singapore, on the west side; and on the east in Pahang.

Rhynchospora aurea, Vahl. Kuantan, No. 336.
Distr: Throughout the Peninsula.

Andropogon Wightianus, Steud. Kwala Pahang, No. 323.
Distr: Within the Peninsula only known from the Pahang coast.

Thuarea sarmentosa, Pers. Balok, No. 203.
Distr: On the coasts round the Peninsula.

Spinifex squarrosus, Linn. Kwala Pahang, No. 324.
Distr: On the east coast in Tringganu and Pahang; and on the west coast in northern Johore.

Aspidium singaporeanum, Baker. Six miles south-east of Temerloh, No. 177.
Distr: Throughout the Peninsula.

Diplazium speciosum, Mett. Temerloh, No. 176.
Distr: Apparently throughout the Peninsula.

Asplenium macrophyllum, Swartz. Tanjong Tembeling at Kuantan, No. 223.

Distr: All through the Peninsula, on the western side; from the eastern side only obtained as yet in Pahang.

Lycopodium Phlegmaria, Linn. Tanjong Tembeling at Kuantan, No. 224.

Distr: Throughout the Peninsula.

I. H. BURKILL.

ORCHID NOTES.

So little is known of the botany of eastern Johore that it is of interest to record the receipt from Mr. St. V. B. Down, of the following three orchids collected by him on the Sedili river near Dohol:—

Eria vestita, Lindl.

Eria velutina, Lindl., 30 feet above the river on a *Lagerstroemia indica*, associated with Drynaria.

Dendrobium Serra, Lindl.

Dendrobium crumenatum, Sw.—the Pigeon-orchid.

From Mr. F. J. Hallifax, President of the Municipal Commission, Singapore, the Gardens have received specimens of a salmon flowered *Dendrobium crumenatum*, Sw. The plant grows on Goodwood Hill, Singapore, uncultivated, in Mr. Hallifax's garden. Its stems are of a bright chestnut colour.

Thecostele secunda, Ridl.

Thecostele secunda, Ridl., flowered in the Botanic Garden, in October, 1914, producing four downwardly directed (rigid, not pendilous) racemes with respectively 6, 7, 11 and 17 horizontal flowers. It flowered again in April, 1915. The plant was brought from Sarawak, by Mr. J. W. Anderson, in 1912. Its leaves measure 9 by 1½ inches.

A description of the colour of the flower is desirable. The interior sepal is honey-coloured with a slight claret flush outside near the tip and a light claret median line within in the lower half; the lateral sepals are similarly coloured but the line within is obscure. The lateral petals are honey-coloured becoming paler towards the tip, the margin below this pale part and the median line within being claret. The lip has on the median lobe a whitish ground with a well defined claret V in the centre and ill defined lateral Vs on each side of it merged into it at the contiguous extremities. These are formed by claret coloured hair; a small yellowish honey-coloured spot lies above the central V with a claret dot on each side of it,

and beyond are three claret dots, the erect lateral being just under the two crests of the lip; the lateral lobes are liver coloured on both sides with a white border and a patch of claret coloured hair inside the fold at the base.

The column has lines of pale claret below and is a deep dull maroon above with the stigma greenish white, the anther wall pale claret and the side lobes tipped as if with grey wax.

The surface of the column foot over the nectary, directed to the inside of the flower, is white: at the head of its cavity is an orange coloured nectary of considerable size which secretes abundant honey.

Every bract, before the flowers are mature, has a nectary at the centre outside which secretes a tiny drop of clear honey. When the buds are young the apex of the axis bearing them bends up straightening itself as they approach maturity.

Five species of Thecostele are known, occurring from Burma to Borneo and Java: and the road to their honey is so crooked that it would be most interesting to ascertain what insects visit the flowers.

Microstylis congesta, Reichb. f.

Among the orchids brought back by Mr. J. C. Moulton from the slopes of mount Kinabalu, were living specimens of *Microstylis congesta,* from which the following notes have been made: for even thought the orchid is well known in herbaria, a description from life of the flowers is worth giving.

Of the several plants of the orchid sent to the Botanic Gardens the largest bore seven full sized bright green leaves.

Before opening the buds ascend very slightly from the horizontal; but when the flower has opened the ovary curves slightly so that the flower faces a little down from the horizontal. During flowering the ovary straightens itself again, and after flowering it ascends so as to lie as close to the axis as possible. The bracts are lanceolate, very acuminate, and become strongly reflexed early, remaining so; they are pale green.

The sepals are green with a tinge of purple which increases through flowering. The lateral sepals curve round from behind the labellum towards one another but do not meet by about 1½ mm.; they are 4½ mm. long and when flattened 2 mm. broad; but owing to the way in which they are folded back along their midrib their edges are not more than 1½ mm. apart. The dorsal sepal (the sepal which would be dorsal if the ovary were twisted) is longer and narrower that the lateral sepals; it is curved forwards so that its point comes to the front of the flower just under and almost from between tips of the lateral sepals; length 5 mm. breadth 1½ mm.: These three sepals make a landing stage for visiting insects.

The lateral petals are similar in colour to the sepals. They are curved a little—less than the lateral sepals—and project outside them; length 3½ mm., breadth 1 mm. or a little more.

The lip is emerald green with malachite green at the lateral borders. Its centre forms a shallow flat bottomed recess. The borders of this recess are thickened particularly below and less so at the sides.

The sides of the lip are parallel and drawn forward on either side of the column, but they end rounded below and not in auricles. The apex has three teeth, of which the central is bent back on the limb through about 40 degrees. From base to apex of this tooth, the lip, measured outside, is 3 mm. long, but inside it is so attached to the column that there is less than 2 mm. free. If the lip be flattened it is found to be 2½ mm. across.

The column is emerald green. The anther wall after the flower opens shrivls and frees the pollinia upwards. It seems probable that pollen can reach the stigma without the intervention of insects. But the parts are so small that it is very difficult to ascertain what usually happens.

After flowering a purple line appears on the ovary down the dorsal face from top to bottom, and two smaller fainter lines appear on the ridges on either side: these ridges are slightly frilled.

In the Annals of the Royal Botanic Gardens, Calcutta, viii., (1898) on plate 23 is figured the Sikkim form of this species. The flowers of which are "red or occasionally yellow" (p. 20).

I. H. BURKILL.

THE SINGAPORE PRICKLY-PEAR.

The Prickly pear which may he seen near the coast about Tanjong Katong, on various roofs in Singapore town, sometimes in Chinese gardens and often in pots in Chinese houses, is *Opuntia monacantha*, Haw., and not *Opuntia Dillenii*, Haw., as recorded.

Its home is in south-eastern Brazil, along the coastal districts; in which place it must have attracted the attention of early voyagers, for there is a figure sufficiently accurately representing it in Lobel's Icones which was published in A. D. 1591.

It was certainly in english Winter-gardens about 1700; and long before 1790, at which Sate the records for India begin, it was taken to Southern India and Bengal so that in 1790 it had already become widely distributed from Madras to Calcutta; there is reason to believe that it was in Cochin-China also at the same period. The shoots were supplied to ships for a vegetable because, although

not very appetising, anything was valuable that would keep green and could be used to ward off the dreaded scurvy. It is probable that its distribution to the East was due to this use.

Its home in the coastal region of south-eastern Brazil has a moist climate; and the countries, which are its new homes, have like conditions. It has recently been recorded by Dr. H. Johnstone and Mr. Henry Tryon in the Report of the Queensland Prickly-Pear Travelling Commission, to exists in Southern France (as a rare plant), in the island of Teneriffe, in the coastal regions of South Africa from the Cape peninsula to East London, in Natal, at Pretoria and Pietershurg in the Transvaal, at Zanzibar, Beira and Lorenzo Marques in East Africa, in Queensland, New South Wales, Victoria and South Australia, as well as in the sub-Himalayan tracts, Assam, Bengal, the eastern parts of the Central Provinces of India, Madras, Ceylon and Burma.

Opuntia monacantha is one of the very few Prickly-pears which withstand the moisture of Singapore and are not difficult to cultivate.

I. H. BURKILL.

A NEST OF LIVING DRYMOGLOSSUM PILOSELLOIDES.

It is recorded that birds making nests in Europe sometimes distribute herbs, because seed accidentally gets enmeshed in the material interwoven (Willis and Burkill in *Proceedings of the Cambridge Philosophical Society,* viii., 1893, p. 86); but the use of a living fern in the East is probably unrecorded.

In clearing away a thicket in the Botanic Gardens a nest of the Merebah (*Pycnonotus analis*) was found in the crown of a tree fern, having a foundation of dead leaves, a lining of Arenga palm fibre, and a wrapping of living and leaf-bearing rhizomes of the common little epiphytic fern *Drymoglossum piloselloides,* Presl, which by this use had obtained a new coign of vantage.

Ridley in the Journal of the Royal Asiatic Society No. 31, 1898, p. 84, writes of this bird in the Botanic Gardens making nests "of bents and roots."

I. H. BURKILL.

KENARI SEEDS, CANARIUM RUFUM.

Botanic Gardens, Singapore, 11th June, 1914.

SIR,

In my letter dated 31st January, 1914, under which the nuts of *Canarium commune* were forwarded to you, I promised to send those of *Canarium rufum*, when ripe.

I have now the honour to advise the despatch to you of 368 of the nuts of the latter species.

I am, Sir,
Your obedient servant,
(Signed) I. H. BURKILL,
Director of Gardens, S. S.

The Director,
Imperial Institute,
London,

Imperial Institute, London, S. W.
21st August, 1914.

Sir,

I have the honour to enclose a report on a sample of *Canarium rufum* seeds which was forwarded to the Imperial Institute by the Director of the Botanic Gardens at Singapore with letter dated 11th June, 1914.

I have etc., (Signed)—ERNEST GOULDING,
for the Director.

His Excellency The Governor,
Straits Settlements.

Date, 21st August, 1914.

Imperial Institute No. 54063. Reference.

Letter dated 11th June, 1914, from the Director of the Botanic Gardens at Singapore.

Weight, 10½ lbs.

Number or mark, and weight of sample. Description.

The sample consisted of nuts having a brown, tough outer coat of shrunken appearance, about ⅛ inch thick, which in a few cases had partially rotted away. The outer coat enclosed a three-sided, hard nut, tapering to a point at each end, of a brown colour, and about 1¾ inches long and ¾ inch thick. Embedded in the woody shell were three slender kernels about 1 inch long, and from ⅛ to ¼ inch thick having a brown seed coat. The kernels were white, oily and had a pleasant taste.

The nuts consisted of husk 95.3 per cent. and kernel, 4.7 per cent (seed coat 1.6 per cent, interior, 3.1 per cent). The kernels were analysed with the following results:—

Results of examination of the kernels after removal of the seed coat.

Moisture	per cent. ...	...	3.9
Crude proteins ...	„ „ ...	...	16.4
Consisting of			
True proteins	„ ...	15.5	
Other nitrogenous substance ...	„ „ ...	0.9	
Fat	„ „ ...	...	70.5
Starch, &c. (by difference)	„ „ ...	...	4.2
Fibre	„ „ ...	...	trace
Ash	„ „ ...	...	5.0
			100.0

Nutritive value.

Nutrient ratio ... ... 1 : 10.1

(The ratio between the percentage of crude proteins and the sum of percentage of starch and fat, the latter being first covered into its starch equivalent).

Food units 221.4

(The total obtained by adding the percentage of starch to 2.5 times the sum of the percentages of fat and crude proteins). ...

Commercial valuation and remarks.

These kernels have a very high food value, equal to to that of *Canarium commune* kernels, which they resemble in taste and appearance.

The remarks made with reference to the possibility of profitably exporting *Canarium commune* nuts (see Imperial Institute Report dated 7th April, 1014), also apply to the *Canarium rufum* nut. The higher percentage of husk in the present sample is, to certain extent, due to the presence of the outer coat of the fruit which, in the case of the *Canarium commune* nuts, had been removed before despatch.

ONE HUNDRED MILES FOR BLOW-PIPE POISON.

Mr. J. B. Reid of the Soengei Cerpa Estates, Kwala, East Coast of Sumatra, states in a letter on the subject of the Upas tree, *Antiaris toxicaria,* that during the last intertribal war of the interior, men from the mountains came down to Kwala, a distance of 100 miles and more, to collect the juice for the poisoning of their blowpipe darts.

RAINFALL

at the Director's house, Botanic Gardens, Singapore, during the first half of the year 1914.

Readings taken always at 8 a.m. and credited to the date in which the twenty-four hours begin.

Day.	January.	February.	March.	April.	May.	June.
1	0.48	0.37	...	0.06	0.02	0.11
2	0.64	1.86	...	0.04	0.01	...
3	4.13	0.05	0.22	0.05	0.05	...
4	5.27	1.14	0.05	0.03	0.62	...
5	0.57	0.02	1.31	0.01	2.32	...
6	1.24	0.01	...	0.05	Trace	...
7	0.22	0.07	...	1.46	0.20	0.31
8	...	...	...	0.54	...	0.27
9	0.01	...	0.52	2.57	0.79	0.06
10	...	0.02	Trace	0.95	Trace	0.94
11	...	0.01	0.01	0.38	...	0.05
12	0.18	0.38	...	...	...	2.11
13	Trace	...	0.51	5.42	...	0.01
14	...	...	...	0.04	0.03	0.18
15	...	...	0.35	...	0.03	0.10
16	1.23	...	0.56	Trace	0.02	0.14
17	...	...	1.38	2.58	0.02	...
18	0.03	...	0.25	...	...	...
19	2.54	...	Trace	0.02	...	0.65
20	1.68	...	0.19	...	0.14	0.04
21	...	...	0.56	...	0.15	...
22	Trace	...	1.58	...	...	...
23	1.11	...	...	1.62	0.08	...
24	2.73	...	...	0.02	...	...
25	0.52	...	...	...	...	2.46
26	0.97	...	0.04	0.10	0.34	0.01
27	0.27	...	...	...	...	0.26
28	0.01	...	...	0.01	0.09	0.24
29	0.33	—	0.54	0.25	0.06	0.16
30	1.23	—	1.71	0.40	...	0.48
31	0.01	—	0.18	—	...	—
	25.40	3.93	9.96	16.60	4.97	8.58

RAINFALL

at the Director's house, Botanic Gardens, Singapore, during the second half of the year 1914.

Date.	July.	August.	September.	October.	November.	December.
1	0.16	...	..	...	...	Trace
2	1.05	...	0.03	...	0.01	0.28
3	Trace	0.11	...	1.14	0.01	Trace
4	...	...	...	0.12	...	0.02
5	...	...	0.04	...	0.03	...
6	...	...	1.47	...	0.01	...
7	...	...	0.17	...	0.14	3.09
8	...	0.31	0.37	...	...	0.56
9	...	...	0.28	...	0.42	Trace
10	...	0.63	...	...	0.58	0.12
11	...	...	0.03	Trace	0.25	0.23
12	1.02	...	...	...	Trace	...
13	...	...	...	...	...	0.43
14	...	...	...	...	0.11	0.02
15	...	0.02	0.32	...	0.41	...
16	...	...	0.02	...	...	0.03
17	0 24	...	0.38	0.07	...	...
18	0.09	...	0.02	0.03	...	1.02
19	0.35	Trace	0.01	1.56	0.14	1.47
20	0.58	Trace	...	0.83	0.02	0.08
21	0.09	...	...	...	0.03	0.02
22	...	Trace	...	..	1 59	0.03
23	...	0.07	...	Trace	0.64	0.41
24	..	...	...	0.03	0.89	0.14
25	1.10	...	...	...	1.72	0.12
26	0.01	...	...	...	0.02	0.58
27	...	...	...	0.03	0.17	0.01
28	Trace	...	...	0.01	0.62	0.02
29	0.02	...	...	0.14	0.05	0.72
30	...	...	...	0.01	...	0.14
31	...	...	—	0.11	—	...
	4.71	1.14	3.14	4.08	7.86	8.54

RAINFALL

at the head of the Waterfall Gardens, Penang, during the first half of the year, 1914.

Readings taken at 8 a.m. and credited to the date in which the twenty-four hours begin.

Date.	January.	February.	March.	April.	May.	June.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
1	...	..	...	...	...	...
2	...	1.92	...	0.13	0.52	...
3	...	0.05	...	0.98	1 00	...
4	...	...	...	1.98	0.27	...
5	...	0·07	...	...	0.04	...
6	...	...	...	0.16	1.16	...
7	1.03	...	0.03	0.95	0 75	...
8	0.01	...	...	...	1.75	1.65
9	...	...	0.23	3.10	0 77	...
10	...	0.10	...	...	0.02	3.35
11	...	...	...	1.03	0.20	2.15
12	...	0.06	1.21	0.08	...	...
13	0.18	..	0.32	0.30	...	...
14	0.20	...	1.30	...	...	0.37
15	...	...	0.65	...	...	0.50
16	...	...	...	...	...	...
17	...	..	...	...	...	0·06
18	...	...	1.17	0.38	...	...
19	0.09	...	...	...	0.22	0 73
20	...	...	...	...	1.08	0.03
21	...	0.03	...	...	0.08	...
22	...	...	...	...	...	...
23	...	...	...	0.02	3.20	...
24	...	2.70	1.35	0.05	1.23	...
25	0.01	0.07	...	0.03	...	...
26	0.07	...	...	0.02	...	...
27	0.26	...	...	...	...	...
28	0.04	...	...	..	...	0.39
29	...	—	...	0.02	...	0.06
30	...	—	...	1.22	...	0.32
31	...	—	0.03	—	0.14	—
	1.89	5.00	6.29	10.45	12.43	9.61

RAINFALL

at the head of the Waterfall gardens, Penang, during the second half of the year 1914.

Date.	July.	August.	September.	October.	November.	December.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
1	0.80	0.38	0.10	0.27	..	...
2	0.79	0.02	0.89	..	...	0.91
3	...	0.04	1.52	0.21	0.20	0.39
4	...	0.07	1 74	0.08	0.19	0.12
5	...	0.46	0.36	0.07	0 02	0.01
6	...	...	0.61	0.15	...	...
7	0.14	0.26	1.15	0.10	...	1.14
8	...	0.29	0.26	1.25	0.17	0.20
9	...	...	0.44	...	0.33	0.01
10	...	0.50	0.15	...	0.44	0.04
11	...	...	2.47	0.65	0.04	0.69
12	...	...	...	...	0.19	2.05
13	...	0.20	0.29	0.18	0.24	0.23
14	...	...	...	...	2.85	0.36
15	0.20	1.15	...	1.54	0.86	0.14
16	1.02	...	0.05	0.77	0.01	3.28
17	...	0.02	1.62	0.56	0.21	...
18	...	...	0.97	0.03	2.18	0.62
19	...	...	1.08	0.58	0.05	...
20	...	...	0.18	1.78	0.07	0.06
21	...	...	...	0.12	0.11	0.04
22	...	0.12	...	0.15	0.11	0.03
23	...	...	...	0.81	0.71	0.03
24	2.40	...	...	0.33	...	...
25	0.83	...	...	0.16	0.55	...
26	...	...	0.06	0.21	0.14	0.24
27	...	...	0.78	1.05	0.41	0.73
28	...	...	0.16	0.54	...	...
29	0.07	...	0.35	1.15	0.90	...
30	...	...	4.60	0.73	0.02	0.31
31	...	...	—	0.52	—	...
	6.25	3.51	19.83	13.99	11.00	11.63

Registered by the Municipality of George Town, Penang.

SUMMARY OF RAINFALL, 1914.

	SINGAPORE.			PENANG		
	No of rainy days.	Amount of rain in inches.	Longest spell without rain.	No. of rainy days.	Amount of rain in inches.	Longest Spell without rain.
January - -	24	25.40	2 days.	9	1.89	6 days
February -	10	3.93	18	8	5.00	9
March - -	19	9.96		9	6.29	
April - -	22	16 60	3	16	10.45	4
May - -	19	4.97	3	16	12.43	7
June - -	19	8 58	5	11	9.61	7 (twice)
July - -	13	4.71	8	8	6.25	7 (twice)
August - -	8	1.14	9	12	3.51	9
September -	14	3.14	13	22	19.83	5
October - -	12	4.08		27	13.99	2
November -	22	7.86	3	24	11.00	2
December -	25	9.54	2	22	11.63	2
Total	207	99.91	...	184	111.88	...

Greatest amount in 24 hours. ...	5.42	4.60
" " 48 " ...	9.40	4.95
" " 72 " ...	10.04	5.50
Excessively rainy periods, more than 5.00 having fallen in 72 hours.	2 (Jan. & April)	1 (September).
No. of days when condition existed. -	7	2
Periods of Comparative drought, less than 0.02 having fallen in 120 hours.	4	15 (All months Jan., to Sept. except April).
No. of days when the condition existed. - - -	32	39

CADAMUSTUS TYPICUS—A MINOR COCONUT PEST.

In August last, Mr. J. H. George of the Dindings-Selama Coconut Company, sent to the Botanic Gardens specimens of a "white fly" found feeding in numbers on the juices of coconut leaves at Matang Kubu in the Dindings. This insect was sent to the Imperial Bureau of Entomology, at the British Museum of Natural History and a reply received from Mr. G. A. K. Marshall, the Director, to the effect that the insect is "*Cadamustus typicus*. Distant, which was originally described from Ceylon, where it was found to attack Cardamons and Bananas." Mr. Marshall adds that it has recently been received from the Philippine islands.

Cadamustus typicus is a Tingid fly of small size with the wings beautifully laced and the body curiously shaped.

A VERY DESTRUCTIVE FLASH OF LIGHTNING.

In the night of January 10th—11th, 1914, a grove of coconuts on the coast near Bedok, east of Singapore, was struck by lightning, and the number of trees which died at once or slowly over the months which followed amounted to one hundred and four.

The case in recorded on account of the extent of the damage, and of the fact that the cause of the death of the trees is in this case indisputable. This usually is not the case when a malay ascribes the death of a coconut palm to lightning.

I. H. BURKILL.

BORROWINGS FROM NEW BOOKS.

Culture et Exploitation du Caoutchouc au Brésil, by O. Labroy and V. Cayla, Paris, 1913, pp. 1-233.

