

(b) Single-stemmed species—*Acanthorhiza aculeata*, Wendl., *Livistona altissima*, Zoll., *L. australis*, Mart., *Latania Comersonii*, L., *Caryota urens*, L., *Elaeis guineensis*, Jacq., *Cocos plumosa*, Lodd., *Martinezia caryotaefolia*, H. B. K., *Phoenix rupicola*, Anders., *Dypsis madagascariensis*, Hort., *Oreodoxa regia*, H. B. K., *Actinorhynchus calapparia*, Wendl., *Dictyosperma album*, W. and D., *Archontophoenix Alexandrae*, Wendl. None of these require much shade.

AVENUE PLANTS. Many palms lend themselves for this kind of work and the following have proved very effective.—

Sabal palmetto, Lodd., *Caryota urens*, L., *Dypsis madagascariensis*, Hort., *Oreodoxa regia*, H. B. K., *Cocos plumosa*, Lodd., and *Arenga saccharifera*, Labill., all of which are sun rather than shade loving plants.

F. FLIPPANCE.

(To be continued).

THE FUNGUS FLORA OF HEVEA BRASILIENSIS.

A little while ago an enquiry was received asking what were the fungus diseases of *Hevea brasiliensis*. On consulting the literature on this subject it was ascertained that there was no recent complete enumeration of the diseases that have been found to attack this tree in Malaya. Such lists have been prepared for other countries, as for instance by Petch for the *Hevea* in Ceylon, but the diseases are not necessarily the same in different countries and it seemed desirable therefore to have a list for Malaya.

At the same time the present paper goes further than recording the diseases that have actually been proved and enumerates all fungi, both those that are known to be parasitic and those that are so far regarded as saprophytic, which have been found on *Hevea* locally.

The importance of having such a list is ably reasoned by Professor C. F. Baker in Vol. II, No. 4 of the "Gardens Bulletin," in his article "Hevea versus Fungi."

The records from which this compilation is made are the works and collections of H. N. Ridley, W. J. Gallagher, K. Bancroft, A. Sharples, W. N. C. Belgrave, R. M. Richards, and C. F. Baker.

It is considered that additions will have to be made to this list from time to time as further investigations produce new records.

Ridley in "The Agricultural Bulletin, Straits Settlements and Federated Malay States," Vol. X, 1911, page 141, quoting M. George Vernet gives on page 143 "a list of all pests recorded to the plant," and numerates 25 species of fungus, ending with the comment, "This may seem a formidable list but it is really small compared with the pests which attract most cultivated plants."

The same remark may equally well apply to the present list but it is to be hoped that the latter part of it may now be modified considerably. One might indeed at first wonder whether the *Hevea* tree would grow at all under the burden of such a number of uninvited guests, and so far no other kind of tree in Malaya has so many fungi observed on it. It must be remembered however that the chief reason so many fungi are here recorded is that so much individual attention has been paid to the *Hevea* by Malayan mycologists. There is no doubt that an equally large number of fungi would be found on any other tree grown under similar conditions and studied so assiduously and sympathetically by experts.

In the present list the fungi are grouped according to their respective habitats. It will be seen that all parts of the tree carry their quota and that all the great groups of fungi are represented.

ROOT AND COLLAR.

Fomes lignosus, Klotsch (*Polyporaceae*). An orange coloured bracket fungus, probably the best known of rubber diseases. Previously, this fungus was known as *F. semitostus*, Sacc, owing to a wrong determination in the first instance. The first specimens in Malay were collected by Ridley in 1896 and forwarded to Kew. Considerable work has been carried out in connection with it chiefly by Gallagher and Bancroft, and is published in the bulletin of the Department of Agriculture, Federated Malay States.

Fomes pseudoferreus, Wakefield (*Polyporaceae*). The "Wet Rot" of *Hevea*, previously described under *Poria hypolateritia*. Investigated by Belgrave in 1917-1919.

Helicobasidium, (?) *H. mompa*, Tanaka (*Thelephoraceae*). The specimens which were collected by Ridley in Selangor in 1901 were sterile, and could not be definitely determined. Massee considered them a species of *Helicobasidium* probably *H. mompa* which is very destructive to the mulberry in Japan. No further collections of this fungus have been recorded.

Hymenochaete noria, Berk. (*Thelephoraceae*). A common brown root disease.

