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Report for 1929

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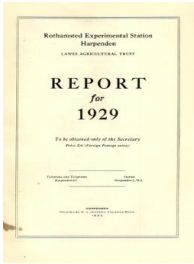

Entomology

Rothamsted Research

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Experiments in the chambers are at present in progress on the influence of air temperature and of humidity on secondary infection.

Virus Diseases. The Imperial Agricultural Conference of 1927 recommended that "funds should be provided for the more extended study of the fundamental nature of virus diseases in plants." The Empire Marketing Board thereupon provided the means for a considerable development of the virus investigations at Rothamsted which are under the general charge of Dr. Henderson Smith. Three scientific posts were created, Dr. John Caldwell being appointed to the post of Virus Physiologist, Dr. Frances Sheffield to that of Virus Cytologist, and Miss Marion Hamilton to that of Virus Entomologist. Grants were provided for equipment and maintenance during a period of five years.

Dr. Henderson Smith has studied localised forms of the disease found in *Datura stramonium* and *Lycium chinense* where certain parts of the plant only are affected, the rest being free not only from symptoms but also from the virus, so that the juices can be inoculated into highly susceptible plants without result. This is unusual : in other instances the disease affects the whole plant.

The remarkable bodies present in the cells in infected plants have also been studied. They are protein in nature, but probably not alive, as has been repeatedly asserted of similar inclusions both in animal and plant virus disease. Their progressive development from small particles carried in the protoplasmic streaming up to the stage of the completed body has been watched in individual cells of detached infected leaves.

Entomology. The Entomological work is largely concerned with the parasites of insect pests, they being among the most important agencies for effecting control in nature. As an example: meadow foxtail is liable to attack by gall-midges. In 1928 the attack in a particular instance was slight: there was 38% parasitism. In 1929, in the same experiment, the attack was heavy: there was only 3% parasitism. A new parasite of the frit fly has been found: a Chalcid *Callitula bicolor*. Another important observation is the greatly increased prevalence of *Loxotropa tritoma* during 1929, and decline of the Chalcid *Halticoptera fuscicornis*, two phenomena which are apparently related.

Another method of control now being tested is to alter the cultivation of the crop so as to make it less suitable to the insect. Thus, by delaying the flowering of meadow foxtail grass till after the main flight period of the midges was over—as can be done by early cutting or grazing—the attack was reduced from 80% to just over 10%. Control of the frit fly is obtained, as is well known, by earlier sowing of the oats.

Dr. Barnes has closely studied the gall-midges that infest the willow and cause much loss to the osier industry. Under experimental conditions, the "Harrison" variety of osier has been found to be immune to attack by the button top midge. The usual method of classifying the midges according to the type of gall produced has proved unsound, as one and the same species of midge can produce different types of gall. Of much greater biological interest, however, is the discovery that the fertilised females of the midge *Rhapdophaga heterobia* H : Lw. produce, as offspring, unisexual families only—a phenomenon unknown previously among insects, except in the Mycetophilidæ studied by Metz in America.

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The breeding of stocks of insects for weed control in New Zealand was continued, and further consignments of insects attacking bramble, ragwort and gorse were sent out, including 15,260 *Tyria jacobæae,* 23,300 *Apion ulicis* and 350 root stocks containing *Coræbus rubi.* They arrived safely and in sufficient numbers to permit the New Zealand staff to take up their part of the investigation. As this work has now passed out of the research stage, it has been handed over to the Farnham Royal Laboratory of the Imperial Bureau of Entomology, which is specially equipped for the breeding and supplying of large quantities of insects.

Dr. Davidson having been appointed to the Waite Research Institute, South Australia, the investigations on aphides, with which he was associated, have been discontinued.

The insecticide investigations have been mainly concerned with pyrethrum, one of the most promising of vegetable products, as it can apparently be grown satisfactorily in this country.

Bees. The investigations on bees have followed the lines of previous years, and the accumulated data are being worked up in conjunction with the Statistical Department. The relative advantages and disadvantages of the "warm way" and "cold way" of arranging the frames, of having double walls for the hives, and of packing them in winter with insulating material, are studied. Feeding tests have so far shown no differences in effect between cane sugar and beet sugar as winter food, nor anything to justify the preference for the cane sugar. The "brood food" swarming hypothesis is being tested, and valuable information obtained, by the study of marked bees, about the ages at which they are engaged upon specific activities.

THE ACCURACY OF THE FIELD EXPERIMENTS.

The advantage of the modern Rothamsted field technique is that the results can be checked. The "standard error" per plot can be calculated; the degree of trustworthiness is therefore known. Usual standard errors per plot on our present methods of good working are:—

USUAL STANDARD ERRORS PER PLOT FOR GOOD WORKING

	Weight per acre	Per cent. of yield
Potatoes	0.4 tons ...	7
Sugar Beet... ...	0.5 ,, ...	9
Barley: Grain ...	1.3 cwt. ...	9
,, Straw ...	2 ,, ...	7
Oats: Grain ...	2 ,, ...	8
,, Straw ...	2 ,, ...	6

The standard error precisely measures the accuracy of the experiment and it includes errors of working, inequalities due to variable natural agencies, such as weather, birds, insects, diseases, and also soil variations within the individual plots, but not the large variations between plot and plot which are eliminated by the method of arranging the experiment. It is not, however, an absolute measure, since it depends to some extent on the size and arrangement of the plots. Thus, a standard error of 0.4 tons per acre of potatoes in a latin square experiment is not strictly comparable with a standard error of 0.4 tons in a randomised block experiment having more plots. Nevertheless, it is a useful guide to the experimenter as showing the standard of performance he is attaining in