This book is a report to the Government of Brazil upon the conditions under which rubber is produced in that country at present and the existing facilitities for planting agriculturally viewed. It does not cover the whole ground of rubber-production in Brazil, but for certain regions only; and much of the book is intended to teach the adoption of planting as practiced in Malaya. But there are many interesting observations scattered through its pages, some of real importance to Malaya. The authors (p. 30) say that *Hevea brasiliensis* shows considerable variability in the Amazon basin

observable in the colour of the bark, its corkiness, and its thickness, the colour, shape and size of the leaves, the number of glands on the petiole, the time when fruiting begins, the number of seeds in the fruit, their shape, size and colour, and lastly of the greatest importance in the amount of latex. On p. 63 the authors recommend the collection of seeds from wild trees found to yield well; from p. 42 forward the way in which the Brazilian seringueiro taps is described, the conclusion being reached that the better "to avoid damage to state property resulting from bad tapping, it will suffice to increase the control of the work of the seringueiro instead of as Akers advised enforcing the disuse of his tapping axe in favour of a tapping implement more modern but strange among the Amazon workmen."

What the authors say about the endebtedness of the seringueiro to the middlemen exposes the weakest spot in the industry of Brazil.

After dealing with Hevea, the authors discuss Manihot. Of species several are defined including a new one *Manihot Toledi;* and as regards them the conclusion is reached that generally it is best to plant *M. Glaziovii,* if it is a case of planting a Manihot, although of the smaller species *M. heptaphylla* and *M. piauhyensis* for instance might be planted, or *M. Toledi* which is intermediate in size.

The authors give a series of facts showing that about two centres in Brazil, Ceara rubber planting is taking a hold. They add that the wild plant has received such severe treatment that it no longer counts as a reliable source of commercial rubber.

The establishment of an experimental station to select, improve and experiment with Ceara rubber is set forth as desirable.

The last few pages of the book are devoted to a discussion of *Castilloa Ulei* and *Hancornia speciosa.*

Annual Report of the Board of Scientific Advice for India for the year 1913-14 (Calcutta, 1915). Among the records in this report of extensive work done, a few are of special interest in Malaya. In the report for 1912-13 it had been explained how in the soil of swampy paddy lands various gases are produced, notably methane or marsh-gas, nitrogen, hydrogen and carbonic-acid gas; and that after the paddy has been planted out a film forms on the surface consisting largely of bacteria, and minute green organisms such as algae and diatoms. Messrs. W. H. Harrison and Subramania Aiyar, continuing their work, show (page 9) how this film lives on the gases that exist as a result of changes within the soil and doubtless are in continual process of formation, using up the methane and the carbonic-acid gas (in part at any rate) with a liberation therefrom of oxygen. The function of this surface film is thus to liberate oxygen, so that the rice roots are more liberally aërated than they would be without it. Drainage of rice land by producing a flow of water through the film into the soil carries this oxygen to the rice roots below; but as too

great a drainage prevents the full development of the film, there is an optimum to be aimed at,—an adjustment of the water supply to the drainage, and the production of the right rate of percolation into the soil. Green manuring by increasing the output of gases in the soil, increases the activity of the surface film, and aided by the percolation increases the aëration of the soil in contact with the rice roots. The ploughing in, as we see it in Malaya, of sedges on rice fallows is green manuring. The authors appear to hold that the important benefit to be got from this is the indirect one of aëration at the roots of the rice.

On page 109 is given an important conclusion arrived at by Mr. C. M. Hutchinson, the Imperial Agricultural Bacteriologist, namely that with such soils as he used for experiment the most rapid and complete nitrification of any given quantity of nitrogenous organic matter could be effected in soil by producing anaërobic conditions with water saturation and subsequently draining and aërating; the rapidity with which nitrification takes place under these conditions depends upon the relative completeness of the anaërobic and subsequently of the aërobic conditions, i.e., the soil must be open.

Experimenting with lime, Mr. Hutchinson "found that decomposition of nitrogen-yielding manure was rapid in proportion to high lime content, although in time the soil lower in lime attained the same nitrate concentration". And lime we know goes a long way in keeping a soil open; but the connection of lime and nitrification is not yet established in detail.

In connection with forestry it is recorded (page 120) that "data showed large quantities of tan barks" to be "available in the mangrove forests of Tenasserim and Arakan, that they can be exploited at a reasonable cost, and that the local conditions are generally favourable for the erection of a factory."

Messrs. Grieve and Shebbeare have drawn attention to the circumstance that the unmixed forests of the Sal tree—*Shorea robusta*, Gaertn.—which occur in the Sub-Himalayan tracts of Bengal are there at any rate artificial; for if fire be withheld an evergreen undergrowth asserts itself against which the sal seedings cannot compete in spite of repeated clearings. This *Shorea* is thus seen to be a pioneer in reafforestation, for it appropriates to itself in time savannahs annually fired.

Proceedings of the Third International Congress of Tropical Agriculture, held at the Imperal Institute, London, June 32rd to 30th, 1914. (London John Bale, Sons, and Danielsson, 1914, p. xii-407. Price 10s. net). Abstracts of the papers read at the Congress, and full reports of the discussions are printed in these Proceedings, together with the opening address by the President, Professor W. R. Dunstan. The Transactions of the Congress containing the papers themselves, are in preparation.

Chief among the subjects dealt with are Technical Education in Tropical Agriculture, Organisation of tropical Departments of Agriculture in relation to Research, Agriculture Credit-Banks and Co-operative Societies; Sanitation on Estates, Legislation against Tropical pests, Fertility of Soils, Rubber, Cotton and other fibres; Cereals, Sugar, Cocoa, Tobacco, Oil seeds.

The Capitalist is a need in the Tropics; and experts from most of the warmer parts of the world were at the Congress to meet him; consequently a not inconsiderable part of the time of the sessions was occupied in his education; with this was interwoven the devout wish to attract scientific workers to the immense field open to them. The proposed College of Tropical Agriculture appeared conspicuously in the discussions, whereat both East and West laid claims to it.

As regards legislation against Plant diseases and Pests, the Congress met with no clashing interests. Never was there before any meeting a subject where discussion started with a more common purpose. It ended in the adoption of a motion by Dr. Warburg that a Committee should be appointed to formulate proposals in regard to points of difficulty in applying the suggestions of the International Phytopathological Convention of Rome. The paper which led the discussion will appear in the Transactions.

Pages 132-156 give the whole discussion on the subject of the variability of plantation rubber, and Professor Dunstan's summing up "that the time is premature for considering what may be called standardization."

A series of resolutions (pp. 385-407) closed the Congress:—

i. To appoint a Committee to collect information on the organization of Government Departments of Agriculture.

ii. To appoint a Committee to report on the question of estate sanitation.

iii. To arrange for the exchange of publications.

iv. To appoint a Committee to collect information on agricultural co-operation including credit, against the next Congress.

v. To appoint a Committee to support the London Committee which is promoting the establishment of an Imperial College of Agriculture.

vi. To appoint an International Committee to consider how far the proposals of the International Phytopathological Conference of Rome, 1914, are applicable to the Tropics; and that the official delegates should be asked to report this to their Governments.

vii-ix. Personal.

x. To support the formation of a British Institute of Tropical Agriculture.

xi. To appoint a committee to co-operate with the International Institute of Agriculture in Rome.

xii. To appoint a committee to discuss the internal affairs of the Association Scientifique d'Agronomie Coloniale et Tropicale, i.e., the organisation under whose auspices these Congresses are held.

Dr. J. D. Gimlette's "*Malay Poisons and Charm Cures*," (J. & A. Churchill, London, 1915, pp. viii + 127) and the *Rubber Receuil* of the International Rubber Congress and Exhibition, (Batavia, 1914, J. H. de Bussy, Amsterdam, 1914, pp. 614), are books recently published, which should find their way to every station in the Peninsula.

The poisonous Depu plandok mentioned by Dr. Gimlette on page 48 and elsewhere proves to be a new species of *Wikstroemia*,—*W. Ridleyi*, Gamble,—which is restricted to Pahang, Tringganu and Kelantan, as far as we know at present.

The

Gardens' Bulletin

STRAITS SETTLEMENTS,

into which is incorporated all that has been published as the third series of the Agricultural Bulletin of the Straits and Federated Malay States.

Vol. I. Issued July 10th, 1916. No. 10

CONTENTS.

To be purchased at the Botanic Gardens, Singapore; from Messrs. Kelly and Walsh, Ltd., No. 32 Raffles Place and 194 Orchard Road, Singapore.

DEPARTMENTAL NOTICE.

Seeds of *Hevea brasiliensis*—Para rubber—as available from trees, twenty-nine years old or older, will be sold at three dollars per thousand up to the number of ten thousand, and at two dollars and fifty cents for every further thousand on the same order.

Errata on p. 309.

Line 14 from bottom (description of *Loxura atymnus*) for 5 cm. read 35 mm. and lines 15 and 16 for plate XXXIX figure 2 read plate XXIV figure 7.

Last line description of *Tagiades gana* for plate XXIV figure 7 read plate XXXIX figure 2 and for 9 cm. read 45 mm.

THE

GARDENS' BULLETIN,

STRAITS SETTLEMENTS,

INTO WHICH IS INCORPORATED ALL THAT HAS BEEN PUBLISHED AS THE THIRD SERIES OF THE AGRICULTURAL BULLETIN OF THE STRAITS AND FEDERATED MALAY STATES.

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THE

GARDENS' BULLETIN,

STRAITS SETTLEMENTS.

Vol. 1. Issued July 10th, 1916. No. 10.

LOCUSTS IN MALACCA

JULY 1914 TO OCTOBER 1915.

On July 3rd, 1914, one of us (I. H. B.) was sent to Malacca to enquire into the locust problem; and on August 15th, 1914, the other (P. C. C.-B.) was appointed Special Assistant for Locust Destruction in Malacca, and went into residence there. We continued to work together until the commencement of November 1915; and we here report on the work done.

The first date coincided with the planting of the rice crop in Malacca, and it happened to coincide also with a recrudescence of hopper-hatching in the Territory. Thus fortuitously it is a convenient one for our report. We believe that the infestation of the Territory with locusts had been increasing up to that time and that the work done against the insects subsequently has decreased it.

We operated by means of bag-traps of the pattern used in the Federated Malay States (vide Pratt, The Malayan Locust, Bulletin No. 24 of the Department of Agricuture, F. M. S., 1915). At first the traps in use were two, so that only about fifty days bagging work per mensem were possible; but the number was increased to six in August 1914, and to eight in November, making possible two hundred days' work per mensem. We obtained information of the whereabouts of hoppers through native subordinate officers such as penghulus and sedangs, as well as personally, and by the employment of locust-scouts who searched the country. So dense is the population of Malacca, and so complete the village system of administration that we believe only a few breeding places could escape detection. Whether the hoppers were destroyed or not, depended on a bag trap and trained subordinate being available to attack them.

Occasionally Malays would catch fliers by night, and were rewarded for doing so: but no campaign against fliers of this nature was organised. Malays both eat the hoppers themselves and used them for feeding fowls.

We were not willing to use poison; for the number of buffaloes and cattle in the Territory is great, the Malays keeping buffaloes for ploughing etc., they and others keeping bullocks for draught, and rubber estates owning bullocks extensively. The buffaloes graze with little supervision; herds of cattle are turned into the lallang wastes daily: and by a circular we ascertained when considering the question that fifty-one out of fifty-six large rubber estates at the time used bullocks for cultivation etc. We hoped by destroying, say, 75 per cent of a swarm of hoppers to bring the destruction of the whole within the compass of their natural enemies, most of which are destroyed along with the locusts when poison is used.

We illustrate this report by maps, whereon every breeding place detected is marked by a dot or a ring. It is necessary to assume that the reader knows enough of the geography of the Territory of Malacca to do without names on the maps. For some reason the breeding places fall very largely within two circles, which for convenience we take as a circle of eight miles radius from Alor Gajah and a similar circle from Jasin. These villages may not be the very centres of circles, 16 miles across, which would contain the most breeding places: but it is convenient to make them so serve as what we say later will show.

There was a plentiful production of hoppers in other parts of the Territory.

Whether the greater abundance of hoppers within the Alor Gajah and Jasin neighbourhoods can be due to their green rice valleys keeping the fliers from moving away, until their breeding time came, or whether another cause must be sought we are unable to state. We do not think that the breeding places were so much better reported near these centres than elsewhere as to cause a false appearance of local prevalence. On the other hand this local prevalence when realised determined in some measure where the subordinates who had charge of the bag traps should live.

The following table gives mukim by mukim (parish by parish) the amount of work done against the locusts, the unit being one day's work with a trap and gang of coolies. The thirty and more mukims which are not named in the table are those where no breeding occurred.

TABLE 1

No. of day's work of a trap.

		August 1914	September	October	November	December	January 1915	February	March	April	May	June	July	August	September	October
	Average rainfall	3.97	4.12	7.39	8.10	6.15	4.41	1.79	5.39	8.13	4.06	6.43	6.05	6.37	6.12	8.10
	Tebong	...	...	...	...	...	...	...	...	...	...	...	8	4	...	23
	Ulu Batang Malaka	16	...	...	...	...	...	...	...	...	...	...	...	...	...	17
Circle round Jasin	Nyalas	...	...	...	...	...	...	...	...	17	43	...	...	...	...	6
	Chabau	...	...	...	...	...	...	...	...	...		13	...	...	...	...
	Chohong	...	...	...	...	...	...	...	...	29	...	...	...	...	...	...
	Chunchin	...	...	...	15	9	...	...	29		...	...	9	...	...	...
	Jus	...	...	...	19	58	13	...	...	...	...	13	12	19	...	...
	Bukit Singgeh	...	...	...	...	...	...	...	...	...	...	...	19	...	...	...
	Selandar	...	...	7	30	28	29	6	...	...	30	21	31	24	...	...
	Kesang	...	...	...	...	...	...	...	5	11	...	9	10	...	...	...
	Rim	...	...	...	...	24	9	...	...	24	...	...	11	18	...	...
	Jasin	...	...	...	23	16	...	...	...	27	29	16	...	10	33	...
	Ayer Panas	...	...	...	...	...	...	...	...	...	...	...	...	12	...	...
	Ayer Molek	...	...	...	...	...	...	...	...	...	...	...	9	...	...	...
Circle round Alor Gajah	Melekek	...	...	...	...	24	...	...	...	...	...	...	...	12	...	...
	Taboh Naning	...	...	...	...	...	...	...	...	...	...	...	...	...	10	...
	Pulau Sabang	...	5	...	...	...	7	...	...	12	...	...	...	13	...	...
	Kemuning	...	...	...	16	12	...	...	...	21	12	...	...	...	...	...
	Tanjong Rimau	...	2	...	...	...	...	...	...	...	...	...	30	...	...	...
	Padang Sabang	...	...	...	...	...	3	...	...	...	...	...	...	...	...	...
	Pegoh	...	...	...	...	...	11	...	...	...	...	...	...	...	...	...
	Ayer Pa abas	...	...	...	...	...	...	...	...	...	25	...	...	...	...	...
	Kelemak	...	...	...	...	...	...	...	...	...	...	...	6	...	...	...
	Gadek	...	2	14	...	12	7	...	...	...	...	...	17	15	...	68
	Malaka Pinda	...	...	...	...	...	...	...	...	...	...	...	16	14	...	...
	Parit Melana	...	11	...	...	...	...	...	...	...	...	...	...	...	...	...
	Belimbing	...	...	...	...	...	4	...	...	...	...	...	...	...	...	...
	Rembia	...	...	2	...	...	...	...	...	13	...	...	...	...	...	...
	Durian Tunggal	...	...	1	...	...	...	...	...	...	...	...	...	4	...	...
	Machap	...	...	...	...	...	...	...	...	...	...	...	...	5	...	...
	Paya Rumput	...	...	2	...	...	...	...	...	...	...	...	...	18	...	...
	Lendu	...	...	...	...	...	...	...	...	...	13	...	20	...	...	...
Coast mostly	Bukit Rambai	...	...	...		...	...	...	...	...	...	...	...	...	...	9
	Sungei Bharu	...	...	...	...	...	4	23	...	...	...	9	18	1	...	...
	Tanggah Batu	...	...	...	...	...	7	...	...	...	...	...	...	...	...	...
	Balai Panjang	...	...	...	...	...	...	11	...	...	...	...	...	...	...	...
	Telok Mas	...	...	...	...	...	...	4	...	...	...	...	...	11	11	...
	Pasir Puteh	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...
	Ayer Pasir	...	...	...	...	...	...	...	...	...	...	...	...	...	17	...
	Bukit Umbei	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...
	Merlimau	...	...	...	...	9	10	...	...	...	...	...	...	...	...	...
	Sabatu	7	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Sungei Rambai		15	...	...	...	...	...	...	...	...	...	...	...	...	...
	Total	43	42	103	192	104	44	—	106	132	145	90	215	192	10	123

Map 1. Distribution of locusts in Malacca in July 1914. Fliers in the centre flying southward, hoppers in the east.

Within the Malay Peninsula, the migratory locust against which these operations were directed, first attracted attention near Port Dickson, Negri Sembilan, in February, 1912. When it came is not known: but as the several swarms bred synchronously, a common origin is not unlikely, and would be by importation of eggs in soil some 12-24 months previously. The importation may not have been from far away, for, whether we call the locust *Pachytylus migratorioides* or *Pachytylus danicus,* it has been identified with what occurs in Southern India and in the Philippine islands as well as elsewhere. It is certain that the past condition of the country,—well forested—would be inimical to it: but now that wide cultivation has removed the trees, and left large grassy wastes, a condition suiting it has been brought into existence. These artificial wastes, the strongholds of the locusts are most extensive behind Port Dickson, but extend widely through Malacca, and beyond into Negri Sembilan and Johore. They meet the three needs of the locusts:—

a warm soil for incubation
a grassy vegetation for food
a comparative freedom from enemies,

like the wide fire-swept downs of Africa, the steppes of Southern Russia, and the "cogonales" of the Philippine Islands, in which locusts so often multiply in large numbers.

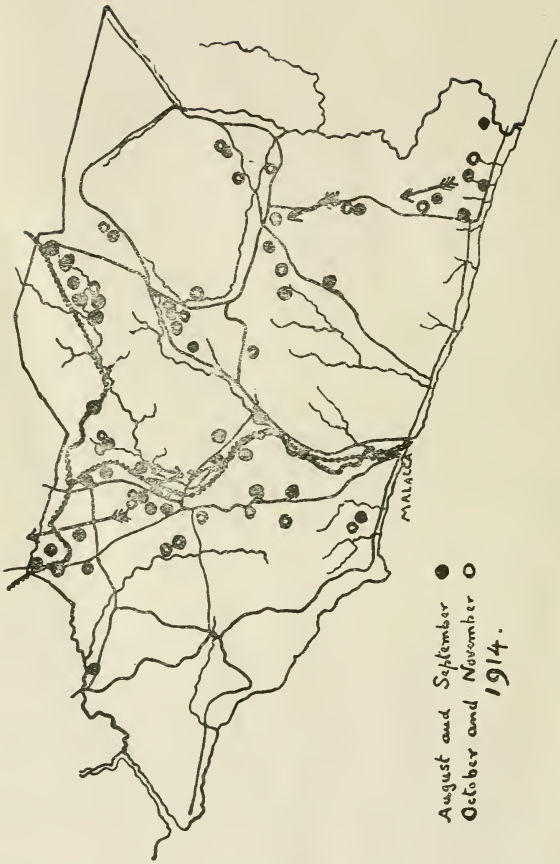
The reader will understand that the forest meets none of these needs; the rice fields, the "grass-weeded" rubber estates, the coconut plantations and the Malay village lands (really orchards in grass) and the lallang wastes meet them in large part, but clean weeded rubber estates do not meet them at all adequately.

Distributed as these conditions of vegetation are in Malacca, there appears to be hardly a mukim (parish) in the whole Territory where locust breeding is impossible.

In our work we kept careful records intended to help towards ascertaining whether certain mukims might escape and if so why. And the following is a summary of the distribution of locust breeding during our fifteen months.

In July, 1914, as map 1 shows, the locusts in eastern and western Malacca had not bred synchronously; but eastern Malacca carried hoppers in many places, while to the west fliers alone were found. These fliers were in considerable swarms all moving southwards as the arrows in the map indicate. We were not able to attack all the places where hoppers hatched out, but only those few indicated in table 1.

In August, between the 1st and the 15th, enormous numbers of hoppers hatched out on the Tebong Estate at the very head of the Malacca river, which also we were unable to attack: and others appeared in the central part of the valley of the river from Gadek down to Belimbing, and also east of Merlimau towards the Johore boundary. In both regions the hoppers were attacked, but east of Merlimau only in September,



Map 2. Hopper-infested spots in Malacca, August to November, 1914; migrations of fliers marked by arrows.

Hoppers continued to appear at places along the Malacca river valley, through the rest of August and through September also.

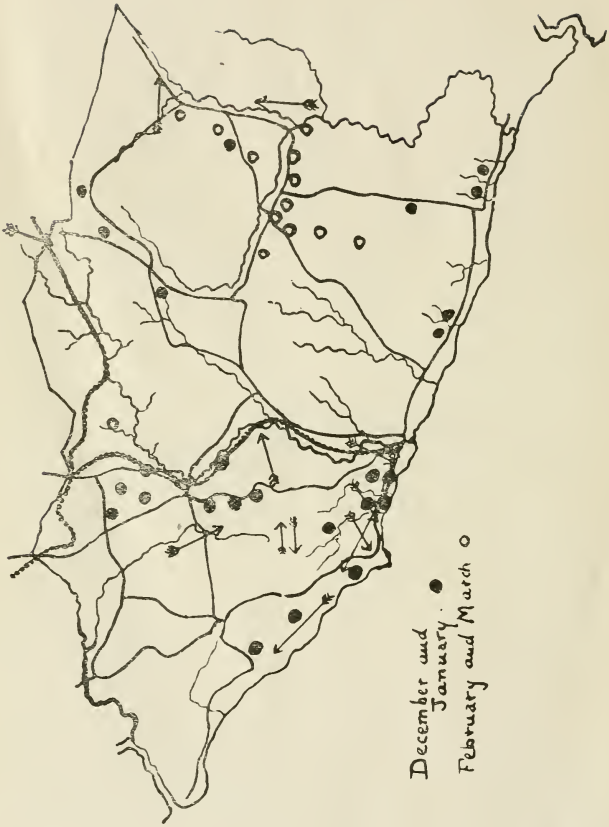
Towards the end of September they appeared in several spots in or near the top of the Jasin valley and near to the road from Malacca to Jasin. They were attacked, and large numbers destroyed. But greater numbers hatched out in October. It seems probable that they were the first descendants of fliers which had been circling about Jasin in the month of September, reinforced by a swarm which had invaded the neighbourhood from the direction of Merliman. If the reader will kindly examine the second map, it will be seen by the number of rings about Jus, Selandar, Kesang, Jasin and down to Chinchin (all places along the same stream) how great was this infection. Some of the breeding places escaped the catchers' attentions.