Irpex flavus, Klotsch. (*Hydnaceae*). A bright yellow woody fungus first collected on rubber by Ridley in 1897. Bancroft's investigations are published in the bulletins of the Department of Agriculture Federated Malay States. It is considered to be parasitic.

Marasmius rotalis, B. et Br. (*Agricaceae*). Bancroft records the mycelium of this fungus as occurring at the base of trees, like "horse hair."

Poria hypolaterita, Berk. (*Polyporaceae*). Investigated by Belgrave and originally determined as this species at Ceylon. Later a re-determination has referred the specimens to *Fomes pseudoferreus*.

Ustulina zonata, Sacc. (*Sphaeriaceae*). A black crustaceous fungus which attacks the trees at their collar causing loss of foliage

and "die back." Investigated by Brooks and Sharples and recorded in the bulletins of the Agricultural Department, Federated Malay States.

Xylaria cynoglossa, Cooke (*Sphaeriaceae*). A small pale coloured tongue-shaped fungus recorded by Bancroft.

STEM AND BRANCHES.

Apiosporium atrum, Massee (*Perisporiaceae*). Found on dead branches. Bancroft does not consider it a parasite.

Asterina tenuissima, Petch, (*Perisporiaceae*). Petch considers that this mould lives on the sugary secretions of the nectaries at the base of the leaves.

Botryodiplodia theobromae, Pat. (*Sphaerioidaceae*). Reported by R. M. Richards as a cause of "Dieback."

Cephalosporium, sp. (*Mucedinaceae*). Recorded by Belgrave as one of the fungi present in "mouldy rot" on tapped surfaces. He also found it a parasite on *Hemilea vastatrix*.

Corticium calceum, Fries, (*Thelephoraceae*). A bark fungus determined by Massee in 1906.

Corticium javanicum, Zimm. (*Thelephoraceae*). A cause of "Pink Disease."

Corticium salmonicolor, B. et. Br. (*Thelephoraceae*). The cause of "Pink Disease." Described in detail by Brooks and Sharples in the bulletins of the Agricultural Department, Federated Malay States.

Cryptovalsa microspora, Sacc. (*Sphaeriaceae*). A new species found by C. F. Baker on rotting stems.

Cyphella heveae, Massee (*Thelephoraceae*). A cause of "Thread blight." Found on the bark by R. M. Richards.

Daldinia concentrica, Ces. et De Not. (*Sphaeriaceae*). A dark chocolate coloured bun shaped fungus forming hard globular masses, occurring commonly on dead wood.

Daldinia concentrica, Ces. var. *escholzii*, Ehrenb. (*Sphaeriaceae*). Found on a dead trunk.

Didymella oligospora, Sacc. (*Sphaeriaceae*). Recorded by C. F. Baker on dead branches.

Diplodia rapax, Massee (*Sphaerioidaceae*). Described by Ridley as a "pestilential black fungus" and named by Massee in 1909.

Diplodia, sp. (*Sphaerioidaceae*). The cause of "Die Back." It is considered to be a wound parasite, that is to say, it can only enter its host through a dead or wounded part. The fungus itself is scarcely visible to the naked eye, and is in the form of minute black dots on the dead shoots.

Eutypa caulivora, Massee, (*Sphaeriaceae*). This fungus forms numerous large black blotches on the trunk and is considered by Massee to be a parasite. Bancroft suggests it is a "wound parasite," and quotes Petch as stating that this fungus is the same as *Nummularia pithodes*.

Eutypa ludibunda, Sacc. var. *heveana*, Sacc. (*Sphaeriaceae*). Recorded by C. F. Baker on dead limbs.

Gloeosporium alborubrum, Petch (*Melanconiaceae*). Reported on dead shoots.

Hirneola polytricha, Mont. (*Tremellaceae*). A thin dark coloured fleshy fungus occurring in clusters at the ends of dead branches or wounded parts.

Hypochnus, sp. (*Thelephoraceae*). A "thread blight" fungus.

Hypoxylon oodes, B. et Br. (*Sphaeriaceae*). A black nodular incrusting fungus reported by Bancroft on dead branches.

Hysterium heveanum, Sacc. (*Hysteriaceae*). On dead limbs.

Lembosia glonioides, Sacc. (*Hysteriaceae*). On dead limbs.

Megalonectria pseudotricha, Speg. (*Hypocreaceae*). Bancroft describes this as a bright red minute fungus forming small round bodies the size of a pin's head. It occurs on dead bark and stems. Brooks states that *Stilbum cinnabarinum* is the conidial stage of this fungus.

