

the English Channel and in the Bay of Biscay and to the west and south. The chief fish of this region are the migratory mackerel and pilchard and the hake, which apparently is a great wanderer. It is hoped also to investigate the possibilities in respect to tunny, of which there should be an almost unlimited supply in the Atlantic. France undertook the preparation of a fishing chart of certain grounds, Ireland particular cruises to meet the French vessel, and England to continue and extend her investigations into the waters of the Channel. England was also asked to undertake, as soon as possible, regular cruises to the south-west to investigate the approach of the Gulf Stream waters in respect to mackerel, pilchards, and tunny.

At the full meeting on Saturday, March 6, the programmes of the committees were adopted, and Mr. H. G. Maurice was unanimously elected president for the ensuing year, the next meeting to be held in Copenhagen in 1921. The present writer believes that the fishery industry appreciates the vital importance of these very technical investigations, in the results of which the interests of the fisherman and the researcher are identical; he appeals to the industry to co-operate in every way in its power, and in particular to return drift-bottles and marked fish.

Exhibition of Diseases of the Para Rubber-tree.

AN important exhibition illustrating the fungal diseases to which the Para rubber-tree (*Hevea brasiliensis*) is subject in Ceylon and Malaya was opened on March 10 in the Botany Department of the Imperial College of Science and Technology by the Marquess of Crewe in the presence of leading representatives of the rubber trade. The exhibition, which has been organised by Prof. J. B. Farmer, Director of the Biological Laboratories of the college, includes a large number of trunks of rubber-trees, specially shipped from the East, showing the diseases as they occur in the plantation, and forms a striking commentary on the optimism which obtained in the first years of the industry as to the probable relative immunity of *Hevea* from disease.

The warnings issued by botanists at the time that the Para rubber-tree would no more escape epidemic fungal disease than any other crop plant has, unfortunately, been justified by events. At the present time there are several diseases which, if not checked as the result of sound scientific knowledge, intelligently applied, may seriously affect the future of the plantation industry. The former optimism finds a present-day counterpart in the equally dangerous view held in certain quarters that "sanitation" is all that is necessary as a safeguard against disease, and that, in consequence, expenditure on mycological research is waste of money. The fact that the causative organism (if organism it be) of the most dangerous disease in the plantations at the present time ("brown bast") is as yet unknown is sufficient reply to so short-sighted a view. The exhibition comprises three main sections: (1) A series of rubber trunks affected by the chief diseases met with in the East, illustrated by admirable coloured wall-pictures of the diseases *in situ*; (2) cultures and microscopic preparations of living fungi isolated at the college from the trunks exhibited; and (3) a section devoted to the important bearing of a knowledge of the anatomy of the bark of the tree upon questions of latex yield. This section also includes trunks illustrating different systems of tapping. All the exhibits are accompanied by explanatory labels.

The principal diseases represented are as follows:

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(1) *Brown Bast*.—This is by far the most important disease at the present time, and is rapidly increasing, certain estates in Java having as many as 60 per cent. of the trees attacked. It is an affection of the bark in the tapping area, and is of acute importance, since it quickly results in the complete cessation of latex flow. Later, the bark becomes discoloured and burrs appear over the affected area. The disease is met with on young and old and on vigorous and backward trees, and occurs in every type of soil. At present preventive measures are confined to disinfection and excision of the affected tissues, but successful treatment is hindered by ignorance of the real nature of the disease. Hitherto physiological disturbance produced by tapping has been held to be the cause, but recent work in Sumatra suggests a bacterial origin. Further research alone can settle this fundamental question.

(2) *Fomes lignosus*.—Next to brown bast this is the most serious disease of *Hevea*. It is a fungus of the familiar Polyporus type, attacking the cortex of the roots. In cases where it was neglected in the early stages it has since wiped out large blocks of rubber, and from the nature of the disease the replanting of such areas has been impracticable. The mycelium spreads to the *Hevea* roots from old jungle stumps, or from soil in which old jungle roots have been lying. From the infected *Hevea* roots it passes to all healthy roots in the vicinity, finally destroying the trees. Treatment consists in exposing the root-system and painting the diseased roots with Bordeaux mixture or other fungicide. The soil is also heavily limed to destroy the mycelium invariably present in it, and the whole infected area isolated by a trench.

(3) *Fomes pseudoferreus* (*Poria*).—This fungus penetrates deeply into the wood of the *Hevea* roots, often leaving the cortex as a living cylinder until the wood is destroyed by a "wet rot." The tree thus shows little external signs of attack until the disease has reached the final stage. In consequence, measures of dealing with *Poria* are limited to preventing its spread. The treatment adopted is essentially the same as for *Fomes lignosus*.

(4) *Dry Rot* (*Ustulina zonata*).—This fungus is a wound parasite, and gains entrance *via* lesions on roots, stems, and branches, killing the wood, which becomes soft and tindery. Owing to former neglect of wounds, the disease is greatly increasing in older plantations. The best preventive treatment is a periodical dressing of all wounds with tar. When confined to the branches the disease may be removed by pruning, but if on the base of the trunk or on the roots, the tree is usually found to be infected with *Fomes* in addition, and treatment is impracticable.

(5) *Patch Canker* (*Phytophthora Faberi*).—This disease is increasing in all the rubber-growing countries of the East. The bark just below the surface becomes claret-coloured, and eventually dies off in patches. The disease can be controlled by early removal of the bark and coating the exposed surface with tar but the chief difficulty is that the affected bark is freely entered by boring beetles which penetrate deeply into the wood, carrying with them spores of dry rot (*Ustulina*). In consequence, nearly every case of neglected patch canker is also infected with dry rot.