At the same time, *i.e.* in October, hatching of hoppers was occurring all about the Malacca stream valley between Alor Gajah and the Negri Sembilan border at Tampin, and also on the east side of the middle part of the valley to Durian Tunggal. This hatching was followed by hatching in new spots further west at the end of the month of November: and the hoppers on the west in large measure escaped destruction. Map 2 shows clearly that there is a band of rings, *i.e.* later hatchings on the west side of the dots (earlier hatchings) of the middle part of the Malacca stream valley. And although records of migratory swarms cannot be put together so as to show a common origin for all these western hatchings, it is probable that they had one: and it is known with certainty that one swarm passed through the northern part of this area in the second week of October, flying from Pegoh to Kendong on the Negri-Sembilan border, and there losing its direction against the forests of Gunong Tampin.

The number of locusts maturing from this heavy infection of the middle part of the Malacca stream valley led to fliers reaching Malacca town in considerable numbers in December. It may be stated for general information that they had not come from a far distant area, but were bred almost "locally," as no doubt most swarms of fliers are when not in vast numbers; for vast numbers make a much more unsettled whole than small numbers in a country where there is food for all.

The directions in which the swarms moved about Malacca was very varied, but still with a southerly tendency ending for part of the insects at least in death in the sea. They were seen in the waves of the tide on Jan. 25th, 1915 and on March 27th, 1915, out a little way to sea. One swarm at this time flew westwards and doubled back eastwards again on the same day (Jan. 27th, 1915). Finally in February there was a steady tendency in the locusts to more westwards along the coast as is indicated in map 3 by the long arrows.

Early in December the coastal mukims west of Malacca produced hoppers in many places, and there was a synchronous hatching out about Alor Gajah and on the coast east of Malacca, as well as elsewhere in the Jasin division. It appears as possibly of interest that hoppers should have been so much more abundantly



Map 3. Hopper infested spots in Malacca, December 1914 to March 1915; migrations of fliers marked by aorws.

produced on the coast in December that at other times, and we are inclined to explain this as the result of the tendency to fly southwards in the swarms of the previous months which ended in providing eggs for so many more hoppers than the enemies of the locusts could destroy—a seasonal effect.

In February hoppers were nowhere. Doubtless there were plenty of dormant eggs, and the fliers abroad were depositing more; but the condition of the soil was against their hatching. The recrudescence came in the neighbourhood of Jasin where hoppers appeared in the many places marked on map 3 in March.

In April and right into May hoppers appeared on the west of Alor Gajah about the upper part of the stream which runs north-westwards to the Linggi river: and at the same time they ceased to appear in the Jasin neighbourhood. The area where, west of Alor Gajah, they mostly appeared was that part of the country which had escaped attention in November.

Towards the end of May they began again to emerge in the Jasin neighbourhood, and continued to do so through June.

In July they emerged again in the Alor Gajah division.

The reader should turn to map 4, and note that the localities marked therein fall chiefly into three groups, (i) those on the extreme west being April-May hatchings, (ii) those in the Jasin neighbourhood being May-June hatchings, and (iii) those of the upper part of the valley of the Malacca river being July hatchings.

Big swarms movements were only detected on two occasions one towards the south-east, the date being about May 9th; the other towards the north east, the date being about May 2nd.

In August hatching out of hoppers continued in the Jasin valley, and at the same time they appeared at the various places elsewhere indicated by the black dots on map 5, all but one on the map being August hatchings.

In September the whole territory was nearly free of hoppers but fliers were descending the Malacca river valley, and also moving eastward along the northern border.

In November hatchings occurred at Nyalas and at Batang Malaka, along the Malacca river valley and to the west of it in the Lendu mukim.

If our records be tabulated, hatching within a circle of eight miles of Alor Gajah and hatching within a circule of eight miles of Jasin, and hatchings close to the coast, the following results:—

Map 4. Hopper-infested spots in Malacca from April to July 1915; migrations of fliers marked by arrows.

Month	Alor Gajah	Jasin	Coast
July 1914	.....	hoppers emerge	hoppers emerge in east
August 1st half	*hoppers emerge very freely*	.....	emerge freely in east
2nd half	continue to emerge	.....	.....
September 1st half	emerge	.....	.....
2nd half	emerge	begin to emerge	.....
October 1st half	emerge	*emerge very freely*	.....
2nd half	.....	.....	.....
November 1st half	emerge	emerge	emerge freely
2nd half	*emerge very freely*	emerge	emerge freely
December 1st half	emerge	.....	emerge
2nd half	.....	.....	.....
January 1st half	.....	.....	.....
2nd half	.....	.....	.....
February 1st half	.....	.....	.....
2nd half	.....	.....	.....
March 1st half	.....	emerge freely	.....
2nd half	emerge	.....	.....
April 1st half	emerge	emerge	.....
2nd half	emerge	emerge	.....
May 1st half	emerge	emerge	.....
2nd half	emerge	emerge	.....
June 1st half	emerge	emerge freely	emerge
2nd half	emerge freely	*emerge very freely*	.....
July 1st half	emerge freely	emerge	.....
2nd half	.....	.....	.....
August 1st half	emerge	.....	emerge
2nd half	.....	.....	.....
September 1st half	emerge	.....	.....
2nd half	.....	.....	.....
October 1st half	emerge	emerge	.....
2nd half	.....	emerge	emerge

Map 5. Hopper infested spots in Malacca from August to November 1915; migrations of fliers marked by arrows.

From this tabulation one fact is patent, namely that between December and March locust hatching is prevented: and the prevention is doubtless by the relative dryness of the soil in consequence of the lessened rainfall. The rainfall is shown in the top line of table 1.

We have taken the rainfall statistics as published in the Government Gazette, and compared them carefully with the record of locust hatching. Unfortunately for our purpose all the Malacca records read at police stations are of very little value: but again on the other hand fortunately accurate records are read at the District Hospitals of Alor Gajah and Jasin: and these we use in the next table.

Month	Alor Gajah.			Jasin		
	No. of rainy days	Amount	Locusts, abundance indicated by breadth of column.	No. of rainy days	Amount	Locusts, abundance indicated by width of column.
July 1st half	5	3·44		9	4·06	
2nd half	1	1.92		5	2·66	
August 1st half	3	3·51		7	1·87	
2nd half	3	3·95		3	0·67	
September 1st half	5	2·66		5	1·32	
2nd half	3	2 22		6	1·57	
October 1st half	2	1·23		3	0 88	
2nd half	10	11·64		14	12·61	
November 1st half	8	6·27		11	6·47	
2nd half	2	1·86		8	2·49	
December 1st half	7	6·55		13	2·47	
2nd half	4	4·21		8	2·49	
January 1st half	1	1·96		5	4·18	
2nd half	4	2·37		8	3·71	
February 1st half	2	1·36		4	2·37	
2nd half	2	1·26		2	0·94	
March 1st half	4	2·05		5	4·30	
2nd half	9	3·01		6	0·87	
April 1st half	8	7·63		11	4·43	
2nd half	8	7·12		13	6·21	
May 1st half	3	1·33		4	2·84	
2nd half	2	0·63		2	2·11	
June 1st half	6	4·01		7	3·58	
2nd half	5	2·58		6	3·84	
July 1st half	3	3·95		7	1·83	
2nd half	5	1·66		6	3 18	
August 1st half	5	2·03		6	2·12	
2nd half	6	10·72		11	3·18	
September 1st half	4	2·87		6	3·27	
2nd half	5	1 77		10	1·86	
October 1st half	3	1·17		6	2·83	
2nd half	11	7·91		6	4·62	

From this table a second fact seems to appear, namely that hopper emergence was reduced in any half month when the local rainfall was very heavy. Thus in the second half of October, 1914, when Alor Gajah had 11.64 inches of rain falling on ten days, there were no hoppers discovered nearer than the Negri Sembilan border at a distance of more than eight miles; and in the second half of August, 1915, when 10.72 inches fell on 6 days, no hoppers emerged; and again when in the second half of October, 1914, Jasin had 12.61 inches falling on 14 days, no hoppers emerged, or at least none were discovered.

It is quite possible that such an effect could be produced by the evaporation from the wet ground resulting in a temperature just under the surface too low for the eggs to develop.

The maximum and minimum amounts of rain in half months when hatching occurred were:—

Alor Gajah,	maximum 7.63	in amount or	9 in days.
	minimum 0.63	in amount or	2 in days.
Jasin.	maximum 6.21	in amount or	13 in days.
	minimum 0.88	in amount or	2 in days.

The minimum is the absolute minimum of either place during the period of the observations.

Excessive hatching was recorded in half months when the rainfall was:—

Alor Gajah	3.51	1.86	3.95.
Jasin	0.88	4.30	3.58 and 3.84.

We sum up all that we can say then thus:—that we believe the soil moisture in such places as the locusts choose for depositing eggs to be in Malacca territory sufficient through nine months of the year to allow the eggs to develop, but that excessive rain is liable to create by evaporation a temperature which inhibits the development. Such a view explains the cessation of appearance of hoppers at the times recorded.

Mr. F. W. South has written (Agric. Bull. of the Federated Malay States, iii, 1915, p. 295) "from April to October there is a tendency to a general movement of the locusts in the Malay Peninsula in a north-westerly direction; while during the remainder of the year the direction is reversed." We suspect that the tendency is different in Malacca and the forces, light winds or whatever they be leading the insects to move southwards, are much stronger than Mr. South's statement would imply; and further we suspect that the tendency such as it is, sends swarms of fliers down to deposit eggs near the coast, in the low land not subject to fires where as enemies are more numerous, the toll taken of the hoppers is greater than in the lallang lands towards the north. This view regards the lallang wastes as danger spots,—foci whence the broad coastal rice lands may get infected recurrently, and therefore regards the latter more as a "permissive area" to invading locusts.

A record has been kept of the nature of the vegetation in which hoppers were observed; and it may be summed up as follows:—

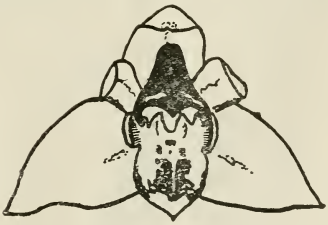
in rice fields and nurseries	17	occasions.
in rubber plantations (grass weeded or weedy)	38	„
in tapioca crops	3	„
about houses in villages (kampong land) ..	14	„
on grass pastures	8	„
on roadsides which are chiefly like pastures ..	10	„
on the railway embankments which are chiefly in lallang	2	„
in lallang waste land	38	„
in lallang turning to scrub (belukar)	1	„
in pasture turning to scrub (belukar) ..	1	„
in scrub (belukar)	8	„

P. C. Cowley-Brown. I. H. Burkill.

ORCHID NOTES

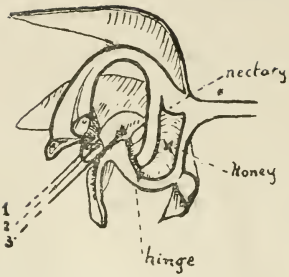
Thecostele secunda, Ridl.

The flower of this orchid was described in the Bulletin on p. 318. To that description it appears well to add the annexed figures, and a note on the mechanism as regards pollination by insects.



Thecostele secunda,—flowers. × 2, from in front.

A visiting insect should settle on the lip and be of such weight as to depress it on the hinge marked in the sectional drawing. When the lip is depressed, a way is opened to the abundant honey through the groove over the centre of the crest. Just under this groove is a yellow spot as described on p. 318. When the weight of the insect is removed the lip returns to the position in which it was, closing the road to the honey again. The part of the lip fitting over the mouth is furnished with hairs such as would prevent small insects from entering the honey-cavity.



Flower of Thecostele secunda in section: 1 side lobe of the lip; 2 interlocking lobe of the column; 3, crest of the lip.

On either side of the central groove, between the crest of the lip and the bracket-like side lobes, are other grooves into which dovetail the side arms of the column. The lip is free to move up and down on its hinge; but if the visiting insect should give a lateral thrust to it, the crests and side lobes engage the side arms of the column and prevent displacement. The insect is thus kept in the middle line with its head immediately under the sexual organs, where only it can be of use to the flower in effecting pollination.

In the black and white drawing the black parts of the flower are either deep magenta or claret, the light parts pale green.

THECOSTELE MACULOSA, RIDL.

x 2.

Flower of Thecostele maculosa x 2. from in front.

Thecostele maculosa, Ridl. (Collabium Wrayi, *Hook. f.*) recently flowered in the Botanic Gardens, Singapore, and a figure of it is here given in black and white, to correct impressions gained from that in the *Icones Plantarum,* 4th series, I., 1892, t. 2065, and also on account of certain ways in which the colour is not as described.

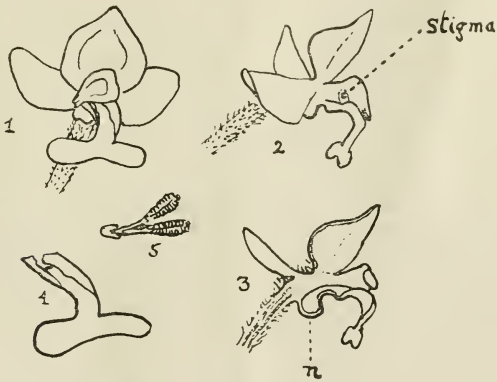
The colour of the flowers is maroon and white, the latter passing to a dull yellow at the base of the sepals and petals. The

position taken by the flower is strictly horizontal. The raceme is directed downwards, but just upcurved at the tip. The flowers open in acropetal succession. The large nectarial cavity with a yellow nectary in the upper wall near the base contains abundance of honey; approach to it is guarded by the lip closing the entrance and by papilla-like hairs arising in it. Lesser hairs cover the forward surface of the lip affording a foothold for visiting insects. The distribution of colour in the flower is best understood from the figure. A visiting insect seeking honey is kept in the middle line of the flower by the side lobes of the lip, which like crooked little fingers, approach the arms of the column.

Thecostele maculosa has been collected from various places between Kedah and Malacca and on the coast of Pahang.

Haemaria discolor, Lindl.

Haemaria discolor and its variety *Ordiana*, Williams, have flowered very abundantly in the Botanic Gardens recently, and the curious distortion observable in the column and lip has been studied. Each inflorescence carried 10-15 flowers so that considerable number have been available for examination. Invariably was the distortion in the one direction as represented in the figure.



1. Flower of Haemaria discolor form in front × 2; 2. from the side; 3. in section, n being the honey sac. 4. the lip; 5. the pollinia.

The hood (composed of one sepal and two petals fused) rises obliquely over the sexual organs; the lateral sepals are half reflexed as figure 2 shows: they are not distorted. But the column is twisted in the direction of the movement of the hands of a clock through about 50 degrees, bringing the stigma to such a position that it is exposed towards the side of the flower (figure 2). The lip from a little median honey sac is bent out of the median line towards the opposite side of the flower to the stigma, and towards the base its edges partially make a tube: it does not make a landing

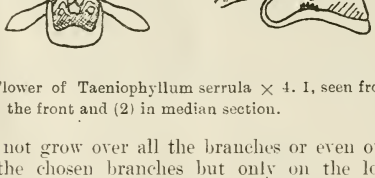
stage under the sexual organs at all, and with its limb like an inverted T offers a restricted surface for an insect to settle upon. This surface is slightly twisted often.

Exactly how pollination is affected has not been ascertained: but all the earlier flowers in the Gardens obtained it.

It will be gathered from what has been said that the condition figured "from nature" in Engler's Naturliche Pflanzenfamilien II part 6, 1888, p. 118, with the lip uppermost, has not been met with: and as the old figures (Botanical Magazine, 2055 and Botanical Register, 271) represent the flower in the position, invariable at Singapore, with lip below, it is questionable if such an inverted position is normal in any race.

Taeniophyllum Serrula, Hook. f.

Taeniophyllum Serrula grows on the bark of two trees in the Botanic Gardens, both *Dillenia indica*, and both within a few yards of the bank of the Cluny Lake.



Flower of Taeniophyllum serrula × 4. 1, seen from the front and (2) in median section.

It does not grow over all the branches or even over the whole surface of the chosen branches but only on the lower sides of those facing more or less to the south or lake side. At the north side is a bamboo fence and then a quiet roadway. It flourishes best on the tree which lies lowest. Removed with the bark carefully to a site away from water the plants died: but in the site of its own choosing, it is plentiful enough.

This note is published to record that—like *Dendrobium crumenatum* or *Saccolabium Calceolus* it is a periodic flowerer. The little flowers open on the different plants about dawn, and wither, whether fertilized or not towards dark, to be followed by a fresh crop after an interval which is being studied. These are the dates on which flowering was observed:—

October 1st, 1915.
October 13th, interval without flowers 11 days.
October 26th, interval without flowers 6 days.
October — a flowering which was not accurately recorded.
November 6th, double interval, 15 days or, say, 7 + 7 days without flowers + 1 day of flowering.
November 11th, interval without flowers 4 days.

November 25th, interval without flowers 13 days.
December 7th, (a few flowers also on the 8th), interval without flowers 11 days.
December 22nd, interval without flowers (13 or) 14 days.
January 1st, interval without flowers 9 days.
January 8th, interval without flowers 6 days.
January 20th, interval without flowers 11 days.

At this stage the observations were interrupted. They will be resumed in the next season.

The spikes produce many flowers in succession. Sometimes fertilisation of one will arrest the flowering of the inflorescence, but sometimes not. Once and then as an abnormality two flowers were open on the spike at the same time: they stood side by side. About two per cent of the flowers obtained pollination during the period over which the observations extended. How has not been ascertained. The flower has a white lip, a purple anther cap: and elsewhere it is clear greenish yellow. It stands horizontally as the drawing indicates. No free honey has been found; but the whole lip is very fleshy.

I. H. Burkill.

RECORD OF A FEW ORCHIDS.

and other interesting plants (Monocotyledons) found in Penang, Setol, Kedah Peak and Bukit Wang in the north of Kedah.

Orchidaceae.

1.	*Oberonia* sp.	Jenun (South Kedah).
2.	*Liparis* sp.	Kedah Peak.
3.	*Platyclinis linearis*, Ridl.	Kedah Peak.
4.	*Dendrobium Kelsallii*, Ridl. ..	Kedah Peak.
5.	*Dendrobium ericaeflorum*, Lindl ..	Kedah Peak.
6.	*Dendrobium trinervium*, Ridl. ..	Setol.
7.	*Dendrobium hercoglossum*, Reichb. f.	Bukit Wang.
8.	*Bulbophyllum linearifolium*, King.	Kedah Peak.
9.	*Bulbophyllum longiflorum*, Ridl. ..	Kedah Peak.
10.	*Bulbophyllum fascinator*, Rolfe. ..	Setol.
11.	*Eria albotomentosa*, Lindl. ..	Kedah Peak.
12.	*Eria monticola*, Hook. f.	Kedah Peak.
13.	*Eria teretifolia*, Griff.	Kedah Peak.
14.	*Eria velutina*, Lindl.	Lankawi.
15.	*Thunia alba*, Reichb. f.	Bukit Wang.
16.	*Ceratostylus pendula*, Hook. f. ..	Penang, Penara Bukit.
17.	*Plocoglottis ?foetida*, Ridl. ..	Setol.
18.	*Tainia Maingayii*, Hook. f. ..	Kedah Peak.
19.	*Calanthe angustifolia*, Lindl. ..	Kedah Peak.

20.	*Calanthe albolutea*, Ridl.	Kedah Peak.
21.	*Arundina speciosa*, Blume.	Penang (Stone Quarry).
22.	*Arundina Philippii*, Reichb. ..	Penang (Stone Quarry).
23.	*Pholidota imbricata*, Lindl. ..	Penang (Rifle Range).
24.	*Eulophia Keithii*, Ridl.	Setol.
25.	*Geodorum citrinum*, Jacks. ..	Penang (The Spout).
26.	*Cymbidium Munronianum*, King and Pantling	Setol.
27.	*Cymbidium Finlaysonianum*, var. *atropurpureum*	Setol.
28.	*Bromheadia rupestris*, Ridl. ..	Kedah Peak.
29.	*Bromheadia palustris*, Lindl. ..	Kedah Peak.
30.	*Phalaenopsis Esmeralda*, Reichb. f.	Kedah Peak.
31.	*Renanthera arachnitis*, Lindl. ..	Penang (Ayer Etam).
32.	*Renantherella histrionica*, Ridl. ..	Penang (Rifle Range).
33.	*Rhynchostylis retusa*, Blume. ..	Bukit Wang.
34.	*Saccolabium saxicolum*, Linn. ..	Kedah (G. Kriang).
35.	*Podochilus sciuroides*, Reichb. f. ..	Kedah Peak.
36.	*Podochilus muricata*, Schlechter ..	Kedah Peak.
37.	*Pogonia plicata*, Lindl.	Penang (Mt. Erskine).
38.	*Aphyllorchis pallida*, Blume. ..	Penang (Waterfall Valley). Penang (near stone Quarry).
39.	*Lecanorchis malaccensis*, Ridl. ..	Kedah Peak.
40.	*Anoectochilus Reinwardtii*, Blume.	Kedah Peak.
41.	*Cheirostylis flabellata*, Wight. ..	Penang (Spout).
42.	*Cryptostylis arachnites*, Blume. ..	Kedah Peak.
43.	*Habenaria monticola*, Ridl.	Kedah Peak.

ZINGIBERACEAE.

44.	*Alpinia javanica*, Blume.	

BURMANNIACEAE.

45.	*Burmannia disticha*, Linn.	Kedah Peak.

DIOSCOREACEAE.

46.	*Dioscorea pyrifolia*, Kunth. ..	Kedah Peak.
47.	*Dioscorea aculeata*, Linn.	Gunong Kriang.
48.	*Dioscorea ?zollingeriana*, Kunth. ..	Bukit Wang.

PALMAE.

49.	*Pinanga paradoxa*, Scheff.	Kedah Peak.

PONTEDERIACEAE.

50.	*Monochoria vaginalis*, Presl. var. ..	Bukit Jenun.

The *Liparis*, No. 2 above, has been collected on Kedah peak before (Ridley, June 1893); but the flowers remain unknown.

Cheirostylis flabellata was found at "the Spout" close to the Bungalow above the Waterfall. It has been established there ever since the bungalow was purchased by the Municipality and caused to be abandoned as a residence; but it is likely to disappear when the jungle overgrows the site.

Pogonia plicata was found at the ruined bungalow of Mr. Erskine above the Waterfall Gardens (abandoned about 60 to 70 years ago).

Arundina speciosa and *Arundina Philippii*, were found on the top of the old Quarry near the entrance to the Gardens. They may be self-sown from the plants cultivated in the Gardens; but both are likely to be lost when the secondary jungle in which they are found becomes overgrown with Gleichenia, etc.