Nectria diversispora, Petch (*Hypocreaceae*). A common small red fungus, saprophytic on dead bark and fruits.

Nectria sanguinea, Fries (*Hypocreaceae*). An orange red saprophytic fungus found on the bark.

Neotrotteria pulchella, Sacc. Found on the bark by C. F. Baker and described by Saccardo as a new species.

Nummularia pithodes, Petch (*Sphaeriaceae*). Reported by Brooks and Bancroft to be common on dead branches and roots. It is one of the causes of black lines in the wood. Its black fructification has the appearance of a piece of asphalt. Petch considers *Eutypa caulivora* Masee, to be the same thing.

Nummularia repandoides, Fuck. var. *singaporensis*, Sacc. (*Sphaeriaceae*). On dead limbs.

Oospora gilva, Berk. (*Mucedinaceae*). A pink powdery fungus recorded by Bancroft as occurring commonly on burnt rubber stems.

Peroneutypa heteracanthoides, Sacc. (*Sphaeriaceae*). Recorded by C. F. Baker on dead limbs.

Phyllosticta heveae, Limm. (*Sphaerioidaceae*). A disease affecting the youngest shoots and widely spread throughout the country. It is closely associated with the "die back" fungus, and Bancroft considers that in many cases of the "die back" disease the primary cause is this fungus.

Phyllosticta ramicola, Petch (*Sphaerioidaceae*). Recorded by Bancroft as a stem disease.

Phytophythora Faberi, Maub. and P. spp. (*Perenosporaceae*). Very common and destructive parasites credited with causing "Black Thread," "Stripe Canker," "Cambium Rot," and canker of the bark.

Pleonectria heveana, Sacc. (*Hypocreaceae*). On rotting stems.

Polystictus sanguineus, Fries (*Polyporaceae*). The most brilliant coloured and one of the prettiest of Malayan bracket fungi. Its colour varies from a brilliant scarlet to dark blood red. It grows on all dead wood very commonly everywhere.

Schizophyllum commune, Fr. (*Agaricaceae*). A small mushroom with a lateral stipe growing in patches over dead wood. When wet it is a fleshy colour and expanded but when dry it turns white and the edges become involute. It is densely covered with hairs and is to be found on almost any dead wood.

Sphaeronema, sp. (*Sphaerioidaceae*). Reported by Belgrave to be the cause of "mouldy rot" on the tapped surfaces.

Stilbella heveae, Limm. (*Stilbaceae*). A minute pin shaped fungus with a salmon coloured head and dark coloured stalk. Reported by Bancroft on dead bark.

Stilbum cinnabarinum, (Mont.) Lind. (*Stilbaceae*). On dead parts, reported by Brooks to be the conidial stage of *Megalonectria pseudotrichia*.

Thyridaria tarda, Bancroft (*Sphaeriaceae*). Considered by Bancroft as the perfect stage of the "Diplodia" fungus, the cause of "die back." Vincens of Saigon also does not think this should be separated from *Diplodia*.

Xylaria obovata, Berk. (*Sphaeriaceae*). On stumps.

Xylaria scopiformis, Mont. (*Sphaeriaceae*). Recorded by Ridley and Bancroft on dead wood.

Xylaria tuberiformis, Berk. (*Sphaeriaceae*). Occurring on stumps.

LEAVES.

Helminthosporium heveae, Petch (*Dematiaceae*). Recorded by Ridley as attacking the young leaves and proving troublesome in nurseries.

Limacinia javanica, Sacc. (*Sphaeriaceae*). A sooty mould recorded by Bancroft as following on a scale, *Lecanium nigrum*. Such fungi live on the honey dew secreted by the insect and do not actually extract any food from the leaves, although their presence in masking the leaves is harmful in a young plant.

Pestalozzia Guepini, Desmaz (*Melanconiaceae*). This fungus first appears as small grey spots, more or less circular in shape. These spots enlarge and often coalesce and are bordered by a narrow black line. The fungus kills the chlorophyll and consequently causes the grey colour of the leaf. Recorded by Bancroft. This fungus is a very serious disease on tea.

Phyllosticta heveae, Limm. (*Sphaerioidaceae*). Recorded by Bancroft as a leaf parasite.

Sphaerella heveana, Sacc. (*Sphaeriaceae*). Recently collected on dead leaves by C. F. Baker, and considered a new species by Saccardo.

