ROTHAMSTED RESEARCH

Report for 1939-45

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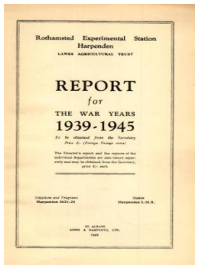

The Control of Insect Pests

Rothamsted Research

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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

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rotenone was the most potent, were isolated, and S. H. Harper elucidated the structure of elliptone and malaccol and discovered a compound with an *iso*-flavone structure which he suggested might well be a precursor of the several compounds found in Derris and Lonchocarpus.

Much work has also been done on the powerful insecticide pyrethrum. In the years 1939-42 pyrethrum flowers and their extracts were of importance for food preservation and the control of insect pests such as the mosquito and the body louse. An important drawback was the dermatitis caused by pyrethrum preparations in susceptible people. J. T. Martin, himself a susceptible subject, studied this problem and showed by personal experiments that the pyrethrins themselves were not responsible, and further work has since been done on sorption methods for preparing concentrates relatively free from this trouble. Biological methods were worked out for the evaluation of the pyrethrum heavy-oil insecticides extensively used for the protection of stored food. Another piece of work dealt with the stability of certain pyrethrum preparations for prospective use as mosquito repellants. Methods of preparing standard pyrethrum-in-oil preparations were devised, and methods of chemical analysis of similar commercial preparations worked out and it was found that the biological and chemical techniques gave results which agreed fairly closely.

Attention has been concentrated recently on the biological assessment of stomach-poison insecticides : the susceptibility of insects as affected by strain, species, age and environmental factors : and on the investigation of certain potent synthetic compounds such as D.D.T. developed largely for war needs in order to ascertain their usefulness in the agricultural and horticultural field. Field-scale trials in conjunction with the Plant Pathological Laboratory of the Ministry of Agriculture were carried out with D.D.T. at several centres. It was shown that cabbage caterpillars and such pests as mustard beetle were completely controlled. Other pests were controlled to varying extents, but red spider and, to a less degree, certain aphides were resistant. Laboratory tests were also carried out on a wide range of insects and such points as potency and degree of persistence under weathering were studied. Work is in progress to test the effect of particle size and shape upon the toxicity of D.D.T., and a dipping technique for determining the insecticidal value of various types of preparations is being worked out. Account was taken of the effect of D.D.T. on beneficial insects and, jointly with the Bee Department, the toxic action on bees, both by contact and as a stomach poison, was studied. The results obtained so far indicate that the danger is less serious than was anticipated. The possibility of harmful effects on the plants themselves was also examined, and it was shown that cucumbers and vegetable marrow suffered some damage.

A prolonged research in which the various analogues of D.D.T. were compared showed that, molecule for molecule, D.D.T. was more toxic than its analogues but that the slopes of the respective regression lines were very different. An explanation of this is now being sought.

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