With regard to *Renanthera arachnitis*, I find that it escaped the notice of the old collectors. It was found unexpectedly by me in the valley of Ayer Etam Hill on large boulders forming the boundary between two plantations, and apparently is indigenous.

Phalaenopsis esmeralda, known as regards the western side of the Peninsula only to grow near the coasts of Lankawi was unexpectedly found on Kedah Peak at about 2000 feet above sea level.

Dendrobium ericaeflorum and *Thunia alba*. These occur in the Himalayas and the latter as far south as Lower Burmah: but this is the first time that they have been collected in the Malay Peninsula. Their occurrence illustrates Mr. Ridley's remark that the flora of India travels as far as Kedah Peak.

Cymbidium Munronianum, *Cymbidium Finlaysonianum*, var. *atropurpureum*, *Bulbophyllum fascinator*, and *Eria ochracea* were found on the isolated hill in Setol known as Bukit Bunga. They are new to Malaya and are not mentioned by Mr. Ridley in his Materials for a flora of the Malayan Peninsula. The *Eria* and *Bulbophyllum fascinator* were found by me and forwarded to the Royal Botanical Gardens, Kew, through Mr. Derry. In the Kew Bulletin, 1909, page 366 they are referred to as probably from Siam: the exact locality is Setol.

Monochoria vaginalis, occurs at Jenun in a very handsome form, the raceme of deep blue flowers being six inches long and more, while the blades of the leaves are so narrow as not to obscure it. This form has been introduced into the Waterfall Gardens.

MOHAMED HANIFF.

A Skipper Trapped in a flower of Dipladenia Harrisii.

In the Botanic Gardens on November 1st, 1915, a skipper, *Hyarotis adrastus*, was observed struggling in a flower of *Dipladenia Harrisii*. It was obviously held by its proboscis. Investigation showed that the insect seeking for honey had managed to pass this organ in between the corolla wall and the exceedingly pilose outer surface of the cone of anthers and could not extract it again.

I. H. BURKILL.

RAINFALL at the Director's house, Botanic Gardens, Singapore, during the year, 1915. Readings taken always at 8 a.m. and credited to the date in which the twenty-four hours begin.

Date.	January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.	
1										24		20		68				22						
2		80		01			1	34		07				01				94		28		trace		
3		26								88	1			01		28	1	81		26	1	28		55
4		69				19		04		44		07		06				70		38	1	38		
5		35		10										09		04		84		01		05		37
6		11						trace				01				trace		03			1	73		
7		45										01		78		62				34		01		
8		21				10		03		trace			1	56		15		01				84		03
9	1	21		trace				30						03								15		
10		23		01				80		07		trace		62		29				02		08		93
11				53		48				07				05		02		02		83	1	02		
12		trace		01		trace		51		08				32			1	71		33		15		
13						27		41						01				19		04		25		52
14		trace				05		trace		02		75								33	1	26		02
15		06				56		14				07						48		trace				
16		07				14		trace						27	1	32		04		58		32		06
17		05		98				14		47				08				03		85		trace		67
18	1	13		61						19		73				04		06		05				01
19		01		04		24		34				03		62		58			2	37		38		
20		21				11		79				01	2	06		01		90				16		08
21		10				17		52		02		32		01		21		06		01		trace		
22		09				28		13					1	58		01		03		trace		09		27
23							1	87		09	1	74				19		22		14		24		52
24		27				32		02				trace		38		trace		43		25	1	05	1	21
25		10				04		39						02		25		02		67		01	1	10
26						72				40		trace											3	22
27				23				12				26		01						20		trace		13
28	1	50						trace				32												01
29		33				01		05		13		trace						81						08
30		trace				01		02		77		05		08		02		trace		trace		01		
31		66				01				01						74							1	39
	8	89	5	43	5	70	8	96	3	95	4	57	9	33	4	77	9	55	7	94	10	46	11	17

RAINFALL at the head of the Waterfall Gardens, Penang, during 1915, registered by the Municipality of George Town at 8 a. m., credited to the day in which the twenty-four hours begin.

Date	January		February		March		April		May		June		July		August		September		October		November		December	
1							1	72		20								73		34				
2										30				60		85		09			2	40		
3												77					1	15	1	16		17		
4								60		02	1	66					1			88	1	70		
5								85			1	23		16		18		56		30		17	1	40
6		01			1	90		04		23		49				70					2	10		
7		18			1	17		10								02	1	05						
8		16										23			1	10	1	88			1	06		58
9		50										33	1	85	1	87		18						03
10		14										04										22		
11		01				14				13		03		04				05		20		10		
12										05						10		43		48				
13		15							1	54		27		24		05				93		40		
14		07								11	1	37		65		80		08		40		22		
15								32				03		65						10		45		70
16		03						07		30	3		2	31		15		26	3	70	1	45		
17				01				23				09	2	93		30		45	1	92		04		
18				07				05	1	63		39		02		15		30	1	46		85		
19												70		62	4	70		07		65		04		
20														04	3	50	1	83			1	70		
21						05		07								38		46	1	05		06		
22								03				16			1	70		31		93		19	1	
23										14						60		27				30		
24						04		52		25	1	12					1	88		62		50		
25					1	97		28	1	16		12		14							1	50		
26		43			1	94		01	2	14	2	80						43				40		
27		11			1	62		14	2	26		10				15		17		50	2	90		
28		06				14		34		07		02						18				16		
29					1	23	1	57				23		03		85		10				42		
39						48	1	49		58		06				70								
31										70						70								07
	1	85		08	10	68	8	43	11	81	15	24	10	28	19	02	14	11	15	62	19	50	3	78

SUMMARY OF RAINFALL, 1915.

	SINGAPORE.			PENANG.		
	No of rainy days.	Amount of rain in inches.	Longest Spell without rain.	No. of rainy days.	Amount of rain in inches.	Longest Spell without rain
January - -	25	8.89	2	12	1.85	19
February -	10	5.43	7	2	08	
March - -	18	5.70	4	11	10.68	15
April - -	23	8.96	3	18	8.43	7
May - -	17	3 93	3	18	11.81	4
June - -	19	4.57	3	23	15.24	2
July - -	22	9.33	2	14	10.28	3
August - -	18	4.77	4	21	19.02	3
September -	22	9.55	3	24	14.11	1
October - -	23	7.94	2	17	15.62	5
November -	24	10.46	2	25	19.50	5
December -	19	11.17	2	6	3.78	8
Total	240	90.72	37	191	130.40	72

Greatest amount in 24 hours. ...	3.22	4.70
,, ,, 48 ,, ...	4.32	11.20
,, ,, 72 ,, ...	5.53	11.58

Excessively rainy periods more than 5.00 having fallen in 72 hours.	1. (December).	5 (March, May, July August, October).
No. of days when condition existed -	1	6
Periods of Comparative drought, less than 0.02 having fallen in 120 hours. (Feb. 3rd March, May, June). - -	6	12 (Jan. 2, Feb. 2 March, April, Oct. 2 Dec. 4
No. of days when condition existed. -	13	54
Longest of the Spells - -	4 days	16

LISTS OF PLANTS,

which may be obtained generally, at the Prices stated, from the Botanic Gardens, Singapore or Penang.

P in brackets means at Penang only.

The cost of packing and all subsequent charges are extra.

LIST A. Ornamental Plants.

	$ cts.
Abrus precatorius—Crab's Eye—climber ..	0 10
Acalypha Godseffiana—shrub	0 15
Acalypha macrophylla—shrub	0 15
Acalypha macrostachys—shrub	0 15
Acalypha torta—shrub	0 15
Acalypha obovata—shrub	0 15
Acalypha Sanderiana—shrub	0 15
Acanthorhiza aculeata—palm	1 00 and upwards
Actinorhytis calapparia—palm	0 20 and upwards
Adiantum Capillus-Veneris—Maiden Hair fern	0 50 and upwards
Aeschynanthus Lobbii—pot plant (P.) ..	0 50
Aeschynanthus obconica—pot plant (P.) ..	0 50
Agathis robusta—Kauri pine	1 50 and upwards
Agave americana—Century plant	0 40
var. variegata	1 50
Aglaia odorata—small flowering tree	0 25
Aglaonema commutatum—pot plant	0 15 and upwards
Aglaonema costatum—pot plant	0 50 and upwards
var. inornatum	
var. virens	
Aglaonema Haenkii—pot plant	0 25
Aglaonema oblongifolium, var. Curtisii (P.) ..	0 50
Allamanda cathartica—shrub	0 15
Allamanda Schottii—half scandent shrub ..	0 15
Allamanda violacea—half scandent shrub ..	0 40
Alloplectus Lynchii—pot plant	0 20
Aloe vera—aloe	0 20 and upwards
Anemia rotundifolia—fern	1 00 and upwards
Angelonia salicariaefolia—half herbaceous plant	0 10
var. alba	0 10
Angiopteris evecta—fern	0 75 and upwards
Anthurium Bakeri—pot plant	1 00 and upwards
Anthurium cristallinum	1 00 and upwards
Anthurium pedato-radiatum—pot plant ..	1 00 and upwards
Anthurium splendidum—foliage plant ..	1 00 and upwards
Antigonum leptopus—Honolulu creeper ..	0 15 and upwards
var. album (white)	0 15 and upwards
Antigonum guatamalense—climber, deep red	0 25 and upwards

	$ cts.
Archontophoenix Alexandrae—palm	0 25 and upwards
Areca Catechu—Betel-palm	0 15
Arenga saccharifera—Kabong—palm ..	0 20
Aristolochia Duchartrei—climber	0 20
Aristolochia hians—climber	0 25
Aristolochia elegans—climber	0 15
Aristolochia saccata—climber	0 50
Arundina bambusaefolia—terrestrial orchid ..	0 25 and upwards
Arundina chinensis—terrestrial orchid (P.) ..	0 25 and upwards
Arundo donax var. variegata—ornamental grass	0 20
Asclepias curassavica—bedding plant ..	0 20
Asparagus plumosus—climber	0 50 and upwards
Asparagus Sprengeri—climber	0 50 and upwards
Astrocaryum tucumoides—palm	0 50 and upwards
Barleria cristata—bedding plant	0 15
Barleria prionitis— small shrub	0 20
Bauhinia tomentosa—yellow Bauhinia ..	0 25
Bauhinia spp.—shrubs or small trees	0 25
Beaucarnea recurvata—foliage plant	1 00 and upwards
Beaumontia grandiflora—flowering climber ..	0 75
Beloperone oblongata—flowering shrub ..	0 20
Bignonia crucigera—climber	0 25
Bignonia aequinoctialis—climber	0 15
Bignonia magnifica—climber	0 25
Bignonia tweedieana—climber	0 25
Bougainvillaea glabra—climbing shrub ..	0 25
Bougainvillaea Sanderiana—climbing shrub ..	0 25
Bromheadia palustris—terrestial orchid ..	0 25
Brownea ariza—flowering tree	0 50
Brunfelsia americana—shrub	0 25
Brunfelsia eximia—flowering shrub	0 40
Buxus sempervirens—Box	0 25
Caesalpinia pulcherrima—shrub	0 25
Calanthe veratrifolia—terrestial orchid ..	1 00 and upwards
Calyptrocalyx spicatus—palm	0 30 and upwards
Canna indica, various races, unnamed ..	0 05
named races	0 10 and upwards
Carludovica palmata—Panama hat plant ..	0 50
Cassia fistula—IndianLaburnum—small tree	0 40
Cassia siamea—flowering tree	0 20
Casuarina equisetifolia—tree	0 25 and upwards
Chonemorpha Rheedii—climber	1 00
Chrysalidocarpus lutescens—palm	0 25 and upwards
Clematis —climber	0 75
Clerodendron capitatum—shrub	0 15
Clerodendron macrosiphon—flowering shrub..	0 25
Clerodendron Minnehassae—flowering shrub ..	0 40
Clerodendron speciosum—climber	0 15
Clitorea ternatea—climber	0 25
Cocos plumosa—palm	0 25 and upwards

	$ cts.
Cocos flexuosa—palm	0 25 and upwards
Congea tomentosa—climber	0 25
var. azurea	0 25
Crotons—Codiaeum—in variety	0 15 and upwards
Cryptostegia madagascariensis—flowering shrub	0 30
Cyclanthus bipartitus—foliage plant	1 00 and upwards
Cymbidium Finlaysonianum—orchid ..	1 00 and upwards
Cyperus Papyrus—reed	1 00
Cypripedium niveum—terrestial orchid (P.) ..	0 50
Cyrtophyllum fragrans—Tembusu—tree ..	0 15
Cyrtostachys Lakka—Sealing Wax plant ..	2 00 and upwards
Daedalacanthus nervosus—shrub	0 25
Davallia fijiensis—fern	1 00 and upwards
Davallia pallida	1 00 and upwards
Dendrobium thyrsiflorum—orchid	1 00
Desmodium gyrans—telegraph plant	0 25
Dictyosperma album—palm	0 40 and upwards
Dieffenbachia spp.—pot plants	0 25 and upwards
Dracaena fragrans, var. Lindeni—foliage plant	0 50 and upwards
Dracaena, various spp.—foliage plants ..	0 30 and upwards
Duranta Ellisii—shrub	0 20
Duranta Plumieri—shrub	0 20
Dypsis madagascariensis—palm	0 25 and upwards
Elaeis guineensis—palm	0 25 and upwards
Eranthemum atropurpureum—shrub	0 20
Eranthemum malaccense—shrub	0 20
Eranthemum reticulatum—shrub	0 20
Eranthemum Wattii—shrub	0 50
Eucharis grandiflora—Amazon Lily	0 25
Euphorbia heterophylla—herb	0 05
Euphorbia pulcherrima—Poinsettia	0 75 and upwards
Eurycles sylvestris—bulb	0 25 and upwards
Euterpe oleracea—palm	0 30 and upwards
Evodia hortensis—shrub	0 15
Evodia Ridleyi—shrub	0 20
Excoecaria bicolor—shrub	0 20
Faradaya papuana—climber	0 25
Ficus Benjamina—wringing in. tree	0 20
Ficus repens—creeper	0 25
Filicium decipiens—small tree foliage ..	0 25
Galphimia glauca—small flowering shrub (P.)	0 50
Gardenia florida—shrub	0 20 and upwards
Gliricidia maculata—flowering tree	0 50
Gloriosa superba—climber	0 20
Graptophyllum hortense—shrub	0 15
Gustavia spp.—large flowering ..shrub ..	1 00 and upwards
Haemanthus sp.—bulbous pot plant	0 50 and upwards
Hamelia patens—shrub	0 25
Hedychium coronarium—herb	0 50 and upwards

Heliconia spp.—foliage plant	0 75 and upwards
Hemigraphis colorata—creeper	0 15
Heterospathe elata—palm	0 25 and upwards
Hibiscus Cameroni—shrub	0 15
Hibiscus mutabilis—shrub	0 15
Hibiscus Rosa-sinensis—Shoe-flower—shrub ..	0 10
Hibiscus schizopetalus—shrub	0 10
Holmskioldia sanguinea—flowering shrub ..	0 25
Hosea Lobbii—climber	0 25
Hymenocallis spp.—bulbs	0 10 and upwards
Inga (Pithecolobium) saman—Rain tree ..	0 15
Ipomoea digitata—climber	0 15
Ipomoea Horsfalliae—flowering climber ..	0 40
Iresine sp.—foliage plant, herb	0 10
Ixora Bandhuca—shrub	0 20
Ixora coccinea—shrub	0 20
var. lutea	0 20
Ixora macrothyrsa—shrub	0 25
Jacaranda mimosaefolia—tree	0 25
Jacobinia magnifica, var. carnea—shrub ..	0 40
Jacquemontia violacea—climber	0 25
Jasminum Sambac—half climbing shrub ..	0 25
Jasminum spp.—climbing shrub	0 25
Kentia Woodfordii—palm	0 50 and upwards
Kopsia fruticosa—shrub	0 25
Lagerstroemia Flos-reginae—tree	0 25
Lagerstroemia indica—shrub	0 25
Lagerstroemia subcostata—tree	0 40
Lasia heterophylla—herb	0 25 and upwards
	$ *cts.*
Ledenbergia roseo-aenea—herb	0 20
Licuala grandis—palm	1 00 and upwards
Licuala spinosa—palm	0 25 and upwards
Licuala triphylla—palm	0 25 and upwards
Livistona altissima	0 25
Livistona chinensis—palm	0 25 and upwards
Livistona Hoogendorpii—palm	0 25 and upwards
Lobelia syphilitica—herb	0 25 and upwards
Lonicera macrantha—Honeysuckle	0 20
Ludovia crenifolia—foliage plant	0 75 and upwards
Malpighia coccigera—flowering shrub ..	0 25
Malpighia nitida—shrub	0 25
Martinezia caryotaefolia—palm	0 25 and upwards
Memecylon coeruleum—shrub	0 20
Mesua ferrea—tree	0 50
Miconia Hookeriana—pot plant	0 25
Montrichardia aculeata—herb	0 25
Murraya caloxylon—shrub	0 25
Mussaenda erythrophylla—half climbing shrub	0 25 and upwards
Mussaenda luteola—shrub	0 15
Nerium oleander—flowering shrub (P.) ..	0 15
alba (P.)	0 50
Nyctanthes Arbor-tristis—shrub	0 25

	$ cts.
Oreodoxa regia—palm	0 25 and upwards
Orthosiphon stamineus—half herbaceous ..	0 15
Pedilanthes tithymaloides, var. variegata ..	0 25 and upwards
Panax fruticosum—shrub	0 15
var. crispum	0 20
var. Guilfoylei	0 20
var. Victoriae	0 15
Pandanus graminifolius—Screw pine	0 25 and upwards
Pandanus Houlletii—Screw pine	0 25 and upwards
Pandanus utilis—Screw pine	0 20 and upwards
Passiflora edulis—climber	0 30
Passiflora laurifolia—Sweet Cup or Passion Fruit	0 15
Passiflora vitifolia—climber	0 25
Passiflora Watsoniana—climber	0 25
Pedilanthes tithymaloides, var. variegata ..	0 25 and upwards
Pentaclethra filamentosa—tree	0 20
Pergularia odoratissima—climber	0 15
Petrea volubilis—half scandent shrub ..	0 25
Phaleria Blumei—shrub	0 25
Philodendron gloriosum—ornamental plant ..	1 00 and upwards
Phoenix reclinata—palm	0 25 and upwards
Phoenix rupicola—palm	0 25 and upwards
Phyllanthus pectinatus—tree	0 40
Phyllanthus pulcher—shrub	0 10
Pinanga Kuhlii—palm	0 25 and upwards
Pinanga patula—palm	0 25 and upwards
Pithecolobium Saman—Rain tree	0 15
Plumbago rosea—shrub	0 20
Plumeria lutea—Frangipani	0 20
Podocarpus neglectus—tree	0 25
Poinciana regia—Gold-mohur tree or Flame-of-the-Forest	0 15
Porana volubilis—climber, Bridal creeper ..	0 15
Pterocarpus indicus—Angsana	0 20
Ptychococcus paradoxus—palm	0 50 and upwards
Ptychosperma McArthuri—palm	0 20 and upwards
Ptychosperma Sanderiana—palm	0 50 and upwards
Quassia amara—shrub	0 25
Randia macrantha—shrub	0 40
Raphia Hookeri—palm	0 50 and upwards
Raphia Ruffia—palm	0 25
Rhapis flabelliformis—palm	0 40 and upwards
Rhopaloblaste hexandra—palm	0 25 and upwards
Ruellia ciliatiflora—half shrubby	0 10
Russelia juncea—shrub	0 20
Russelia sarmentosa—shrub	0 20
Sabal spp.—palm	0 40 and upwards
Saraca declinata—tree	0 50
Saraca indica—tree	0 50
Saraca trijuga—tree	0 50

	$ cts.
Saraca taipingensis—tree	0 50
Sagus laevis—sago palm	0 20 and upwards
Salvia coccinea—flowering herb	0 15
Sarcocephalus esculentus—shrub	0 40
Selaginella spp.—various	0 25 and upwards
Scutellaria javanensis— herb (P.)	0 20
Solandra grandiflora—shrub	0 40
Solanum maroniense—shrub or small tree ..	0 25
Spathodea campanulata—tree	0 20
Spathoglottis plicata—terrestrial orchid ..	0 75 and upwards
Stephanotis floribunda—climber	0 75 and upwards
Stevensonia grandifolia—palm	0 25 and upwards
Stigmaphyllon ciliatum—climber	0 20
Stigmaphyllon lancifolium—climber	0 20
Strobilanthes Dyerianus—foliage plant ..	0 25
Tabernaemontana coronaria—shrub	0 20
Tacca cristata—herb	0 30 and upwards
Tecoma stans—shrub	0 20
Thaumatococcus Danielii—foliage plant ..	0 20
Thunbergia erecta—shrub	0 20
Thunbergia grandiflora—climber	0 25
var. alba	0 30
Thunbergia laurifolia—climber	0 15
Tinnea aethiopica—shrub	0 15
Tococa platyphylla—shrub	0 25 and upwards
Triphasia aurantiola—shrub	0 20
Tristellateia australasica—creeper	0 15
Turnera ulmifolia—herb	0 15
Verschaffeltia splendida—palm	0 25 and upwards
Vinca rosea—herb	0 10
var. alba	0 10
Vitis discolor—climber, foliage	0 20
Wedelia biflora, double flowered—shrub ..	0 15
Wormia spp.—shrub	0 15
Xanthosoma Lindeni—pot plant	1 00 and upwards
Zalacca edulis—palm	0 20 and upwards
Zephyranthes spp.—bulb	0 05

LIST B.—Economic Plants.

AT TWO CENTS PER SEEDLING OR PER SUCKER.

Alpinia Galanga—Galangal
Curcuma longa—Turmeric
Cymbopogon Nardus—Lemon Oil Grass
Hevea brasiliensis—Para Rubber tree
Mentha viridis—Mint
Panicum maximum—Guinea Grass
Sanseviera zeylanica—Bowstring hemp
Sanseviera suleata
Sanseviera guineensis

AT THREE CENTS PER SUCKER OR PER ROOT.

Ananas sativa—Pineapple; races Mauritius, Ruby, Jamaica, Harvey's, Sarawak, and Perambuco
Andropogon squarrosus
Boehmeria nivea—Rhea or Ramie, two races
Boehmeria tenacissima
Maranta arundinacea—Arrowroot

SOLD AT 20 CENTS IN FOUR TO SIX-INCH POTS, OR AT MORE THAN 20 CENTS IF LARGE PLANTS IN LARGE POTS.

