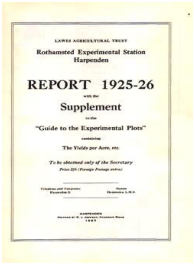
Report 1925-26 With the Supplement to the Guide to the Experimental Plots



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Plant Resistance and Immunity to Fungus Disease

Rothamsted Research

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RESISTANCE AND IMMUNITY OF PLANTS TO FUNGUS DISEASE.

Fungus diseases are being studied by Dr. Brierley and his staff in a somewhat different manner. The easiest way of dealing with them is, where practicable, to avoid their attack by growing immune or resistant varieties. The discovery of potatoes immune to Wart Disease largely solved the practical problem in the great potato growing districts. Much attention has been devoted by Miss Glynne to the study of this immunity. Apparently it does not arise from any power to keep out the fungus, for she has succeeded in inoculating the fungus into shoots of immune tubers, where it continued living to the stage of the summer sporangia, but, up to the present, it has developed no further. Apparently, therefore, the immunity arises from the unsuitability of the tubers for the continued growth and multiplication of the fungus.

Further, the immunity seems to be inherent in the tissue itself; it is not conferred by some chemical agent produced in the leaf and sent down to the tuber. Mr. Roach has grafted immune tops on to some susceptible roots; the new plants grew and developed tubers. Those produced below the graft remained susceptible, while those above the graft were immune, yet both were fed by the same leaves. Conversely, the grafting of susceptible tops on to immune roots gave rise to mixed plants, the tops of which remained susceptible, while the roots remained immune.

Furthermore, many if not most of the common parasitic fungi consist of a greater or lesser number of distinct strains which, although often looking alike, have different powers of causing disease. Each strain has its own geographical or climatic distribution, although these often overlap or coincide, and each strain can cause disease in particular varieties, or ranges of varieties, of host plants. The field problem of disease is, in fact, rapidly being understood as the relation between particular varieties of crop-plant and particular strains of parasitic fungi, and this is throwing much light on the relative immunity of varieties to certain diseases in particular areas and their sucepti-bility in other areas or under other conditions. This knowledge has already proved of importance in the control of rust diseases of cereal crops.

Dr. Brierley has been studying this problem in the highly variable fungus, *Botrytis cinerea,* which is very destructive on many different kinds of crop and glass-house plants. The apparent variability has been traced to the many constant and closely allied strains of the fungus, very similar morphologically, but differing widely in their physiological properties. There is evidence, which will be tested, that each strain has its particular range of host-plants, on which it can produce disease. One strain suddenly gave rise to colourless, instead of black sclerotia, and this new form remained constant for over 1,000 generations. This type of change is not infrequent in particular strains of many species of fungi, and occurs not only in pigment formation, but in structure, and much more importantly, in physio-logical and parasitic qualities. There is, thus, always the possi-bility that a particular strain of fungus may change, and so diminish or extend its power of producing disease in crop-plants.

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As this problem of fungus-strains seems of great importance, much attention has been devoted to it.

Dr. Chodat investigated from this point of view a saprophytic fungus, *Aspergillus ochraceus,* and a tomato parasite, *Phoma alternariacearum,* and observed remarkable genetic changes in pedigree strains. His results are set out on p. 76.

Mr. Dickinson has studied the covered smuts of Oats and Barley, both very destructive fungi. The black bunt or dust of these fungi consists of microscopic spores, about 1/2600 inch diameter, and each of these gives rise to four very much smaller sporidia. By means of his "Isolator," Mr. Dickinson can, with certainty and at will, isolate single sporidia, which are then grown in pure culture, until they form colonies an inch or more in diameter. The sporidia and their subsequent colonies are of one or other of two genders ("sex"), and fusion has been found to occur between them. The microscopic structure and physiology of the pure strains derived from single sporidia of both *Ustilago hordei* and *U. levis,* and of the fusion products when different genders of the one fungus or one gender of one fungus and the other gender of the other fungus combine, have been studied in detail. Neither gender by itself appears to cause disease: only when both genders are present is the plant attacked. The parasitic qualities of these strains will be further investigated and special attention paid to genetic changes.

VIRUS DISEASES OF PLANTS.

Perhaps the most obscure of all plant diseases are those studied by Dr. Henderson Smith, grouped under the name, Virus diseases, including Mosaic, leaf curl, etc. They are spreading, and they cannot as yet be prevented or cured. They are very easily transmitted from one plant to another, not only of the same kind, but, in some instances, of different kinds. They can be transmitted by contact, by insects, and in other simple ways. Their cause is unknown. Many organisms have been isolated from diseased plants, but, so far, none that produces the disease, nor can any casual agent yet be cultivated outside the plant.

There is reason to believe that several distinct types of these diseases, due presumably to different viruses, occur in nature. They may exist singly, or in combination in one plant, either producing symptoms or not; thus potato mosaic and tomato aucuba mosaic both affect tomatoes, giving characteristic symptoms, but the two together produce the harmful stripe disease. Owing to much preliminary work done by Dr. Henderson Smith on these problems, more searching investigation has become possible.

BEE INVESTIGATIONS.

Bees are studied at Rothamsted as honey producers; their diseases are investigated at Aberdeen.

Mr. Morland has been engaged on two problems of importance to beekeepers in this country: the possibility of using metal combs and the best way of arranging the frames in the hives.

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