ROTHAMSTED RESEARCH

Report for 1931

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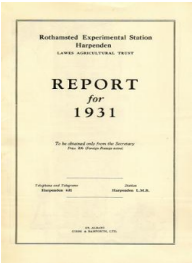

Fungus Diseases

Rothamsted Research

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each can be kept constant or made to vary uniformly as desired. The plants are grown entirely by artificial light, so that experiments at different times of the year are strictly comparable.

Air temperature plays the chief part in the development, as distinct from the spread, of the disease. Black-arm is essentially a high temperature malady, and in the control chambers severe secondary infection of the growing plant by spraying with a virulent culture is only obtained at temperatures above 30°C. The physiological reasons underlying this are under investigation ; they appear to be bound up with the relative rates of growth of the parasite and the plant, and the carbohydrate metabolism of the plant as shown by its sugar content. Fluctuating temperatures, whether soil or air, which resemble more closely natural conditions, give the same result as a constant temperature near the mean of the varying factor.

Soil temperature is less important. It plays, however, some part in determining the amount of disease on the very young seedlings grown from infected seed. The amount of this primary infection is reduced by high soil temperatures, e.g. above 30 C., but not sufficiently to offer any prospect of control by this method.

Air humidity is the chief factor determining the spread of the disease, but it is important only during the short period required for inoculation. Humid conditions are necessary for successful penetration of the tissues by the bacteria on the surface, however they have got there, but once penetration has been effected the external humidity has little direct effect.

Internal infection of seed, which has been suggested as a serious cause of primary infection, was found to be very rare ; external infection is the usual source. The primary infection can be controlled and healthy seedlings raised by complete sterilisation of the outside of the seed, indicating that the organisms are usually carried on the fuzz of the seed coat.

The costly appliances needed for this work were purchased and are maintained out of grants made by the Empire Marketing Board.

FUNGUS DISEASES OF PLANTS

W. B. Brierley continued his study of racial problems in fungi. A number of natural infections of different hosts by *Botrytis cinerea* were intensively analysed and, with few exceptions, two or more races of the parasite were obtained from any single lesion. In certain cases the fungus produced infections which could not be distinguished from each other but the host lesions contained populations consisting of different races or of assortments of the same races in different proportions. This method of intensive analysis was extended to other fungal parasites with similar results, and it seems possible that, in many diseases, infection may be caused by genetically complex populations rather than by single races of specific fungi.

Numerous experiments designed to study the educability of individual races of *Botrytis cinerea* produced no evidence of change lasting beyond the one generation.

M. D. Glynne continued her study of the wart disease of potatoes. Among varieties which, on the basis of field trials, have been officially certified as immune are some which, under the more stringent con-

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ditions of laboratory testing, develop small infections. The development of the parasite has been traced in a number of these varieties and, in some, the increase of the disease seems to be prevented by the development of a necrotic area in the region of infection by which the plant sloughs off the parasite with the dead tissues.

Critical examination of doubtful specimens of wart disease has been continued for the Ministry of Agriculture and the National Institute of Agricultural Botany and reports have been made on seventy-four specimens belonging to thirty-seven varieties.

Investigations into the relation of nutrition to certain fungal diseases of the potato plant by L. M. J. Kramer, at Rothamsted and at Woburn, showed no correlation between manurial treatment and the severity of attack by blight (*Phytophthora infestans*). The distribution of the disease was determined by the direction of the prevailing wind and the presence of infective centres.

Pot culture experiments, however, showed that excessive applications of phosphatic fertilisers increased infection of tubers by pink rot (*Phytophthora erythroseptica*).

A method of assessing the extent of fungal invasion of potato tubers was devised which corrects for the errors due to the size of the tuber. It has been extensively used and is of wide application.

THE INSECT PESTS

Wheat Midges. Observations made by H F. Barnes during the past five years on the incidence of wheat blossom midges on Broadbalk, combined with studies of the records of the Ministry's entomological advisors, have revealed some degree of periodicity in their attack. About every fourth or fifth year they do great damage to wheat, but in the intervening years the damage is insufficient to warrant any expenditure on control measures. The figures for the damage on Broadbalk for the last five years are :

Year.	1927	1928	1929	1930	1931
Percentage of damage to grain	3.2	6.5	7.7	17.6	21.4

Thus 1930 and 1931 were years of great damage on Broadbalk. The Ministry's records show that 1916, 1920 and 1926 were also peak years of damage. H. F. Barnes is following up these remarkable observations. If they lead to forecasting of attack some valuable practical results might be expected to emerge.

Varieties of Plants immune to insect attack. Agricultural pests are not easily controlled by direct methods such as spraying, which is so effective for hops and fruit. Indirect methods, including the use of resistant or immune varieties, are more suitable.

H. F. Barnes has continued his search for varieties of willows immune to gall midge attack ; this year he has concentrated on the midge that attacks the cricket bat willow (*S. coerulea*) which causes serious loss of sets, and has found certain basket willows immune to attack.

M. E. Metcalfe has been doing similar work on clovers and grasses, such as timothy, rye grasses and cocksfoot. All varieties of red

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