Adenanthera pavonina—Shade tree
Achras Sapota—Chiku
Aegle Marmelos—Bel
Albizzia moluccana—Shade tree
Aleurites triloba—Candle nut
Aloe vera—Barbados aloes
Anacardium occidentale—Cashew nut
Anona muricata—Soursop
Anona squamosa—Custard Apple
Areca Catechu—Betel nut
Arfeuillea arborescens—shade tree
Artocarpus integrifolia—Jack fruit
Artocarpus lanceaefolia—Kledang
Artocarpus polyphemia—Champedak
Artocarpus rigida—Mankey Jack
Averrhoa Carambola—Carambola
Boehmeria tenacissima
Bouea macrophylla—Kundangan
,, microphylla—Ruminia
Cananga odorata
Carapa guineensis—Shade tree
Carica Papaya—Papaw
Castilloa elastica—Central American rubber
Cedrela Toona—Tun
Chrysobalanus Icaco—Coco plum
Chrysophyllum Cainito—Star apple
Cinamomum iners
Citrus decumana—Pumelo, white fleshed
Citrus decumana—Pumelo, red flesh; Bali stock, Perak stock, Siamese
Citrus medica, var. acida—Citron
Citrus acida—Lime
Citrus Aurantium—Orange, Chinese
Coffea arabica—Arabian coffee
Coffea Laurentii
Coffea liberica—Liberian coffee
Coffea stenophylla
Coffea zanzibarica
Cola acuminata—Cola
Connarus semidecandrus

Cordia Myxa
Croton Tiglium—Croton oil plant
Cynometra cauliflora—Num-num
Derris elliptica—Tuba
Dialium laurinum—Kranji
Dichopsis Gutta—Gutta percha tree
Diospyros discolor—Mabola
Durio zibethinus—Durian
Elaeis guineensis—African oil palm
Erythina indica—Dadap
Eugenia brasiliensis—Brazil cherry or Grumixameira
Eugenia grandis—Jambu ayer laut
Eugenia jambolana—Jamun
Eugenia jambos—Rose apple
Eugenia malaccensis—Malay apple
Eugenia uniflora—Ibipitanga
Eugenia xanthocarpa
Erioglossum edule—Mertajam
Flacourtia Cataphrata
Flacourtia Ramontchi
Funtumia elastica—Lagos rubber tree
Garcinia Cowa
Garcinia dulcis—Mundu
Garcinia ferrea
Garcinia Mangostana—Mangosteen
Inocarpus edulis—Otaheite Chestnut
Lansium domesticum—Langsat
Lansium domesticum, var. Duku—duku
Mangifera indica—Mango
Manihot Glaziovii—Ceara rubber
Mimusops Elengi—Bunga tanjong
Mitrephora Thorelii
Morus alba—Mulberry
Nephelium lappaceum—Rambutan
Nephelium malaiense—Mata kuching
Nephelium mutabile—Pulasan
Pandanus utilis
Passiflora laurifolia—Sweet cup
Paranephelium macrophyllum
Pentaclethra filamentosa
Piper nigrum—Pepper
Pithecolobium acre
Pithecolobium Saman—Rain tree
Pittosporum pentandrum
Pittosporum viridiflorum
Pithecolobium fasiculatum
Pogostemon Patchouli—Patchouli
Psidium Guajava—Guava
Psidium laurifolium
Pterocarpus indicus—Angsana
Sandoricum radiatum—Kechapi
Sterculia Jackiana

Strophanthus dichotomus
Styrax Benzoin
Swietenia macrophylla—Broad leaved Mahogany
Tamarindus indica—Tamarind
Terminalia Catappa—Bengal Almond
Terminalia procera
Treculia africana
Thespesia populnea
Theobroma Cacao—Cocoa, Garden seedlings
Triphasia aurantiola
Zalacca edulis—Buah Salak

AT 50 CENTS EACH.

Bertholletia excelsa—Brazil nut
Eugenia caryophyllata—Clove
Myristica fragrans—Nutmeg
Persea gratissima—Avocado Pears

Additions to this list will be published from time to time in the "Gardens' Bulletin, Straits Settlements."

The

Gardens' Bulletin

STRAITS SETTLEMENTS

into which is incorporated all that has been published as the third series of the Agricultural Bulletin of the Straits and Federated Malay States.

Vol. I | Issued March 31st, 1917. | No. 11-12

CONTENTS.

To be purchased at the Botanic Gardens, Singapore; from Messrs. Kelly and Walsh Ltd., No. 32 Raffles Place and 194 Orchard Road, Singapore.

DEPARTMENTAL NOTICE.

Seed of *Hevea brasiliensis*—Para rubber—as available from trees thirty years old or older, will be sold at three dollars per thousand up to the number of ten thousand, and at two dollars and fifty cents for every further thousand on the same order.

Plants of *Eucalyptus robusta* may be obtained at fifty cents each as far as available.

THE

GARDENS' BULLETIN,

STRAITS SETTLEMENTS

INTO WHICH IS INCORPORATED ALL THAT HAS BEEN PUBLISHED AS THE THIRD SERIES OF THE AGRICULTURAL BULLETIN OF THE STRAITS AND FEDERATED MALAY STATES.

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THE

GARDENS' BULLETIN,

STRAITS SETTLEMENTS.

Vol. I. Issued March 31st 1917. No. II-12.

A REPORT ON RACES OF THE GREATER OR TEN MONTHS YAM,—DIOSCOREA ALATA,— CULTIVATED IN THE BOTANIC GARDENS, SINGAPORE.

The first six plates illustrating this issue of the Gardens' Bulletin represent tubers of the Greater or Ten-months yam, a vegetable which might be cultivated more widely in the Malay Peninsula.

It is a starchy food, and supplies the place of the potato in several parts of the World, especially in the more moist parts of the tropics; for the potato, a native of the temperate parts of South America, is not a tropical plant, but is even grown in the Peruvian Andes at so great an elevation as 14,000 feet.

When the New World was discovered the potato was only spread in the continent of its own home, and limited by temperature it had not passed the Isthmus of Panama northwards. This passing of the Isthmus of Panama happened only when European voyagers took it to Virginia and to neighbouring parts. About 1535, when the conquest of Peru had been effected, the Spaniards brought the potato to Spain; and seeing how difficult it was to provision ships in those days, we may be sure that they made use of it for the purpose. Then in 1585, perhaps through the seizing of some Spanish ship, perhaps in another way, the potato was brought alive to Ireland; and Ireland adopted it. It was not welcomed however on the Continent of Europe, and was only just accepted in Great Britain in spite of earnest advocates such as Gerard, the King's

Herbarist to James I, whose portrait was drawn with a shoot of it in his hand: and favour did not turn towards it until years of scarcity came. Scotland adopted it only in 1740, and it required the distress of the Napoleonic wars to assist it to its place in northern Europe. Italy, which now exports so much, was particularly unwilling to have it at first. Yet for Europe in the sixteenth century in comparison with the vegetables then available it was unrivalled.

The Greater Yam is Dioscorea alata, a plant not at all allied to the Potato plant, although it furnishes a tuber which on chemical analysis is seen to be extremely similar. Dr. Hooper in the Journal of the Asiatic Society of Bengal, N. S. vii, 1911, p. 60, gave the following comparison:—

	Yam	Potato
Fat	1.02	0.46
Albuminoids	10.87	10.14
Carbohydrates	77.01	84.79
Fibre	5.16	
Ash	5.94	4.61

The Greater Yam is a native of the Eastern Tropics and has been cultivated from the Indian Ocean to the Pacific for a long time. Everywhere between these bounds, where the inhabitants had attained some small degree of civilisation over long ages it must have held an important place limited on the East and South by the Ocean and North by cold climates; further westward it was not spread because being a wet tropical plant—more intensely so than the Sugar-cane,—it was unable to reach the continent of Europe, even with the Moors, on account of the dry countries which separate India from the Mediterranean. It remained unknown to Europeans until the Portuguese found it and provisioned their ships with it.

The same adventurous age which brought both the Potato and the Yam to European knowledge was the age which took the yam to the New World, a competitor there with the tapioca plant, but hardly with the potato.

However in India the yam and the potato came into competition in the northern part of the country, and the yam lost favour before its rival. But while the potato is cultivable in the Bengal plains, and on the plateaux further south, so that Bombay gets a supply from the Ghats behind it and the Madras Presidency has a small supply from the Nilgiri Hills, it is not cultivable in the plains south of the Tropic of Cancer; which means that over a very large part of India the Greater yam has not been thrown into competition by being grown and marketed alongside the potato, and throughout the villages, of course where the rainfall is adequate, it retains its old place as the chief of edible stachy tubers. Also it still holds a place above the potato elsewhere on account of the backwardness or the peculiar local conservatism of the inhabitants.

The Malay Archipelago as regards the potato is like the Madras Presidency: it has mountains where the potato can be grown, and lowlands where it cannot: but European enterprise has touched so little of the mountains, that the possibilities are developed nowhere except in Java: and under the existing circumstances the Greater Yam is a desirable vegetable.

Two drawbacks have to be admitted at the outset, namely the time that the crop is in the ground, and the circumstance that owing to its mucilaginous nature, it boils badly; but in this Bulletin, No. 9 pp. 304-305, other ways of cooking it have been given.

The writer began the study of yams conjointly with Sir David Prain when in India; and a collection of living plants was got together in the Royal Botanic Gardens, Calcutta, not only from all parts of India, but also from Ceylon and by the kindness of Mr. W. Jackson, of the Queensland Sugar Refining Co., from Fiji. Much of the material was examined and gradually discarded for one reason or another, and most particularly because the climate of Calcutta proved unsuitable for the more slowly maturing southern races: but in 1914 Major A. T. Gage, now Superintendent of the Royal Botanic Gardens, there, was so good as to send to Singapore a selection from what remained. This, together with two collections from Manila, one from Saigon, one from Port Darwin, two from the Gold Coast and two from Southern Nigeria, and also some local races, forms the new Singapore collection. To the Department of Agriculture of the Philippine Islands, through Mr. O. T. Barrett, and to Professor C. F. Baker, of the College of Agriculture, Los Banos, P. I., Singapore is indebted for the Philippine Yams, including one from the Caroline Islands and several from the Island of Guam. To Mr. C. E. F. Allen, formerly Curator of the Botanic Station, Port Darwin, Singapore is indebted for the tubers from Northern Australia. To M. Morange, of the Botanic Gardens in Saigon, Singapore is indebted for the tubers received thence: and to the Botanic establishments of the two African colonies for the tubers which were sent through Kew to Singapore.

The Philippine collections were reported on briefly in this Bulletin No. 9 pp. 297-304 and also in the Philippine Agriculturist and Forester iii. 1915 pp. 205-209, the object of the reports being rather to indicate the range of variation observed in a preliminary investigation that to classify the races. In this report however, the lines of a classification will be laid down; but the whole collection can by no means be brought under discussion.

Many of the races of yam, now being grown, have been obtained from far away, witness those from West Africa, and in spite of the most excellent packing the roots unavoidably suffer on the way. The procedure on arrival of a consignment is this:—the tubers are unpacked and examined, the dead tissue is cut away, and the outside of the living tissue treated with permanganate of potash; then what has been saved is planted. In every case new

comers have been planted on the slope behind the Director's house, for the convenience of watching them; but the soil is there very inferior; and therefore as soon as possible the plan adopted has been to remove the stock to better soil in the Economic Gardens. But before this can be done the stock has had to be built up from the small beginning, and in the cases where the original tuber arrived in a very bad state more than one year has been requisite.

All the races to be reported on below, have had a year of cultivation in Block 14 of the Economic Garden in a place where the soil is a moist and good loam with but one fault—that it contains too much rotting timber.

There is an axiom in work of the nature of this study—that the plants must exist under the best possible conditions, for otherwise they do not exhibit their characters fully. It has been impossible to give them better conditions.

In 1914 when the work now in hand was commenced in Singapore, planting was done in the first week of February, except for a few tubers received too late, and digging was done in the third week of October, so that the crop was on the ground for 8½ months. For 1915 planting was done in the first week of December, 1914, and digging in the very end of September, 1915, so that the crop was on the ground for almost 10 months. For 1916 planting was done in the second week of December, 1915, and up to the New Year; and digging was done in the end of August and in the first half of September, 1916, so that the crop was on the ground for 9 months.

In 1916 it occupied an area of rather more than one quarter of an acre.

No. of sets planted 643
Area occupied 12,518 sq. feet or .287 acre = 1,163 centaires.
Yield, all included, 4398½ lbs. = 1995.7 kilos.

No. of races represented.

of local origin	2
of Indian origin	14
of Saigon origin	4
of Philippine origin	37
of Australian origin	1
of Guam origin	4
of Caroline origin	1
of Fijian origin	20
of West African origin	10
of uncertain origin	2
	95

Average No. of plants of each race 6.77

Average yield per plant 6 lbs. 13 oz. = 3.09 kilos.

Greatest average yield of any race 17 lbs. 10 oz. = 8 kilos.

Greatest yield of any plant 30 lbs. 2 oz. = 13.7 kilos.

Rate per acre 12623.7 lbs. = 12 cwt. 2 qrs. 23.7 lbs.

Rate per hectaire 2321 kilos.

Before going any further it is convenient to state the chief characters in which the races differed from each other, everyone of which must be taken into consideration in building up a sound scheme of classification, and of which the degrees of importance have to be guaged.

(i) the variation in the colour of the tuber,—whether with magenta sap or without,

(ii) the variation in the whiteness of the flesh, apart from the magenta sap, whether ivory white or with an ochre tint,

(iii) the variation in the consistence of the flesh,

(iv) the variation in the length of the tuber,

(v) the variation in the number of tubers, whether solitary or twinned or more than twinned,

(vi) the variation in the evenness of the tuber, whether branched or not,

(vii) the variation in the corkiness of the skin,

(viii) the variation in the number of rootlets over the surface,

(ix) the variation in the position of swelling, whether high up or low down,

(x) the variation in yield,

(xi) the variation towards earliness or lateness,

(xii) the variation in keeping power, whether the tuber can be made to rest or cannot,

(xiii) the variation in the presence of magenta colour in the above-ground parts,

(xiv) the variation in the size of the frills on the stem,

(xv) the variation in the production of prickles,

(xvi) the variation in the outline of the leaf, whether the auricles are rounded or are not,

(xvii) the variation in the degree of glaucousness at the back of the leaf,

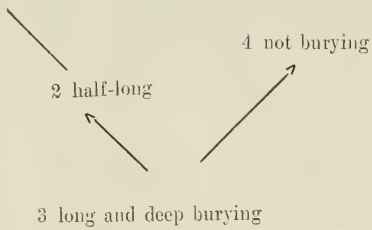
(xviii) the variation in the production of bulbils, etc., etc,

In guaging what degree of importance, is to be assigned to each of the above, the first consideration is that man has selected the Greater Yam from something growing wild, and therefore we must ascertain as far as possible what appearance the wild parent had, and what characters the first cultivators would be likely to consider. Now the Greater Yam has several close allies among the wild yams of Eastern Tropical Asia: and if not from these, from something very similar it must have taken its origin. These allies grow in moist regions where forest prevails, finding their opportunities for vigorously fruiting where the canopy of overhead foliage has been disturbed, and the sunlight let in. They have tubers which are buried deeply in the soil out of the reach of being uprooted by wild pigs: and these tubers are white fleshed and esculent, having none of the poisonous principle which is present in the tubers of those more remote species of Dioscorea which are surface rooting. The tubers are thin, thickening a little downwards, but not greatly, and they may branch a very little, or not at all. Jungle tribes eat the wild yams of this type: but it is not much that they return for the labour of digging them out. Once the writer engaged a woman of a jungle tribe to dig wild yams for him from a forest in Northern Burma where they are particularly common, and obtained less than a meal for two persons as the result of four hours work. But without doubt from wild yams yielding such a meagre return, jungle man commenced the selection of the Greater Yam. First the tribes would eat what they could find: then becoming more settled in habitation they would find it necessary to encourage the plants to grow about the settlements, and would protect them a little: thirdly they would plant them in the immediate neighbourhood of the villages: and out of this procedure they would evolve a regular cultivation, selecting naturally the parents for propagation which were most productive. The second stage of development being reached in this way, it would be realised advantageous to grow plants with abbreviated tubers so that the tilling might be less laborious and the digging out more easily accomplished. Therefore, second to yield, man would operate on the length of the root, which in this stage of social development he could now protect against uprooting by wild pigs—at least in some measure.

It is perfectly certain that he would not select for excellence in flavour at this stage, for the jungle man everywhere eats apparently by no means unwillingly, the most nauseous vegetables. Colour he might select for, as a toy which pleases, long before thinking of palatability. Shape of leaf, rootiness of the tuber, upgrowing fleshy shoots, and other such characters, he would not notice. All these variable features, then, may be put down as secondary to the length of the tuber: and in that feature the first division in the classification of the races will be based.

If a yam be examined, it will be noticed that at the top the tissue is rather hard and woody: that hardish tissue is a part of a perennial underground "stem:" and it produces the new annual shoot or shoots, and new roots each successive year, whereof one, perhaps more than one, becomes fleshy and swells up into the annual tuber. This tuber is so built into the bit of stem, that it is difficult to tell where the one ends and the other begins, and the stem sometimes sends up short shoots in the autumn which are themselves fleshy. Races vary among themselves much in this peculiarity, which as it appears not to occur in any wild allies, must have stepped in during man's period of modifying the plant: but it does not seem clear how he would look upon it in selecting, unless as it spoils the evenness of the tuber he would select against it. Yet there is the feature to be reckoned with.

Just as unsought for would be another development, which happens on the other hand to have served man's purpose, and to have been seized on by him for the production of a curious group of races which do not bury their tubers: the group has been as it were side-tracked, and forms the development illustrated on plate 6. Assuredly in the ancestral condition, the yam plant sent its succulent tuber deeply into the soil: and certainly if it had not done so wild pigs and such animals would have destroyed it from off the face of the earth: but after man had taken the yam into domestication and was protecting it, certain plants apparently lost the tendency to send their fleshy root downwards,—they lost somehow the responsiveness to gravity that they should have, and produced tubers which, while elongating, still remained at the surface. Such plants can be cultivated by earthing up: and they were propagated evidently as convenient for growing: they could for instance be planted in the midden at the back door, which grew with them. These peculiar races deserve a special place in our classification, which we may start with a diagram as follows, side-tracking them:—



Under these four heads the yams will be considered.

Opposite plate I.

Registered No.	Origin.	No. of plants.	Average Weight lbs. oz	grammes.	Yield per acre in tons *
	SOLITARY UNBRANCHED DEEP-GOING TUBERS RATHER THIN.				
162	Khasia Hills "Phan Shriew" 35606	7	6-4	2835	6.28
110	Fiji, 20715	4	6-11	3033	6.72
	SOLITARY, DEEP-GOING, RATHER THIN TUBERS WITH A TENDENCY TO BRANCH.				
186	Nowgong, Assam 35575	5	8-15	4054	8.97
112	Khasia Hills "Phan Suri," 35623	9	4-1	1833	4.08
120	Fiji, "Boti," 20692	4	6-9	2977	6.59
	SOLITARY DEEP-GOING TUBERS WHICH SWELL RATHER TOWARDS THE EXTREMITY.				
156	Fiji, 20702	8	6-5	2863	6.34
108	do. 21693	9	9-6	4252	9.47
136	do. 20692	7	9-8	4309	9.42
	SIMILAR BUT MORE CLAVATE.				
118	Fiji, 20710	4	7-12	3515	7.78
114	do. 20714	3	8-8	3815	8.54
116	do. 21686	2	4-5	1956	4.33
54	Philippine Is. 1044	2	4-8	2041	4.52

* These rates per acre are worked out on 2250 hills to the acre, a number which might easily be exceeded.

Yam No. 162 : origin, Assam : flesh white with magenta under the skin : yams descend deeply.

Yam No. 186 : origin, Assam : flesh yellowish : yams descend deeply and then branch.

Yam No. 156 : origin, Fiji : flesh white : yams descend rather deeply and are bulky.

Yam No. 118 : origin, Fiji : flesh white with a little magenta sap under the skin : yams descend rather deeply.

Deep going tubers.

Deep-going tubers (descending vertically and elongated) without uprising shoots, not exhibiting twinning, nor branching,—such, because their characters appear ancestral, we start with. On plate 1 to the left of the metre measure, which makes a division down the centre are figured three tubers of race No. 162. The length attained was just one metre or 39 inches. There was no flattening, and the even surface was very free from rootlets. The skin was of a particularly dark brown: with just under it a layer of the flesh holding magenta sap: the inner part of the flesh was quite white. The first parental tuber of this race was one collected for the writer by Babu R. K. Das on the south face of the Khasia Hills under Cherrapunji and he reported that the Khasias use the tuber curried, and say that it is irritant raw. The largest tuber in 1916 weighed 10½ lbs. (4763 grammes), and the average weight was 6¼ lbs. (2835 grammes).

In the collection there are other similar races, but only one of them can as yet be reported on, namely No. 110 from Fiji. It possesses a similarly smooth skin, but of a lighter colour. The average return in 1916 was similar, namely 6 lbs. 11 oz. (3033 grammes).

Of characters, which are among those considered secondary, these two also proved to be similar in that they possess rounded auricles to the largest leaves, but the degree of roundness so far observed differs: the second exhibited prickles on the stem, but neither up-growing fleshy shoots, and both have some magenta sap in the surface of the tuber, and both are without it in the vegetative parts. Thus they were found closely related although not identical.

The figures of production show them no better than races with short tubers: and unless it may be for a delicacy in the deeply buried parts of the tubers as a consequence of being grown remote from the air* (an effect akin to that produced by earthing up celery for instance) there appears no advantage in cultivating them where races with shorter tubers could be raised.

Deep going tubers, (as the last two), but with a tendency to branch. The yam No. 186 figured on the right half of the upper part of Plate 1 differs from that on the left in a tendency to branch. The depth to which the roots went was almost the same, but they were not so easy comparatively to dig out unbroken on account of this branching. The surface was less smooth and carried more small rootlets than that of No. 162. Under the skin there was no magenta sap: and the flesh in the interior was yellowish. Cooked, the race appeared a good one: but comparative methods of judging comestible value with regard to these yams have yet to be devised. The yield of the largest tuber was 14 lbs. 2 oz. (6407 grammes) and the average for the five plants was 8 lbs. 15 oz. (4054 grammes).

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* The Afou or Yellow Yam of Jamaica produces a bitter flavor in any parts of its tubers exposed to the air (Harris, in Bull. Dept: Agric. Jamaica, 1909, p. 4).

Opposite plate 2.

ELONGATED AND TWINNED.

