

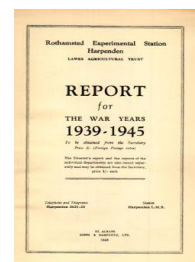
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ROTHAMSTED
RESEARCH

Report for 1939-45

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Studies of Earthworms, Slugs and Various Insects

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isolated and identified as crystalline nucleoproteins, and studies have been made of their physical, chemical and serological properties. The serological work has led to the development of a rapid method of diagnosis for some of the commoner virus diseases. Wide variations in the size and shape of tobacco-mosaic virus have been detected and the conditions responsible for the variations have been determined. The shape of the virus particles has been found to account for their serological behaviour. The factors responsible for flagellar and somatic-type serological behaviour have been elucidated. The manner in which viruses are held in infected tissues has been studied, and it has been found that infected plants contain much more virus than was previously suspected. The work has included studies of the origin and significance of intra-cellular inclusions, new types of which have been found in infected plants and new insects have been identified as vectors. The intricate relationships between viruses and their vectors have been studied, and in the field special attention is being given to the factors which affect the spread of virus diseases particularly in potato and sugar-beet crops. Annual surveys of the insects and virus diseases of these two crops have been made and much information has been obtained on the effects of weather on the insect vectors, the relative importance of different species of insect in causing spread, the distance over which spread occurs and the important sources of infection. A book on Plant Viruses and Virus Diseases was published by F. C. Bawden in 1939 (second edition, 1943).

Biochemical work on normal and virus-infected leaves has been in progress since 1940 and has included studies of the conditions governing the release of normal protein from the leaf fibre. Use has been made of methods involving fine grinding and enzymatic disintegration. Work has also been done on plant proteases and on pectase. Extraction and fractionation of tobacco-mosaic, tomato bushy-stunt and the tobacco-necrosis viruses were carried out in the Biochemical Section.

FUNGUS DISEASES

Increased attention has been given to field work on fungus diseases. Surveys of commercial crops in many districts have shown the importance of Eyespot of wheat (*Cercospora herpotrichoides*), and many experiments have been made to ascertain the conditions favouring this disease and to devise control measures. A survey of the causes of wastage in stored potatoes showed that *Phytophthora infestans* was the main cause but also revealed a previously unsuspected cause *Fusarium avenaceum*. Studies have been made of the environmental conditions affecting the survival of soil-borne fungi, their ability to cause infection and their survival in the absence of susceptible crops. Among the fungi studied were *Ophiobolus graminis*, *Fusarium culmorum*, *Plasmodiophora brassicae*, *Rhizoctonia solani* and *Verticillium albo-atrum*. A book on Root Disease Fungi by S. D. Garrett was published in 1944.

STUDIES OF EARTHWORMS, SLUGS AND VARIOUS INSECTS

Work in the Entomology Department can roughly be grouped into three divisions, a study of the causes of insect outbreaks, secondly work on particular pests—not necessarily insects—such as

slugs, wireworms and gall midges, to study their biology and control, and thirdly an investigation on earthworms and their relation to soil formation and fertility. The last mentioned was started about three years ago, and some 15 species of earthworms have been found on Rothamsted farm in varying relative abundance according to the type of soil and cultivation. A new species has been discovered. Each species has its own particular life cycle and habits, and each will no doubt have its own specific effect on soil conditions. It is already apparent that it is neither desirable nor justifiable to speak in general terms of the effect of "earthworms" any more than of the effect of "insects." Some go deeply into the soil, others live near the surface: some make worm casts above the ground, others do not. Every effort is being made to put the work on a sound basis both biologically and statistically.

Observations on the life cycle and abundance of slugs have now been going on for a considerable period on a statistical basis. The various species are being identified and their habits and ecological relationships studied. It has been found that very small changes in the environmental conditions of gardens make big differences in the total slug population and particularly in the relative numbers of the component species.

A study which has been going on for 20 years of wheat midges on Broadbalk has shown a relationship between the percentage of grain attacked and the annual yield. There is also a correlation between the date of emergence of the wheat midge and the harvesting date. The study of insect outbreaks is really a study of changes of insect numbers in a locality, as outbreaks are only a sudden increase in numbers beyond the danger point. This increase can be brought about by weather conditions favourable to the pest or unfavourable to its enemies, or, alternatively, by a deliberate or accidental movement into the area from outside—in other words by migration or by drift. Some progress has been made in all these branches, and C. B. Williams has obtained a formula for forecasting the general level of insect abundance at Rothamsted for any one month from the weather conditions of the previous three months. It has been shown that under the climatic conditions at Rothamsted, temperature is the most important factor in the winter months and rainfall in the summer months in determining insect abundance.

THE CONTROL OF INSECT PESTS

During the period under review there was naturally a concentration of effort on problems connected with the war, and later on the application of recently discovered insecticides to agriculture and horticulture. It was possible, however, to carry on some of the pre-war programme, and the search for new insect test subjects for evaluating insecticides was continued and also studies on the effect of environment on insect resistance. Extensive researches have been carried out on insecticides derived from plants used by the natives of tropical countries as fish poisons. Species of Derris, *Lonchocarpus*, *Tephrosia* and many others have been examined. The work on derris root included its evaluation by chemical means and the investigation of the effect of its several constituents on each other's insecticidal value. Six active principles, of which