FRUIT.

Asterina tenuissima, Petch (*Perisporiaceae*). Recorded by Bancroft in 1913.

Nectria diversispora, Petch (*Hypocreaceae*). A small salmon coloured fungus on dead fruits.

PREPARED RUBBER.

Bacillus prodigosus (*Bacteriaceae*). Reported by Bancroft as causing red spots on rubber crepe.

Chromosporium crustaceum, Sharp. (*Mucedinaceae*). Reported by Sharples as causing a black spotting in plantation crepe.

Eurotium candidum, Speg (*Perisporiaceae*). A common mould, reported by Bancroft. Sharples considers that the opaque spots on sheet might be attributed to this fungus.

Fusarium sp. (*Tuberculariaceae*). Stated by Sharples to cause a violet flush on sheet rubber. Previously Bancroft had stated this was due to *Bacillus violaceus*.

Monascus heterosporus, Schroeter (*Perisporiaceae*). Bancroft reports this fungus as causing a spotting on prepared rubber. Infection may take place from jungle wood both in the field or in the drying house.

Penicillium maculans, Sharp (*Mucedinaceae*). The cause of a yellow diffused flush on rubber. Investigated by Sharples.

Spondylocadium maculans, Bancroft (*Dematiaceae*). A cause of rubber spotting.

Trichoderma Koningi, Oud. et Konnig (*Mucedinaceae*). Considered by Sharples as the cause of blue black spot on crepe.

The above was already written when an article entitled "Disease Scars" appeared in "The India-Rubber Journal" of 15th November 1919 page 21. The situation is well summed up in the first two paragraphs as follows:—

"We do not think that anyone could visit any part of the East without being impressed with the havoc which diseases have wrought on rubber trees. Even if a visitor to the tropics does not see many rubber estates he is fairly educated on the subject by the Eastern Press. There is a possibility that many individuals who have visited the East for the first time may be led to take an exaggerated view of the danger from diseases, so far as rubber estates are concerned. We do not, as our readers know, wish to minimise the importance of the subject in relation to the future of Eastern plantations but we feel bound to say that in many cases the number of trees affected on particular estates seem to bear some ratio to the activity of the Press and the number of investigators who have reported on the properties.

"Some estates which have not allowed mycologists to visit them declare that they are free from disease. While such a condition may be possible we have very grave doubts as to whether any pro-

perty of considerable age is free from the various bark and root diseases so prevalent throughout the East. We believe that on most plantations there are plenty of affected specimens to be found if the staff is free to search for them. We have generally found that the keener the managers and assistants are the larger the number of cases reported in the usual monthly statement."

It is a matter for consideration as to whether the term "Scares" should be applied to the recording of these diseases which are obviously always with us but only occasionally reported, according to the opportunity the scientist has to investigate them or as they assume undue prominence. They may probably provide a "Scare" for the outside man who is nervous and over anxious about his investment but they should hardly be considered in that light by competent experienced managers for with the assistance of these same scientists who record these diseases, they should feel quite capable of dealing with them and holding them in check.

T. F. CHIPP.

Tuba-Root (*Derris elliptica*).

AS AN INSECTICIDE.

Readers of George Maxwell's "In Malay Forests" will recollect the graphic account of a fishing expedition where the Malays used the root of the Tuba-plant as fish poison.

Many plants exist in the Tropics, and notably in India, which can be put to the same purpose of killing fish, and Watts' Dictionary gives a fairly long list of them. Throughout the Malay Archipelago Tuba-root appears to be the poison most in use, and a very effective one it is in the hands of expert natives.

The interesting question arises whether the toxic properties of this root are also effectual for the destruction of insect life; for, if such were the case, its application to agriculture is naturally all indicated.

The Chinese appear to have solved the question to their satisfaction, for we know that they employ tuba extensively for the protection of their crops against injurious insects. In Sarawak, the Chinese pepper planters always have, or had (for the writer's visit dates far back) a few bushes of tuba growing alongside their vines.*

Beyond that knowledge, however, the enquiry suggests itself whether the macerated tuba-root, as used by the Chinese, acts as a stomach-poison to chewing insects, when taken with their food, as it does in the case of grasshoppers and beetles, or as a contact poison for insects which obtain their food by sucking as bugs and plant-lice generally do, or whether its toxicity is effective both as a contact and a stomach poison.

* Tuba-root is now largely grown in Singapore.