Reg No.	Origin	No. of plants.	Average Weight lbs. oz.	grammes.	Yield per. acre in tons
68	Philippine Is.	10	11-7	5188	11.48
30	do.	4	15-5	6946	15.38
20	do.	4	7-2	3232	7.16
	HALF-LONG.				
76	Philippine Is.	23	10-14	4933	10.92
10	do.	8	13-1	5925	13.12
106	Fiji	6	7-6	2345	7.41
128	Sylhet or Khasia Hills	5	8-5	3689	8.35
	SHORT.				
70	Caroline Is.	17	6-4	2835	6.28
26	Philippine Is.	8	2-0	907	2.01
48	do.	8	4-2	1871	4.14
126	Probably Philippine Is.	6	2-7	1106	2.44

Yam No. 68: origin, Philippine Islands: flesh white with magenta sap under the skin: the yams are clustered, and descend deeply.

Yams Nos. 76 and 70. No. 76: origin Philippine Islands: flesh white: in shape the tubers are much as those of No. 118, but there is a tendency to the production of uprising shoots.

No. 70: origin Caroline Islands: flesh white with a very little magenta sap under the skin and a few flecks of magenta more deeply: yams round and excellent.

This race came from Assam just as did No. 162. But instead of being a Khasia Hills race it was obtained at a forest-buried stream-side village inhabited by Mikirs, where the depth of the soil must have suited it admirably, and where wild animals abound such as would destroy surface rooting races.

The adjoining Khasia Hills furnish other similar races and one was grown under the number 112, collected in 1911 for the writer under the name of Phan Suri, and considered by the Khasias living under Cherrapunji as the best of all yams. Like No. 186 it had pale yellow flesh. Nine plants yielded an average return of 4 lbs. 1 oz. (1833 grammes) or at the rate of nearly 4 tons 2 cwt. per acre.

Again a not dissimilar race appeared among the plants of Fijian origin, namely one called there "Boti" and numbered 120, and another without a vernacular name numbered 110. The surface of the tubers was rooty: the flesh was yellowish, with just a very little magenta sap under the skin. The yield was on the average 6 lbs. 9 oz. (2977 grammes) which works out at the rate of nearly 6 tons 12 cwt.

As regards minor characters, all the three races with these elongated tubers possessing the tendency to branch, have similarly shaped foliage, the auricles of the largest leaves being rounded: but whereas the two Assam races possess no magenta sap, neither in stem nor in tuber, the Fijian race, No. 120, has a little in the tuber and in the frills of the stem. It alone is without prickles. That three of them have a yellowish flesh may prove of some interest.

The Fijian races, Nos. 156 and 118, which are represented in the lower block of plate 1, differ from the races of the last groups chiefly in length, and a tendency to thickening into a club. Similar to them are five other races now to be reported on, namely Nos. 108, 114, 116 and 136 from Fiji, and No. 54 from the Philippine islands.

If the reader will kindly turn to the plate he will see that No. 156 on comparison with No. 162 above, is not only shorter, but is more covered with rootlets. Its flesh is white, magenta sap being absent entirely. The average yield was 6 lbs. 5 oz. (2863 grammes) or nearly 6 tons 7 cwt. per acre.

No. 108 agreed in tuber exactly with No. 156, but yielded more heavily—9 lbs. 6 oz. or 4252 grammes, the return per acre being almost 9½ tons.

No. 118 differed from No. 156 in possessing a little magenta sap in a layer under the skin. Its average weight was 7 lbs. 12 oz. (3515 grammes) or at the rate of 7 tons 15½ cwt. per acre.

No. 114 agrees very closely with the last, having the same shaped tuber and similarly a little magenta sap under the skin. Its average return was 8 lbs. 8 oz. (3854 grammes) or at the rate of 8 tons 10½ cwt. per acre.

No. 116 differed in having a smaller tuber and its average yield was only 4 lbs. 5 oz. (1956 grammes) or at the rate of 4 tons 6¼ cwt. per acre.

No. 136 was again longer and made a return of on the average 9 lbs. 8 oz. (4309 grammes), one tuber attaining 22 lbs. At the rate of 9½ lbs. per hill, the yield per acre would be nearly 9 tons 11 cwt.

The race of Philippine origin, No. 54, exhibited tubers which are white fleshed, without any magenta sap, and they seemed to be more susceptible to injury than the other similar tubers. The average return was 4½ lbs. (2041 grammes) which per acre works out at 4 tons 4 cwt.

One Khasia hill race, No. 168, produced a tuber of the same shape as these now under discussion, but with this difference, that the knot of stem tissue at its head gave rise to many fleshy uprising shoots at the end of the season's growth. There was no magenta sap in the tuber, and the flesh was white, not yellowish. The average yield of the plants was 4 lbs. 15 oz. (2240 grammes) or per acre 4 tons 19 cwt. However it is thought that the race for some reason has not yet had a fair trial.

In review of these races with the slightly club-shaped tubers it may be remarked that magenta sap when present is only found in small quantities; and that most of the races have clean-looking tubers from the absence of small rootlets. As regards the stems one of them (No. 136) possesses prickles. All but the last two, Nos. 54 and 168, are Fijian, and one of these last two namely No. 54, breaks away from the group in its leaves having the venation more than usually prominent. As regards the auricles of the largest leaves, the Fijian races differ among themselves, but there is a tendency for these to be more nearly acute than they are in the foregoing groups.

The upper block on plate 2, represents a race in which the tubers are not solitary, but are produced two, three or more together. This is a very different thing morphologically from the branching which has been described above in regard to plate 1, for whereas in race No. 186 which served for the figure on plate 1, the tuberous root branches, in race No. 68 which is figured on plate 2, and is now under discussion, there arise from the stem-tissue at the head of parent tuber, more than one root destined to swell into a tuber; it is indeed quite a different proceeding on the part of the plant, to form two or more similar organs, where the formation of one is usual, from the other case which is branching. No. 68 is a race from the Philippine islands. Its tubers have a dark skin, free from rootlets; and under the skin there is a layer of tissue holding magenta sap, the flesh being white. The average yield was 11 lbs. 7 oz. (5188 grammes), one plant returning 30 lbs. 2 oz. (13,664 grammes), which works out at 11 tons 9½ cwt. per acre.

No. 30 from the Philippine islands proved similar in characters, but perhaps the flesh was a little more yellow. Its yield on the average was 15 lbs. 5 oz. (6946 grammes) or at the rate of 15 tons 7½ cwt. per acre.

Again No. 12 from the Philippine islands proved to be rather similar; but its tubers were more commonly twins only, instead of being as in the foregoing in number more than twins. The skin of the tuber was rather rooty: and when it was bruised, the flesh exposed very quickly turned orange. The average yield was 7 lbs. 2 oz. (3232 grammes) or at the rate of 7 tons 3 cwt. per acre.

In leaf-characters all these three Philippine races shewed a close similarity, having the auricles of the largest leaves peculiarly elongated. In the year 1915 they were all late in sprouting from the ground and also early in dying down, thus being short-seasoned. The conditions, however, in which they were then being grown were not ideal, and the twinning did not assert itself; so that No. 68 was figured in the Philippine Agriculturist and Forester iii. p. 207 fig. 12 as a solitary tuber. The stem characters of the three are similar, just as we have seen the leaf characters to be; but in rootiness of the tuber and in the behaviour of the flesh on exposure to oxidation differences are observable.

HALF-LONG YAMS.

On Plate 2 the upper line of the lower block represents a type of yam by no means uncommon where this vegetable is grown. There are six tubers in the row, the outer two at each end having no uprising shoots, thus showing a variability in regard to this peculiarity. The race showing this feature is No. 76, and of Philippine origin. The tubers in shape are lumpy and bulky, having an average weight of 10 lbs. 14 oz. (4933 grammes), at which rate the yield per acre would be nearly 11 tons.

The Fijians seem particularly to favour races yielding tubers of this shape, so that in the large consignment which Mr. Jackson was so good as to send to us in 1902 fully three quarters of the total had it. But many of the races which he supplied have dropped out of our experimental cultivation, leaving as representing the type No. 106.

No. 128 obtained from the South face of the Khasia hills or from the plain below produces lower uprising fleshy shoots than did the plants of 76 possessing them. The flesh is white: and the greatest tuber weighed 18 lbs. 15 oz. The average return was 8 lbs. 5 oz. (3770 grammes), and at this rate the yield per acre would be 8 tons 7 cwt.

No. 106 produces tubers which externally are remarkably smooth and free from rootlets. Beneath the skin is a layer containing magenta sap; and of the magenta sap again there may be a little more deeply in the otherwise quite white flesh. Its average yield was 7 lbs. 6 oz. (3345 grammes) or at the rate of just over 7 tons 8 cwt. per acre.

Race No. 10 from the Philippine islands which judging by the figure of the only tuber raised in 1914 (this Bulletin, No. 9 p. 299 fig. 2) appeared a "Long Yam," on further cultivation and with more material for examination comes to be classed as a "Half-long Yam." It is a heavy yielder, the tuber of 1914 having weighed 16 lbs. 9 oz. (7513 grammes); then on poorer soil in 1915 it returned an average of 9 lbs. 6 oz. per hill; and in 1916 it returned an average yield of 11 lbs. 1 oz. (5018 grammes) or per acre 11 tons 5 cwt. The skin is free from rootlets. Under it is a layer of tissue containing magenta sap; and again through the flesh is magenta sap diffused so as to give it almost the tint of crushed strawberries.

Race No. 18, also from the Philippine islands, which furnished figure 5 on p. 299 of this Bulletin is a bulky half-long yam. In 1914 it yielded one tuber weighing 7 lbs. 7 oz. (3374 grammes). In 1915 it returned an average yield of 6 lbs. 6 oz. (2892 grammes); and in 1916 it yielded on the average 6 lbs. 7 oz. (2920 grammes) or at the rate of 6 tons 9¼ cwt. per acre. It has but few rootlets on the surface of the skin; and no magenta sap. It is well reported on as a table yam.

The race No. 8 is again another from the Philippine islands; and, the first tuber which it produced in Singapore, was figured in this Bulletin p. 299 figure 1. Further cultivation shows that it has in some degree a tendency to produce twin tubers, although not so strongly as in those races which have already been discussed. In 1914 the tuber which it gave weighed 9 lbs. 13 oz. (4448 grammes); in 1915 the average yield was 8 lbs. 8 oz. (3855 grammes); in 1916 when twenty one plants were raised, it returned an average of 13 lbs. (5897 grammes) or per acre nearly 13 tons 2 cwt. The flesh is yellowish with just a trace of magenta sap in the layer under the skin: and it is very mucilaginous.

As regards minor qualities, these Half-long Yams, most of them being of Philippine origin, vary somewhat in regard to the shape of the leaf; but they vary in no way as regards the absence of prickles from the stem. As regards the foliage, No. 76 has conspicuously rounded auricles on the largest leaves; No. 18 somewhat approaches it; but the others possess auricles drawn out more or less into a point. The uprising fleshy shoots of Nos. 76 and 128 have already been mentioned; it remains to add that No. 8 at times also produces them. The first and the last of these three have yellowish flesh.

The races illustrated by plate 3 are Half-long Yams which produce great numbers of these fleshy uprising shoots. Both were obtained in Singapore: the upper one, No. 2, was obtained from the deserted garden at the top of Bukit Timah, where probably some caretaker, and if so most likely a native of the Madras Presidency, had planted it: and the lower No. 6 was obtained from a market in the town.

No. 2 is the quickest to sprout of all the yams that have been under observation: this quickness is a great fault, for it means that the yams in store will not keep, but shoot out stems and deplete

themselves in the attempt to grow. In 1914, when first brought under observation it produced a tuber weighing 17½ lbs. (7938 grammes). This large tuber was cut up and replanted returning yams of various weights from 15½ lbs. (7031 grammes) downwards, the average being only 6 lbs. 12 oz. (3062 grammes). Dug then in September, they had sprouted very freely and produced long shoots, much depleting themselves before they could be planted again on November 29th, 1915. Probably in consequence of this in 1916, and for a second time, the return failed by a long way to approach at all the promise of the first year, and was on the average 6 lbs. 13 oz. (3090 grammes). If the reader is interested enough to turn to p. 307 of this Bulletin (No. 9) he will observe from the figures on the bottom line of the tabular statement there given with what rapidity the tubers in 1915 when planted sent their shoots above ground. No other yam of all then under observation did the same.

As a large number of plants had been raised in 1916 some three hundred lbs. of tubers were distributed among the Gardens labour force along with tubers from other races for a comparative test; and the report was made that this yam was better to eat than the others. But in connection with this there arises the question as to whether the preference could be due to some of the flavour and softness depending upon the more plastic condition of the contents of the tuber in consequence of growth occurring, *i.e.* on changes connected with the want of keeping power, rather than to any excellence which would exist if a means of arresting the growth were found.

The tabular statement on p. 307, above referred to, shows that as different parts of the tubers vary in keeping power, by separating the woody stem portion from the root portion the keeping power of the latter can be increased.

Yam No. 2 will be the subject still of particular attention: and it is at the same time a race of considerable interest on account of the enormous number of upgrowing fleshy shoots that it puts forth. The illustration unfortunately cannot be made to show the rudimentary leaves which demonstrate these to be stems.

Race No. 6 which is figured on the lower half of plate 3 is, like the last, also of Singapore origin and similarly has many uprising fleshy shoots. But the keeping qualities are good, as a reference to p. 307 will suggest, for the sets when planted took 37—125 days to send shoots above ground: and not a single set of the race No. 2, which has been shown to be noteworthy for the rapidity of its spouting, was later than the earliest of its sets. The skin of this yam, No. 6, is remarkably thin and very easily bruised, and removed in flake-like pieces. Magenta sap occurs in the flesh at all depths. If not identical with a yam sold freely in the Rangoon markets as Myouk-u-ni, it is extremely similar.

In 1916 there were planted two groups of sets of the race, which had been separated on account of a difference in the intensity of the magenta colour observable in 1915; but unfortunately

Opposite plate 3.

RATHER LONG WITH UPRISING SHOOTS.

Reg. No.	Origin	No. of plants	Average Weight lbs. oz.	grammes	Yield per acre in tons.
2	Singapore	44	6.13	3090	6.84
6	do.	25	6.13	3090	6.84
150	Fiji	4	4.12	2155	4.77
18	Philippine Is.	10	6-7	2920	6.48
8	do.	20	13-1	5925	13.12

Yam No. 2 : origin, Singapore : flesh yellowish : yams in shape as No. 76, but with a very strong tendency to produce uprising shoots.

Yam No. 6 : origin, Singapore where it is known as Ubi merah : flesh with abundant magenta sap at all depths : uprising shoots abundant, but shorter than in No. 2.

one of these groups suffered very much from white ants,—the group with most magenta sap, and did not yield up to anticipation. Whether the way in which it suffered was connected with the delicacy of the skin, or was not, is uncertain; but it must be remarked that no other race suffered in the same way; and no other race has been noted as having a more delicate skin. Again in 1915 it suffered rather considerably from slugs, which made pits into the tissue feeding on it.

The group of sets with the greater amount of magenta sap returned an average weight of 7 lbs. 3 oz. (3260 grammes) or at the rate of 7 tons 4½cwt. per acre: the other group returned an average weight of 5 lbs. 12 oz. (2608 grammes) or at the rate of 5 tons 15½ cwt. per acre.

Both races, 2 and 6, produced an enormous number of bulbils. In 1915, 15 lbs. (6804 grammes) of bulbils were picked up off the ground under a row of fourteen plants of No. 2, and this does not represent the total weight produced.

In minor characters the yams which are now under discussion, all being characterised by abundant uprising fleshy shoots, varied so greatly as to make it seem quite possible that an undue prominence may have been given here to the possession of these shoots. The first two, *i.e.* Nos. 2 and 6, had no prickles on the stem but the Fijian No. 150 had. No. 2 produces leaves of quite ordinary shape: but No. 6 produces leaves which are almost hastate. No. 150 was noticed to have the nerves rather prominent at the back of the leaf-blades, more so than the others.

SHORT YAMS.

On Plate 2 at the very bottom, is illustrated yam No. 70, which from the culinary point is perhaps the best of all that have been grown. As the figure suggests, it is far from being a heavy yielder: but in 1916 the largest tuber produced weighed 10½ lbs. (4763 grammes), and the second largest 10 lbs. 2 oz. (4593 grammes), the third 8½ lbs. (3855 grammes) and the fourth 7 lbs. 15 oz. (3600 grammes), but the average of the whole however was only 6 lbs. 4 oz. (2835 grammes).

In 1915 the soil in which the races of yam were grown was not good; but this race returned proportionately well.

Its tubers are rounded, and quite smooth: the flesh is ivory white, with just a little magenta sap in the layer which underlies the skin and traces deeper in the tissue. Its return per acre at the above average would be 6 tons 5½ cwt. It keeps well, and sprouts tardily.

Race No. 26, which was figured in the Gardens' Bulletin on p. 299 as figure 9, is a Philippine yam very similar to the last: and also very good for the table. Its flesh is ivory white and rather firm, without any magenta sap. Its average yield in 1916 was only 2 lbs. per plant (907 grammes).

Opposite plate 4.

FINGERED AND OFTEN FLATTENED TUBERS.

Reg. No.	Origin	No. of plants	Average Weight lbs. oz.	grammes	Yield per acre in tons.
170	Port Darwin	13	7-2	3232	7.16
22	Philippine Is. 1019	16	17-1	7738	17.14
64	do. 1040	6	17-10	7995	17.70
102	Saigon, "Khoai-mo"	8	2-13	1276	2.82
66	Philippine Is. 1046	6	7-2	3232	7.16
174	Saigon, "Khoai tiem"	9	4-10	2098	4.65
90, 92, 94	Guam I.	3	11-7	5188	11.18
100	Saigon, "Khoai-noc-trang"	5	11-2	5046	11.17
	FINGERED IN A LESS DEGREE.				
98	Saigon, "Khoai Siam"	9	7-10	3459	7.66
20	Philippine Is. 1031	5	16-15	7569	17.00
60	do. 330	4	5-5	1956	5.31
42	do. 947	8	4-2	1871	4.14
40	do. 940	9	10-9	4791	10.61
58	do. 329	21	5-2	2325	5.15
78	do. 938	4	8-11	3941	8.73
50	do. 824	6	13-9	6152	13.62
44	do. 1025	7	14-13	6719	14.88
	LOBULAR, RATHER THAN FINGERED.				
88	Philippine Is. 1941	4	5-14	2665	5.90
56	do. 963	9	5-6	2458	5.40
146	Fiji, 20695	4	6-6	2892	6.40
62	Philippine Is. 1023	6	10-1	4564	10.11

Yam No. 170: origin Port Darwin, Australia: flesh white with magenta sap under the skin: yams branch high up, but not from the very top.

Yam No. 98. origin Saigon, where it is known as Khoai Siam: flesh white with a little magenta sap under the skin: yams branch, but not always high up.

Yam No. 88: origin, Philippine Islands: flesh with some magenta sap at all depths: yams lobular and flattened.

Race No. 126, gave very similar tubers and its average return was only 2 lbs. 7 oz. (1103 grammes) or per acre nearly 2 tons 9 cwt. It differed from No. 26 in possessing a little magenta sap through the firm flesh. Unfortunately it is not known exactly what its origin was, but it came either from the plains of Sylhet or the adjoining parts of the Khasia Hills.

Race No. 48 from the Philippine islands which returned on the average 4 lbs. 2 oz. (1871 grammes) per plant, produces tubers differing from the last in no way except the entire absence of magenta sap. The yield per acre at the result obtained would be nearly 4 tons 3 cwt.

In minor characters the races possessing these small neat rounded tubers differ somewhat among themselves, *e.g.* No. 26 possesses prickles on its stem; but not so any of the others. All have similarly shaped leaves, but in this respect still differ a little. And all are inclined to be early ripening.

Excellence for the table would seem to be connected with grudging production.

SHORT BRANCHED YAMS.

Yam No. 170 from Port Darwin in Tropical Australia is figured at the top of plate 4. The tubers as there seen, branch at a short distance down in the soil, these branches being inseparable without breaking a considerable thickness of tissue. Thirteen plants of it were grown, the sets when planted weighing 6 lbs., and gave a return of 92 lbs. 13 oz., or on the average 15½ lbs. from every 1 lb. planted.

The flesh of the yams is white, with magenta sap in the tissue just under the skin.

The average yield was 7 lbs. 2 oz. (3232 grammes) or at the rate of rather over 7 tons 3 cwt. per acre.

Quite a number of other similar races have been grown: and it would seem as if there is something advantageous about them which makes them favoured in certain regions. It well may be that by branching their yield is increased without the demanding of deep soil, or deep cultivation. In the Philippine islands for instance their place seems to be important: and of the races now to be enumerated those bearing the numbers 20, 22, 44, 58, 64 and 78 came thence. Races No. 98 and 174 came from Saigon. The first of these two Saigon races is also figured on plate 4.

The characters and yield of the races just enumerated will now be given seriatim.

Race No. 20 from the Philippine islands has white flesh with a layer of magenta-coloured tissue just under the skin: and externally it is rather freely covered with rootlets. The average yield was good being 16 lbs. 11 oz. (7569 grammes) which is a return at the rate of 16 tons 15 cwt. per acre.

Race No. 22 has tubers almost identical with those of No. 20 in respect of skin and colour. One of them was figured on p. 299 as figure No. 8. The average yield was 17 lbs. 1 oz. (7738 grammes) which is a return at the rate of nearly 17 tons 3 cwt. per acre.

Race No. 44, has white flesh with a little magenta sap in the layer just under the skin, and in this is like the two last: but its surface is rather free from the rootiness which marks them. Its average yield was 14 lbs. 13 oz. (6719 grammes) which is a return at the rate of nearly 14 tons 18 cwt. per acre.

Race No. 56 produces tubers with magenta sap in them at all depths. Its average yield was 5 lbs. 6 oz. (2458 grammes), which is a return at the rate of 5 tons 8 cwt. per acre.

Race No. 60 in flesh and skin is exactly as the last. Its average yield was 4 lbs. 5 oz. (1956 grammes) which is a return at the rate of 4 tons 6½ cwt. per acre.

Race No. 42 has flesh with a salmon tint, the diffused magenta which in a yellow flesh results in this colour, increasing in intensity to the skin. Its average yield was 4 lbs. 2 oz. (1871 grammes), which is a return at the rate of just under 4 tons 3 cwt. per acre.

Race No. 40 produces lobular flattened tubers, free of rootlets, with white flesh, and a layer of tissue with magenta sap under the skin. It returned on the average 10 lbs. 9 oz. (4791 grammes) or at the rate of 10 cwt. 12 cwt. per acre.

Race No. 58, has white flesh—not quite ivory white but with a faint salmon flush, and under the skin is a layer of tissue holding magenta sap. Its average yield was 5 lbs. 2 oz. (2325 grammes) or at the rate of 5 tons 3cwt. per acre.