(6) *Stripe Canker* (*Phytophthora sp.*).—This canker was a formidable menace during 1915-17, more than 70 per cent. of the trees in tapping on some estates being attacked. The disease first appears as narrow vertical stripes just above the newly tapped bark, and if tapping is continued during the wet season the whole of the tapping surface rots away. Fortunately, it is now almost completely preventable by daily disinfection of the tapping cut.

(7) *Pink Disease* (*Corticium salmonicolor*) has

caused much damage in the East. It rarely attacks very young trees, and develops most rapidly during periods of heavy rain. Manifestations of the disease are extremely variable, but a common form, viz. a pink encrustation on the branches or main stem, gives the disease its popular name. Once the bark is penetrated the fungus spreads rapidly, destroying the cortex, and frequently enters the wood, interrupting the water-supply to the branches, which turn brown and die. So far the best treatment has been the removal of infected branches, or by treating the diseased parts with tar. Except in special cases, spraying is not practicable.

In the section devoted to fungal cultures and preparations, the following fungi, among others, have been isolated and grown from the trunks exhibited: *Cyphella heveae*, a cause of "thread blight" disease; *Botryodiplodia theobromae*, a cause of "die-back"; *Fomes lignosus*; Hyphomycetes associated with *Botryodiplodia*. In addition to living cultures of these fungi on potato and banana agars, interesting experiments are in progress with the view of ascertaining the effect of the vitality of the host upon the potency of the parasite. The fungi have therefore been sown (on wounds) on apple-twigs respectively healthy, of low vitality, and dead, and the cultures kept in a saturated atmosphere and at 25° C.

The third section well illustrates by means of diagrams the important relationship between the anatomy of the rubber stem and the yield of latex. In high-yielding trees the bark shows a large number of rings of latex tubes and a high relative proportion of soft bast as compared with hard bast, which latter contains abundant groups of stone-cells interrupting the rings of latex tubes. In good yielders the stone-cells are more or less confined to the external part of the cortex; in low yielders they are distributed in depth. The well-known superior yield of tapping cuts made from left to right over cuts made from right to left is due to the oblique course of the latex tubes in the bark. This important fact is explained in a large diagram. Mr. H. Ashplant exhibits elaborate statistics showing individual daily tapping yields obtained by different coolies on one estate over a period of three years. The figures show that highly skilled tappers working a group of trees previously tapped by average or poor tappers may collect from 50 to 200 per cent. more latex than the unskilled men. This fact results from the variable depth of the cut made by the inferior tappers, who do not reach the more internal rings of latex tubes. A further interesting point is the favourable influence of a good tapper's work on the yield obtained by an average tapper succeeding him in the same block.

It is much to be hoped that efforts will be made to maintain and develop the present exhibition as a permanent museum of the economic mycology of *Hevea brasiliensis*. Such a museum, with its natural complement of an information bureau, would be of the greatest practical value to the home representatives of planting interests and to the industry generally. The exhibition demonstrates in the clearest fashion the supreme importance of scientific research in this vital aspect of rubber-planting. New diseases are bound to occur in the future, and it may be disastrous to wait until the plantations are seriously affected before taking steps to secure expert advice. Adequate scientific staffs should be continuously engaged in studying the complete biology of *Hevea*, so that in the advent of a new disease experienced specialists could be detailed at once to cope with it. It is, however, essential that such staffs should be composed of men of first-rate ability and training, for where so much is at stake

anything short of the best is worse than useless. Moreover, the best men afford the greatest chance of effecting the desideratum in combating all disease, viz. the stitch in time. The industry must be prepared to pay for such men, but there can be no question that money generously and wisely spent on these lines would be repaid times over.

The Position of the Meteorological Office.

DR. C. G. KNOTT, president of the Scottish Meteorological Society, has sent us a copy of the following resolution passed by the council of the society with reference to the present position of the Meteorological Office:—

"The council of the Scottish Meteorological Society have had under consideration the information published regarding the future status of the Meteorological Office and its relation to various Departments of State. They recognise that an incorporation in one of the great Departments of State is desirable and realise that meteorology has much to gain by an intimate connection with the Air Ministry. At the same time they have in view that the State Meteorological Office has many other departments and interests to serve, not the least of which are those of pure research. They feel that any system by which the policy of the Office was directed by the interests of only one Department might in certain circumstances hamper its proper development. The science of meteorology made notable advances in many directions under the liberty enjoyed by the Director of the Office with the administrative committee as constituted in 1905. The council urge that, whatever constitution it may be convenient to give to the Office, the public, departmental, and scientific interests of the science should be safeguarded by expressly and personally charging the Director with the care of meteorology in all its branches. Under such an instruction the Director could be relied upon to organise the service upon a scientific plan and to build up the administrative elements in accordance with the demands made upon him. The council also feel that any step which will modify the functions and responsibilities of the Meteorological Committee should be taken only after searching inquiry by a Departmental Committee into the necessity for any modification, and the probable effect of such modification on the work of the Meteorological Committee."

Earthworks and Retaining Walls.

IT is admitted that our knowledge of earthwork problems is far from complete, and the information given in two papers read at the Institution of Civil Engineers on February 10 forms a welcome addition. Mr. Ponsonby Moore Crosthwaite has made experiments on the horizontal pressure of sand, and finds that the angle of internal friction is much less than the angle of repose. The experiments show that the pressures on a wall, as calculated from the Rankine and Colomb theories, are much too high, especially for surcharged walls. Further experiments show that the wedge theories which take account of the friction between the wall and its backing give correct results if the wall is not surcharged, but break down for surcharged walls. By modifying the wedge theory so as to neglect the friction on the back of the wall, and introducing the angle of internal friction instead of the angle of repose, marked agreement was found with the experiments for surcharged walls.