Race No. 64 has white flesh which turns brown quickly on exposure to the air. It has no magenta sap. Its average yield was 17 lbs. 10 oz. (7995 grammes) or at the rate of 17 tons 14 cwt. per acre.

Race No. 102 from Saigon where it is known as Khoai-mo, agreed closely with No. 64 from the Philippine islands, but possessed magenta sap under the skin. It yielded one tuber weighing as much as 15 lbs. but the average return was no more than 2 lbs. 13 oz. (1276 grammes) which is a yield at the rate of 2 tons 2½ cwt. per acre.

Race No. 78 from the Philippine islands produces tubers containing magenta sap at all depths, the skin being free from rootlets. Its average return was 8 lbs. 11 oz. (3941 grammes) which is a yield at the rate of 8 tons 14½ cwt. per acre.

Race No. 98 from Saigon, known there under the name of Khoai-siam, has white flesh, sometimes with a little magenta in the deeper part of the tissues, sometimes without. Its average return was 7 lbs. 10 oz. (3459 grammes) or at the rate of just over 7 tons 13 cwt. per acre. For 1917 it is being selected into two by the presence or absence of the magenta sap in the deeper tissues.

Race No. 66 from the Philippine islands, differed a little from the majority of the yams of the short branched type in the length of the fingers. The tubers have white flesh which soon turns orange-brown by oxidation when exposed to the air,—a character which has been thought suggestive of inferiority, but the surface of the tuber is free from rootlets like the best of the yams. Its average yield was 7 lbs. 2 oz. (3232 grammes) at which rate the yield per acre would be just over 7 tons 3 cwt.

Race No. 174 from Saigon under the name of Khoai tiem, produces rather elongated tubers, the flesh flecked with magenta sap, and magenta sap in a layer under the skin. The surface carries many rootlets. The average return was 4 lbs. 10 oz. (2098 grammes) or at the rate of nearly 4 tons 13 cwt. per acre.

The yams grown under the three numbers 90, 92 and 94, originating in the island of Guam, on examination appeared to be but one race, and will be treated as such in future, under the first number. Their average return was 11 lbs. 7 oz. (5488 grammes) or at a rate of nearly 11 tons 9 cwt. per acre. The flesh is white with magenta sap under the skin; and there is a marked tendency to flattening.

Race No. 100 from Saigon under the name of Khoai noc-trang, produces tubers which are excessively flattened. The flesh is white with just a little magenta sap in it both deep and under the skin. The average return was 11 lbs. 2 oz. (5046 grammes) or at the rate of 11 tons 3½ cwt. per acre.

At the bottom of plate 4 is figured yam No. 88 which is more lobular than fingered; and is very much flattened. Its origin was in the Philippine islands, and it appears to have an exact counterpart in another Philippine yam, No. 80. Both have much magenta sap in their tissues. The first named gave a return of 5 lbs. 14 oz. (2665 grammes) per plant and the second of 5 lbs. (2258 grammes) which per acre would be respectively 5 tons 18 cwt. and just under 5 tons ½ cwt.

Race No. 140 from Fiji, was similarly lobular but not flattened. Its flesh is white, turning brown rapidly on exposure to the air; and magenta sap is entirely absent. The average return was 6 lbs. 6 oz. (2892 grammes) or at a rate of 6 tons 8 cwt. per acre.

Race No. 168 from the Khasia Hills of Assam, while suggesting No. 88 in its lobular tubers, approached the half-long yams somewhat, and bore a number of uprising fleshy shoots. Its average yield was 4 lbs. 15 oz. (1240 grammes), but perhaps as yet it has not had a fair trial.

Race No. 50 from the Philippine islands gives flattened branched tubers with clean skins, and beautifully white flesh, which does not oxidise to a yellow-brown on exposure to the air. Its return was 13 lbs. 9 oz. (6152 grammes) on the average, which per acre would be almost 13 tons 12½ cwt.

Opposite plate 5.

SLIGHTLY RECURVING YAMS.

Reg. No.	Origin	No. of plants	Average Weight lbs. oz.	grammes	Yield per acre in tons.
28	Philippine Is.	7	7-7	3374	7.47
	STRONGLY RECURVING YAMS.				
38	Philippine Is.	19	9-8	4309	9.54
32	do.	5	1-13	822	1.82
34	do.	10	3-15	1786	3.94

Yam No. 28: origin, Philippine Islands: flesh white, with magenta sap under the skin: the elongated yams curve in the soil.

Yam No. 38: origin Philippine Islands: flesh white, with magenta sap under the skin: the elongated yams change direction completely in the soil and return to the surface: subsidiary yams grow upwards.

Race No. 62 from the Philippine islands differed from all the Philippine short branched or lobular yams in sharing with the Khasia Hills yam No. 168, the characteristic of having uprising fleshy shoots. The flesh is free from magenta sap except just under the skin, though there is just a faint salmon flush at all depths. Flattening is slightly developed. The return was 10 lbs. 1 oz. (4564 grammes) or at the rate of 10 tons 2 cwt. per acre.

In regard to foliage the series which is now under discussion varied considerably. Nos. 22, 56, 64, 66 and 98 have the auricles of the largest leaves rounded. They are all Philippine except No. 98 which is from Saigon. Quite differently shaped is the leaf of No. 146 from Fiji, for it is nearly hastate: but it does not stand geographically apart from the others because the leaves of No. 50 from the Philippine islands are somewhat similar. The leaves of all the others are of the common type. None produce prickles on the stems. The colour of the tubers varies from ivory-white to salmon and to a faint yellow tint. Obviously the combination of a delicate magenta flush with the yellow tint would produce the salmon.

If, as appears probable, yams of this short-branched type are in favour in certain regions, it will be interesting at a later date and with fuller knowledge to recognise what it is in the soil and agriculture of each favouring country which determines the choice.

PALMATE TUBER WITH A NARROW ELONGATED NECK.

Race No. 74 from the Philippine islands, produces tubers which may be considered as a development of the short branched condition. The flattening is considerable: the fingers are all or nearly all in the same plane; and because there is a kind of neck above, the whole is exactly hand-like. The flesh of the tuber of race No. 74 is white and the surface is rooty. The return was at the average 5 lbs. 13 oz. (2640 grammes) or per acre 5 tons 16¼ cwt. The foliage is of the type with broad rounded auricles; and the stem bears no prickles.

YAMS WHICH DO NOT SEND THEIR TUBERS DOWN STRAIGHT INTO THE SOIL.

To the scientist the most interesting of all the races of Yam grown are those which do not bury their tubers deeply, but have them recurving or in some cases growing upwards from their very origin. Assuredly as said above, these races owe their existence to the protection by man: also as suggested above little civilised man possibly found them excellently suitable for planting in the midden by his hut, where as the tubers extruded he would throw just a little earth and a little more refuse on to the top of them. Rumphius became acquainted with this type of yam and in the Herbarium Amboinense devoted the ninth chapter of his ninth book to a description of it, in two forms, the Ubium anguinum or Ubi

Opposite plate 6.

STRONGLY RECURVING YAMS.

See opposite plate 5.

ASCENDING AND RECURVING YAMS.

No. and Origin		No. of plants	Average Weight lbs. oz.	grammes
72	Philippine Is.	20	6-13	3090

Yam No. 38, unearthed in situ, each tuber kept in position by strings (see plates for particulars.)

Yam No. 72 : origin Philippine Islands : unearthed in situ : flesh white with magenta sap under the skin : yams ascend and then curve over.

Ular (Snake yam) and the Ubium Draconum or Ubi Boaya (Crocodile yam). He tells us that he grew them in rich clay soil free of all stones in order to demonstrate to himself that it was not obstacles in the soil which produced the unusual direction, and "many of them thrust their tails out of the soil."

The cork-screw appearance which Rumphius caused to be drawn, happens to be in excess of anything produced in Singapore, where the longer were gently sinuous.

Tamil gardeners in Singapore, were in charge of the yam beds, and when the yams, as Rumphius expresses it, thrust their tails out of the soil, these men having never seen anything similar in India, were at a loss what to do: but by earthing up as may be seen in Plate 6, the tip was covered whenever it extruded, and its elongation maintained. Experience in 1914 and 1915 had shown that if not earthed up the apex dies.

On plate 6 the reader will find figured the two most striking of the races of this type which were grown. In preparation for the figures there given, a rough bamboo scaffolding was made above the beds and to cross poles the tubers were tied by strings before the earth was removed from around them; and by this means the tubers were retained in their natural position. The race of yam shown in the upper block of plate 6 is shown again in plate 5, lower block: and the upper block of plate 5 exhibits a transition stage between what is usual and this peculiar development wherein the yams curve in the soil but not so as to extrude. Although the extreme conditions such as are shown on plate 6 appear to be confined to eastern Malaya, the condition seen in the upper block of Plate 5 is rather widely distributed: and being for instance a mark of the "Bull's horn yam" of the Shans.

The races with upgrowing tubers will now be taken seriatim commencing with the one which forms the transition.

Race No. 28 has already been figured in this Bulletin as No. 1 on page 301 from a tuber grown in 1914. In 1915 it showed a tendency to branch, but it had bad soil. In 1916 it produced yams as figured on plate 5. The flesh is white but there is magenta sap just under the skin. The skin is not rooty. The average return was 7 lbs. 7 oz. (3374 grammes) which is per acre 7 tons 9½ cwt.

This is the last yam for which a rate per acre can be given, as the others need to the cultivated further apart that they may be earthed up easily; and the number of hills to an acre would thus be reduced below 2250.

Race No. 38 is that which is shown in two plates, both plate 5 and plate 6. From plate 5 the slightly sinuous curving of the tubers may be realised: but it happened to be greater in one tuber too elongated for conveniently arranging in that group. It will be observed that in this race the direction of the tuber at first has been downwards but that at a very early stage a strong curve takes place by which the point begins to ascend more or less vertically. The age at which this change of direction comes in varies, and in one of the tubers figured the tuber did not grow down at all

before ascending. The secondary tubers produced later all ascended. The surface of these tubers is rather rooty: the flesh is white but there is a very distinct layer with magenta sap under the skin. The average yield in 1916 was 9 lbs. 8 oz. (4309 grammes).

Race No. 34 possesses the same habit of turning upwards but instead of producing one long tuber and a few much shorter secondary tubers, it produces several similar tubers which do not attain any great length. It was figured on p. 301 of the Bulletin under the No. 4. It yielded on the average 3 lbs. 15 oz. (1786 grammes) in 1916.

The bottom figure of plate 6 represents race No. 72 which behaved in a different way to the others, in that it grew upwards first and then obliquely downwards or else horizontally as is there shown. Its flesh is white, but with a distinct layer holding magenta sap under the skin: its skin is rather rooty. The average yield in 1916 was 6 lbs. 13 oz. (3100 grammes).

Plate 6 shows the yam beds, and in the lower block the supports of wood which had to be used to build up the mounds for the earthing of Nos. 38 and 72. The yams it will be observed are allowed poles to grow over about eight or nine feet high.

There is some diversity in the leaf characters of these upgrowing yams: for Nos. 28, 34 and 38 have the auricles of the largest leaves rounded; but the others have them more or less subacute. None have thorny stems.

I. H. Burkill.

THE LESSER YAM,—DIOSCOREA ESCULENTA.*

The lesser Yam, here illustrated by three plates, is quite unlike the Greater Yam in foliage, and in the production of many relatively small tubers. Economically it is less important: it is less widely known, less extensively grown, and has not been carried across oceans to the remote islands and continents which the Greater Yam has reached. Fiji for instance, seems to be its eastward limit, whereas the Greater Yam has been taken to the easternmost islands of the Pacific; and Mauritius seems to be its western limit, whereas the Greater Yam has reached Africa and has been carried also to the Tropics of the New World.

As far as can be guessed, its domestication had beginnings not less remote than the Greater Yam's, or perhaps even more remote: for the seed-forming habit has been eliminated from it quite as much as from the Sugar-cane and the Pineapple; it has for instance, never been known to fruit, which the Greater Yam does at rather rare intervals. Moreover its parentage is much more obscure than that of the Greater Yam.

Oncus esculentus, Loureiro; *Dioscorea aculeata*, Linnaens in 1754, but not in 1753: *D. fasciculata*, Roxburgh.

The Lesser Yam. No. 290, a race from Saigon known as Khoai Chach. No. 276, a race from the Philippine Islands.

No. 292, race from Saigon, grown under the name of Tu-cu. No. 288, a race from Saigon known as Khoai Tu-Bua.

Not only does it not fruit, but the production of female flowers is very rare, and the production of male flowers is apparently only common in one known race.

The three plates illustrate some of its races, in particular showing how they are to be distinguished from each other by their tubers.

In the upper block of Plate 7 is shown the Saigon race, Khoai chach, cultivated experimentally in the Botanic Gardens, Singapore, under the Garden's number 290, and below it is shown a race from the Province of Bataan, in the island of Luzon, which bears the Gardens' number 276 and was received without a vernacular name. Again in the lower block of the same plate, in its upper row, with the Gardens' number 292, is a second Saigon race received under the name of Tu-çu. It will be observed at a glance that the three numbers 290, 276 and 292, have in common neat cylindrical tubers in closely packed bunches. They, however, are not identical, No. 276 from the Philippine islands having a bitter taste, not developed in the Saigon races; and the two Saigon races being distinct is some slight morphological characters, as well as in the first being a more palatable vegetable than the second.

The Philippine race is that of which one tuber was figured on p. 303 of the Bulletin, fig. 2, and again in the Philippine Agriculturist and Forester iii, 1915, p. 207 fig. 2.

All the three races produce spinous roots; but it seems that the spines in the Philippine race are larger than in the two Saigon races.

The lowest line of figures on plate 7 represents the Saigon race Khoai bua (No. 288), and the lower block of plate 8 the Assamese race Moa ālu, (No. 286) both having lobed tubers. The name "Moa alu" which means "Sweet tuber" is of Sanskritic origin. It is well applied for the tubers are distinctly sweet.

Other races with lobed tubers have been or are being cultivated. Thus No. 274 of the Gardens' plots which gave figure 1 on p. 303 of this Bulletin and figure 4 on page 207 of the Philippine Agriculturist and Forester, has lobed tubers. It is of Philippine origin, having been received from the Province of La Union in Luzon. And a race with lobed tubers has been grown which came from Lower Burma under the name of Tah-dwe-u or "Letter-d yam." The distribution therefore of lobed races is at any rate more or less continuous from Assam to the Philippine islands via Burma and Saigon. But it is yet to be ascertained to what degree there are distinct races over this area: if, for instance, all are sweet like the Assamese Moa alu, etc. In regard to the name Moa alu, which is used along side that of China alu for another race, it is uncertain whether it originates in a contrasting of the sweet Moa alu with the race China alu, or in a contrasting of Dioscorea esculenta with other yams such as the Greater Yam which is never markedly sweet to the taste like Moa alu.

The number of tubers on a plant of Khoai bua is less than on a plant of one of the three races first named, viz. 290, 276 and 292, and at the same time they are individually larger. Moa alu again has fewer and larger tubers than Khoai bua; of them one for instance

in the small crop raised in 1916, attained the weight of 3 lbs. 5 oz. (1502 grammes). The irregularity of the tubers may be considered as imperfect branching; but no branching of the slender part, the stalk-like part, of the tuberous root occurs,—only of the swollen apical part.

On the upper part of Plate 8 are figures of three Indian races, which in 1916 had their growth interfered with: as a consequence of which the roots appear comparatively poor: but the habit is nevertheless truly represented. The uppermost of the three is a Chittagong race, received from India in 1913 under the name of Pora alu or "Oar tuber." In its first year in Singapore it returned so heavily from a small bed as to yield at the rate of 21,851 lbs. per acre, the number of tubers on a plant being on the average twenty-five (vide this Bulletin, pp. 302-303.) The race has roots armed freely with rather small thorns.

Under Pora alu on plate 8 are represented, as No. 296, the Goradu of Berar, and, as No. 298, the China alu of Jorhat in Assam. This latter goes unarmed or almost so: but Goradu has long formidable thorns on its protective roots, which overlie the tuberous roots. In these three Indian races the length of the tuber bears a fairly constant relation to the diameter. Their tubers are shorter and rounder than those of the trio 290, 276 and 292.

The rest of the races to be referred to, may be arranged conveniently in a series commencing with those whose tubers are relatively small and ending with those that are the largest. No. 278 figured at the top of plate 9 leads thus to No. 280 which is figured below it. Both came from the Philippine islands, the No. 278 from Tarlac under the name of Tugui, and No. 280 from the island of Palawan under the name of Invod. In both races there are formidable spiny roots and in both the flavour of the tubers is slightly bitter.

The lowest block on plate 9, represents the most distinct of all the races, a plant which produces the biggest tubers of all and bears them very diffusely: moreover it is the race which freely produces male flowers.

It occurs in the Philippine islands, whence it has been obtained and grown from four localities, *e.g.*

No. 272 Luzon, but the exact locality unrecorded.

No. 282 from cultivation in the Province of Batangas, where it is called Tugui

No. 270 from cultivation in the Province of Pangasinan, where it is called Carat

No. 284 from the Mountain Province, where it occurs wild, and is called Buga.

The large characteristic tubers have attained in the Singapore plots the weight of 5 lbs. 6 oz. (2438 grammes), and the longest stalk of any one measured was just over a metre in length. The tubers are densely covered with short rootlets. At the base of the stem may be found very formidably armed spiny roots but they in no way cover the diffuse tubers which lie far beyond their protection. And what is interesting about these tubers is that they may be formed quite close to the surface of the soil as if inviting the attack of pigs.

Three Indian races. No. 300, grown under the name of Pora alu, origin Chittagong. No. 298, China alu from Jorhat in Assam. No. 296, Goradu from Berar.

No. 286. Moa alu from Jorhat in Assam.

No. 278, A Philippine race grown under the name of Tuqui, origin Tarlac in the Island of Luzon. No. 280, a race frnm the Island of Palawan, called there Invod.

No. 284, A peculiar race of the Philippine Islands, wbere it seems to be common, and to occur wild (? run wild) as well as in cultivation. It has large diffusely placed tubers.

The tubers with the longest stalks are those formed latest in the season.

It might be claimed for this race that its free flowering suggests a primitive type; and in support be adduced that it is recorded above as wild in the Mountain Province of Luzon. Further it might be said that it appears to be somewhat extensively wild as male flowers may be found in herbaria on specimens from various localities in the Philippine islands which appear quite likely to be of this race and are not recorded as cultivated plants. But *Dioscorea esculenta* certainly persists in India for awhile on the sites of abandoned cultivation: and this particular Philippine race of it by reason of its diffuse tubers is the one of all most likely to be left behind in the soil when the land is abandoned to revert to jungle, under which view doubts at once arise as to the validity of any argument from its occurrence in an uncultivated condition that it is indigenous in Luzon: and then again its remarkable peculiarity that the purpose of the protective spiny roots is not fulfilled by reason of the spreading of the tubers beyond them suggests that it is not primitive. We are consequently left in as much uncertainty as regards the original home of the plant as we were: and are in need of new light.

I. H. BURKILL.

GERMINATION OF THE SEEDS OF ERYTHRINA BEFORE FALLING.

In the very wet weather that occurred in Singapore unseasonably through February, and March, 1917, the seeds of *Erythrina lithosperma* in Tanglin germinated while attached to the open legume-walls still hanging on the tree.

SCOLIA ERRATICA, Smith, A PARASITE OF THE RED-COCONUT-WEEVIL (RHYNCHOPHORUS FERRUGINEUS).

Near Bemban, Malacca, on November 28th, 1916, in the course of an inspection of Coconut palms for the Red Weevil and the Black Rhinoceros beetle, two pupating parasites were obtained from within pupa cases of the Weevil: and these having hatched out on November 28th in a breeding cage, were determined by Dr. R. Hanitsch as *Scolia erratica*, Smith.

Professor Maxwell Lefroy in his Indian Insect Life (Calcutta, 1909) p. 183 says of the Scoliidae, to which it belongs, "as to the habits of this family in India, as a whole they are probably parasitic upon the larvae of Coleoptera in the soil; they persistently fly over the soil, but none have been reared; Froggatt (Agric. Gazette, N. S. Wales, 1902) records *Dielis formosa*, Guen., as an enemy of the beetle *Xylotrupes australicus*, Thoms.,* in Queensland; the wasp burrows down to the grub in the soil, stings and

*The species of Xylotrupes are Rhinoceros beetles allied to the Black Coconut beetle.

paralises it, lays an egg on it and goes away; the larva on hatching devours the grub and pupates there." The proceeding of the *Scolia* is assuredly similar, the wasp pushing a way through the broken up tissue of the Coconut stem to reach the beetle grub: but the act has not been observed.

Bingham in the Fauna of British India, Hymenoptera i. (London, 1897), p. 78, ascribes to *Scolia erratica* a distribution through the following countries, which all have a considerable rainfall,—Sikkim, Burma, Tenasserim, Sumatra and Java. Dr. Hanitsch has taken the insect at Changi, Singapore.

None of these countries are outside the range of the Red Weevil, which occurs over a much wider area, and into much drier regions—even for instance to the Suleiman range on the border of Afghanistan (Ghosh in Memoirs Dept. Agric. India ii No. 10 p. 206). The distribution, therefore, does not suggest another host for the parasite: but we have no warrant for saying that it preys exclusively on the Weevil grubs. Observations should be made.

Scolia erratica, at any rate, may be counted as a beneficial insect.

I. H. Burkill.

THE FLOWERING OF THE PIGEON ORCHID. DENDROBIUM CRUMENATUM, Lindl.

There is a paper of considerable interest by Drs. A. A. L. Rutgers and F. A. F. C. Went on the flowering of the Pigeon Orchid in the last issue of the Annals of the Botanic Garden, Buitenzorg,* in which observations are set forth to throw light upon the marked synchronised flowering of this common plant. The one author worked in Java; the other in Holland: in Java the plants under experiment were grown in the Botanic Garden at Buitenzorg, and observations made there were supplemented by others made elsewhere in the island: in Holland the plants under experiment were grown under glass in the Utrecht Botanic Garden, having been sent thither from Java, and the observations made there were supplemented by others made in Bonn, Gottingen and Hamburg.

In Utrecht the plants maintained their habit of flowering all together, but the dates were different, and the frequency less, because through the winter they did not flower: moreover although at first they bloomed and faded on one and the same day, after the cultivation had gone on for some time they commenced to occupy two days with their flowering because the buds did not open all together on the first day.

On p. 133 a table is given which shows that at Buitenzorg in the year 1894 there were eleven flowerings, in 1895 eight, in 1896 seven, in 1912 ten; but at Utrecht there were four flowerings in 1913, six in 1914 and six in 1915.

*Annales du Jardin Botanique de Buitenzorg, xxix (1916) pp. 129-160.

The authors point out at what irregular intervals the flowering occurs: and they call attention to the way in which the dates differ from place to place, as for instance March the first may be the day for flowers in one spot, but thirty miles away the day for flowers may be March the fourth. The authors then draw the deduction that flowering has not a fixed period, but depends on external circumstances, which circumstances have to be identified.

For the purpose of their work a large number of plants were fixed in positions in the Buitenzorg Gardens where they obtained very different amounts of light: those that got the least then flowered the less freely, but they nevertheless flowered on the same days as their more favoured neighbours. The sums of the light and direct heat of the sun, therefore, are not the controlling factors for the opening of the flowers: they act only upon the vigour of the plants.

Plants in the Utrecht Gardens did not flower through the winter, over which the temperature in the plant houses was controlled by artificial heat within narrow limits: but when spring brought bright weather and the sun shone strongly on the glass roofs it was impossible to keep the temperature any longer from rising far above its former limit, and then in three weeks the plants burst into flower, not only at Utrecht, but at Hamburg and Bonn, the bright spell spreading over all three places, as if the rise in temperature or quite possibly the greater fluctuations had given the required stimulus.

Further the authors do not go than to make a suggestion that this is so and to add that very probably moisture also has an influence: because the flowering takes place so irregularly they suggest that it is possible that the two work together.

If a Pigeon Orchid plant be examined it will be seen that the flowers are produced from large persistent scaly buds. The authors compare these buds to the winterbuds of European trees, calling attention to the circumstance that winter buds are formed in the autumn to pass through a period of rest until spring brings a stimulus for renewal of growth; and they bring forward observations to show that a period of retarded growth occurs in the maturing of the flowers in the Orchid followed by extremely rapid growth at the end, the flower buds rushing to the expanding. During this time of slow growth many buds may fail; the others arrive at a certain stage and wait: the longer the requisite stimulus is in coming the more buds should there be all brought together to the same stage, and the more abundant should be the flowering when it comes, only there is this death of buds to interfere with the process. When the stimulus comes all the buds which have reached the stage of arrest find themselves driven forward together to the flowering, and so it is synchronised.

It is evident that much remains yet to be ascertained before we have a complete understanding of the phenomenon: but the hypothesis which Drs. Rutgers and Went put forward appears to offer a point of vantage from which new experiments may be directed, and may be examined briefly in regard to observations made in Singapore.

RAINFALL in hundredths of an inch over periods of 30 days leading up to flowering of Dendrobium crumenatum. t. means a trace

Sparingly	?	?	?	t	...	..	...	..	...	...	...	...	...	...	...	1	...	...	15	36	48	181	662	425	7	62	...	2	55	94	...	Mar. 12, 1913.
Abundantly	46	t	...	...	26	7	46	1	37	209	t	...	...	7	31	t	17	...	...	37	5	...	...	58	...	27	2	114	4	47	1	June 6
Freely	325	t	...	...	1	...	24	t	7	...	...	64	30	t	27	...	14	...	8	...	..	...	...	43	...	...	4	2	...	...	7	Aug. 2
2 plants only in same spot	7	...	..	64	30	..	27	...	14	...	8	...	...	...	..	43	...	...	4	2	...	...	7	...	...	...	...	..	17	...	82	Sept. 6
2 plants only in a different spot	2	..	...	7	...	...	...	...	...	17	..	582	102	103	20	...	40	78	76	...	..	33	71	2	30	...	3	32	3	6	72	Sept. 25
	...	6	t	...	...	..	3	58	3	96	27	21	76	...	176	127	22	6	...	81	140	41	20	3	2	195	37	7	84	32	t	Nov. 6
Abundantly	6	...	81	140	41	20	3	2	195	37	7	84	32	t	t	...	130	62	29	21	173	2	125	21	147	7	24	183	t	..	23	Nov. 23
	...	1	..		18	t	...	...	123	...	3	254	168	...	t	111	273	52	97	27	1	33	123	1	37	186	5	114	2	1	7	Feb. 8, 1914.
Abundantly	2	1	38	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...	22	5	131	...	...	...	52	t	1	...	Mar. 13
	4	...	t	258	...	2	...	...	...	162	2	...	10	..	1	25	40	2	1	5	62	232	t	20	...	79	t	...	.	...	3	May 15
	...	...	...	..	31	27	6	94	5	211	1	18	10	14	...	...	65	4	...	...	...	...	246	1	26	24	16	48	16	105	...	July 4
Sparingly	...	...	...	...	..	...	...	...	..	3	...	...	4	147	17	37	28	...	3	...	..	...	32	2	38	2	1	...	...	...	...	Sept. 24
One plant only	89	172	2	17	62	5	...	t	28	t	2	...	...	309	56	t	12	23	...	43	2	..	3	...	102	147	8	2	3	41	14	Dec. 25
Few flowers only	172	2	27	62	5	...	...	28	..	2	...	...	309	56	...	12	23	...	43	2	...	3	...	102	147	8	2	3	41	14	12	Dec. 26
Sparingly	2	27	62	5	...	...	28	..	2	...	...	309	56	...	12	23	...	43	2	...	3	...	102	147	8	2	3	41	14	12	58	Dec. 27

Freely	58	1	2	72	14	...	...	80	26	69	35	11	45	21	121	23	...	t	...	t	6	7	5	113	1	21	10	9	...	27	10	Jan. 26th, 1915.
	98	61	4	...	...	...	..	...	...	...	23	...	...	...	...	19	..	...	...	10	...	...	48	t	27	5	56	14	...	.	24	Mar. 20th,
	...	24	11	17	28	...	32	4	72	...	—	1	1	1	...	134	...	4	...	t	...	3	30	80	...	51	41	t	14	t	14	April 18th,
	20	...	100	7	...	1	1	...	...	t	...	..	...	75	7	...	...	73	3	1	32	...	174	t	...	t	26	32	t	5	68	July 2nd,
Very abundantly	4	58	1	21	1	19	t	25	...	...	..	...	2	74	22	94	181	70	84	3	...	1	..	...	2	171	19	...	48	4	3	Sept. 18th.
Freely	20	...	...	t	...	t	128	138	5	173	1	84	15	8	102	15	25	126	...	32	t	...	38	16	t	9	24	105	1	..	t	Nov. 28th,
Freely	...	t	9	8	19	3	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...	...	106	...	...	...	...	...	...	...	...	Feb. 19th, 1916.
Abundantly	64	t	..	10	14	1	64	46	101	65	35	1	136	...	...	...	...	...	.	...	...	...	52	9	18	..	2	18	t	24	23	April 20th,
	7	60	223	...	3	3	4	...	1	...	...	...	19	..	...	21	7	...	69	1	3	t	5	88	26	57	35	...	108	54	...	June 13th,
Sparingly	...	..	27	19	374	..	...	...	34	...	115	1	45	6	...	285	6	7	...	49	60	...	153	....	61	6	2	36	4	5	14	Sept. 6th,
Rather abundantly	...	...	...	32	...	14	...	65	...	...	...	t	135	1	2	1	68	9	19	t	7	33	213	7	...	...	...	66	...	...	..	Oct. 12th,
Freely	34	...	10	7	2	234	45	5	2	...	9	78	171	1	23	1	...	5	65	1	23	...	106	322	272	84	6	217	25	55	48	Jan. 17th, 191
Very sparingly	...	10	7	2	234	45	5	2	...	9	76	171	1	23	1	...	5	65	1	23	...	106	322	272	84	6	217	25	55	48	16	Jan. 18th.
Rather freely	10	7	2	234	45	5	2	...	9	78	171	1	23	1	...	5	65	1	23	...	106	322	272	84	6	217	25	55	48	16	51	Jan. 19th,
Very sparingly	7	2	234	45	5	2	...	9	78	171	1	23	1	...	5	65	1	23	...	106	322	272	84	6	217	25	55	48	16	51	1	Jan. 20th,
Sum of rainfall	967	432	840	1027	953	388	418	557	742	1322	717	1203	1391	846	623	1082	1022	653	542	480	988	1291	2920	1953	1258	1391	624	1225	558	642	551	

During the last four years in the Botanic Gardens, Singapore, the flowering of the Pigeon Orchid occurred on the following dates:—

	1913.	1914.	1915.	1916.
January	—	—	26th (freely)	—
February	21st	8th	—	19th (freely)
March	12th. (sparingly)	13th (abundantly)	20th	—
April	—	—	18th	20th (abundantly)
May	—	15th	—	—
June	6th (abundantly)	—	—	13th
July	--	4th	2nd	—
August	29th (freely)	—	—	—
September	6th (grudgingly) 25th (grudgingly)	21th (sparingly)	18th (very abundantly)	6th (sparingly)
October	—	—	—	12th (rather abundantly)
November	6th 23rd (grudgingly)	—	28th (freely)	—
December	—	25th, 26th and 27th (sparingly)	—	—

There are twenty-seven dates in all in the four years: and since the commencement of 1917 another flowering extending over four days has taken place. On either the seventh, eighth or ninth day before each flowering there was heavy rain, except before the dates September 6th, 1913, November 6th, 1913, May 15th, 1914 and September 18th, 1915. But ten days before the flowering of May 15th, 1914 there was heavy rain, and eleven days before the flowering of November 6th, 1913 there was also heavy rain. However, before the flowering of September 18th, 1915, which was a very abundant one, there was no heavy rain between the sixth day and on the fifteenth day, but rainless days about the eighth: and before September 6th, 1913, when two plants only flowered, there was very little rain after the sixteenth day until the eve of the flowering.

Therefore, although the rainfall statistics read in the Botanic Garden lend some support to the explanation suggested by Drs. Rutgers and Went, in that they suggest as possible that climatic conditions some eight days in advance of the flowering are a controlling factor, reservations must be made: and more observations are called for.

It is not probable that the volume of the rain which falls exercises any direct influence on the flower buds: but it is quite probable that the changes in temperature accompanying heavy rainfall,—a lowering produced by the exclusion through clouds of some of the heat of the sun, by down draughts of cold air, and by the temperature of the air against the sodden soil as the rain evaporates, determine the occurrence. Unfortunately no adequate record of the temperature in the Botanic Gardens is available for use and no mere record of maxima and minima is likely to be fully sufficient, as the phenomenon probably depends on temperature changes, and not on absolute temperatures.

It will be remembered that in the last issue of this Bulletin a short series of observations on the dates of flowering of the minute orchid, *Taeniophyllum serrula*, was given. In comparing that with the local rainfall, it is seen that the fourth day before each flowering was in most cases one with little or no rain: but this was not without exceptions.

I. H. Burkill.

PRECOCIOUS FLOWERING OF MELIA.

Recently the writer were shown by Mrs. G. P. Owen, in Singapore, many seedlings of *Melia azedarach*, Linn., the Persian lilac, flowering at two inches in height: and the occurrence leads up to the remark that there are more trees than one in its order—the Meliaceae—which may behave in this unusual way. Costerus in the Reçeuil des travaux botaniques Néerlandais, i. p. 128 has recorded the precocious flowering at two inches in height of *Melia arguta*.

Hemsley in Hooker's Icones Plantarum, plate 2786 (1905) figured a mahogany plant (*Swietenia Mahogani*, Jacq.), one of many which flowered in Trinidad, West Indies, at the height of 6 to 10 inches. Since then the Mahogany has flowered in a similar premature way in India (Rama Rao, in Indian Forester, 1913 p. 327).

I. H. Burkill.

RAINFALL at the Director's house, Botanic Gardens, Singapore, during the first half year, 1916.

Readings taken always at 8 a.m. and credited to the date in which the twenty-four hours began.

No. of Date.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	.16	..	1.07	1.36	.12	.01
2	1.38	..	.19	..	.07	.03
3	.07	..	.05	..	.05	trace
4	.16	..	..	..	..	.05
5	.12	..	..	..	..	.88
6	.07	..	.01	..	.67	.26
7	..	..	2.24	..	..	.57
8	.02	..	trace	..	.63	.35
9	..	..	.03	..	..	..
10	..	1.06	.55	..	1.03	1.08
11	.43	trace	trace	.52	.03	.54
12	trace	..	.43	.09	..	..
13	.56	..	.71	.18	.07	.25
14	.08	..	.09	..	.60	.15
15	.05	..	.07	.02	2.23	.07
16	trace	..	.08	.18	..	.85
17	..	..	.57	trace	.03	.43
18	..	..	1.19	.24	.03	..
19	..	..	..	.33	.04	..
20	trace	..	.64	trace	..	..
21	.09	..	trace	..	.01	..
22	.08	..	..	.31	..	..
23	.19	..	.10	..	..	..
24	.03	..	.14	.31	..	.49
25	..	..	.01	.20	.19	trace
26	..	.01	.64	..	..	..
27	..	.01	.46	.69	..	.12
28	..	..	1.01	trace	.21	..
29	..		.65	..	.07	..
30	..		.35	..	..	.01
31	..		.01		.69	
	3.79	1.08	11.29	4.43	6.77	6.14

RAINFALL at the Director's house, Botanic Gardens, Singapore, during the second half year, 1916.

Readings taken always at 8 a.m. and credited to the date in which the twenty-four hours began.

No. of Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.98	.17	.02	.07	trace	trace
2	.03	.03	.36	.33	.01	.22
3	.84	..	.04	2.13	..	trace
4	.01	.01	.05	.07	..	.03
5	.18	..	.14	..	..	..
6	.20	..	.05	..	..	..
7	..	..	.34	..	trace	.28
8	..	.27	trace	.66	.28	.03
9	.01	.19	..	..	2.11	.29
10	.27	3.74	.34	..	.55	.03
11	.03	..	..	..	1.68	.95
12	.56	..	..	..	..	.01
13	1.38	..	..	.13	..	trace
14	.01	.34	.32	.20	.01	..
15	..	..	..	.68	..	..
16	.68	1.15	.14	.32	.02	.01
17	..	.01	..	.50	.32	.34
18	.02	.45	.65	.05	.84	..
19	.04	.06	..	.22	1.01	.10
20	.64	..	..	trace	1.23	.07
21	.09	2.85	..	..	.25	.02
22	.70	.06	trace	.07	trace	2.34
23	.88	.07	1.35	trace	..	.45
24	.20	..	.01	.03	.09	.05
25	.01	.49	.02	..	.01	.02
26	.01	.60	.01	..	1.26	..
27	1.42	..	.68	..	.41	.09
28	.01	1.53	.09	..	.63	.78
29	..	..	.19	.18	.55	1.71
30	trace	.61	trace	.05	.23	.01
31	1.78	.06		trace		.23
	10.98	12.69	4.80	5.69	11.49	7.16

RAINFALL at the head of the Waterfall Gardens, Penang, during the first half year, 1916.

Readings taken at 8 a.m. and credited to the date in which the twenty-four hours began; the registration kindly put at the service of the Gardens by the Municipality of George Town, Penang.

Date.	Jan.	Feb.	March.	April.	May.	June.
1	..	..	.27	..	..	..
2	..	..	.77	..	1.48	..
3	..	..	..	..	..	..
4	..	..	..	..	..	.55
5	..	..	..	..	..	..
6	.17	..	.90	..	.81	..
7	.70	..	..	..	.90	..
8	1.30	..	..	.25	.37	..
9	..	..	..	..	1.00	..
10	..	..	..	1.05	1.02	.19
11	..	1.50	..	..	.17	1.17
12	..	..	..	1.44	..	..
13	..	..	.76	..	.59	..
14	..	..	.83	..	2.03	..
15	..	..	.02	..	.09	..
16	..	..	..	..	2.00	1.17
17	..	..	1.02	.70	.02	.63
18	..	..	.80	.09	..	..
19	..	..	.84	..	..	..
20	..	..	..	..	..	..
21	..	..	..	1.12	..	..
22	..	..	..	.75	.31	..
23	..	.10	1.35	.20	..	..
24	..	.07	..	.15	.87	..
25	..	2.72	.08	.17	.29	..
26	..	.08	.02	.20	.27	..
27	..	..	.80	.10	..	.55
28	..	..	..	..	.06	..
29	..		1.13	..	..	..
30	..		1.50	..	.27	.58
31	..		..		.58	
	2.17	4.47	11.09	6.22	13.13	4.84

RAINFALL at the head of the Waterfall Gardens, Penang, during the second half of the year, 1916.

Readings taken at 8 a.m. and credited to the date in which the twenty-four hours began; the registration kindly put at the service of the Gardens by the Municipality of George Town, Penang.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.55	.03	.12	..	..	..
2	1.06	.40	1.10	..	..	..
3	.04	..	.96	.12	..	..
4	..	..	.13	..	1.50	..
5	..	..	.21	.05	.17	..
6	..	.06	..	.54	1.37	..
7	.12	..	..	.14	..	.42
8	..	.20	..	.80	..	..
9	.58	..	..	.28	..	.05
10	.11	..	..	1.71	..	.05
11	.12	..	..	..	..	.02
12	..	..	..	.53	..	.02
13	.36	..	.19	1.31	.18	.39
14	.41	..	2.03	..	.15	..
15	1.56	..	.02	.04	..	..
16	..	..	..	1.80	.68	..
17	4.85	1.31	..	1.73	.14	..
18	4.17	..	..	3.41	..	..
19	.54	..	..	.36	..	..
20	.40	.07	..	.26	..	..
21	..	.10	..	.02	..	..
22	.12	..	..	1.37	..	..
23	.06	..	..	3.57	..	.25
24	.06	.54	.02	1.47	..	.57
25	..	.37	..	4.83	..	.45
26	.06	.08	1.10	..	.48	.18
27	..	.80	1.87	.03	..	.08
28	.30	..	.06	.14	.14	..
29	.11	.05	.08	..	.28	..
30	1.36	..	..	..	.61	..
31	2.30	..		..		..
	19.24	4.01	7.89	24.51	5.60	2.48

SUMMARY OF RAINFALL, 1916

	SINGAPORE.			PENANG.		
	No. of rainy days.	Amount of rain in inches.	Longest Spell without rain.	No. of rainy days.	Amount of rain in inches.	Longets Spell without rain.
January - -	18	3.79	16	3	2.17	33
February -	4	1.08		5	4.47	
March - -	27	11.29	2	15	11.09	6
April - -	15	4.43	9	12	6.22	8
May - -	18	6.77	3	19	13.13	4
June - -	19	6.14	6	7	4.84	9
July - -	26	10 98	2	22	19.24	3
August - -	19	12.69	3	12	4.01	8
September -	21	4.80	3	13	7.89	8
October - -	19	5.69	4	22	24.51	6
November -	22	11 49	4	11	5.60	8
December -	25	7.16	2	11	2.48	9
Total	233	86.31	—	152	105.65	—

Greatest amount in 24 hours. ...	3.74	4.85
,, ,, 48 ,, ...	3.93	9.02
,, ,, 72 ,, ...	4.34	9.87

Excessively rainy periods, more than 5.00 having fallen in 72 hours -	0	3 (July, Oct. 2)
No. of days when the condition eixsted	0	7
Periods of Comparative drought, less than 0.02 having fallen in 120 hours - -	8	14
No. of days over which the condition existed (Jan. 2, Feb. Apr. May, Aug.- Oct. Nov.)	39	71 (Every month except May, July and September)
Longest of the Spells - - -	16 days.	33

NEW BOOKS.

We have been asked to express publicly an opinion upon the following two books.

DE SORNAY, P., *Green Manures and Manuring in the Tropics.* —(a translation by F. W. Flattely of M. de Sornay's Les plantes tropicales alimentaires et industrielles de la famille des Legumineuses, Paris, 1913) London, John Bale, Sons and Danielsson, Ltd., 1916. Pp. xvi + 466 with copious illustrations. Price 16 shillings net with postage abroad one shilling and sixpence.

There is a great difference between the French and English, titles, and the French is by far the more expressive of the contents of the book, which is a full account of the tropical Leguminosae whether used for green manuring or for any other purpose, or whether injurious to stock, in fact all that have a direct bearing on man's operations. The translation follows the French text closely.

The book is a work of reference and is excellent.

MUNRO, R. W. and BROWN, L. C. *A practical guide to Coconut planting,* London, Messrs. John Bale, Sons, and Danielson, Ltd., 1916, pp. xx + 186, with 103 plates. Price 7 shillings and sixpence: postage abroad ninepence.

"This book.....is the outcome of a request made by the Government of the Federated Malay States," and it is claimed by the authors as written for the "intending planter" in the Malay Peninsula. It is meant to tell what costs will be entailed and what returns may be got: and with this purpose in view, the advocacy has been placed in very experienced hands. But the book from the point of view of readers is a little difficult to class: as it is neither so detailed in regard to the first processes of cultivation that the man who has never seen land cleared can take it for a text-book, while it proceeds beyond what can be assimilated by him towards the requirements of the made planter without going far enough in describing races of the coconut palm, and its pests, as to be a vademecum on the Plantation. The existence of many races of the Coconut for instance is all but ignored.

As regards pests, the Red Weevil assuredly does not live in manure (p. 115), nor in rubbish heaps unless dropped into them with infected palm tissue. Brachartona, a moth which attacks the coconut palm leaves badly, is not suppressed in the south of the Peninsula by the ichneumon mentioned in the book, but by the fungus Botrytis necans. The caterpillar described on p. 140 without a name might be that of Erionota thrax, but no less that three different orders of Lepidoptera are represented without information on the associated plate. Helminthosporium, a fungus mentioned on p. 139 is not described at all, and the description of the mild attack of Pestalozzia is inadequate.

The agricultural advice which fills most of the book is excellent. The paramount importance of aeration of the soil has its due place: cover crops, as distinct from catch crops, are recommended, in such a way that the made planter may learn. The wealth of illustrations is excellent.

ERRATA.

p. 309 line 14 from bottom (description of *Loxura atymnus*) for *5 cm.* read *35 mm.*, and lines following for *plate xxxix figure 2*, read *plate xxix figure 7*.

p. 309 last line (description of *Tagiades gana*) for *plate xxix figure 7*, read *plate xxxix figure 2*, and for *9 cm. read 45 mm.*

p. 337. The line commencing Ayer Pasir is misplaced, and should be among the statements relating to the circle round Alor Gajah.

p. 343 last line for *circule* read *circle*.

p. 352 line 4, for *affected* read *effected*.

SUGGESTION FOR BINDING.

No. 1 of this volume is the index to the second series of the Agricultural Bulletin of the Straits and Federated Malay States, and should be bound with it.

No. 2 commences with page 1, and should count as the first part of the Gardens' Bulletin.

Index.