ROTHAMSTED RESEARCH

Rothamsted Report for 1932

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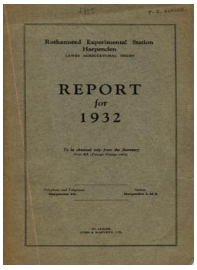

Insect Pests

Rothamsted Research

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These new discoveries have greatly facilitated the study of the group of virus diseases. It is shown that the virus moves freely in the plant from cell to cell along the protoplasmic strands ; also that it multiplies ; the rate of multiplication is much more rapid in some plants than in others. It is further shown that one of their effects is to inhibit the development of the plastid primordia so that chloroplasts do not form.

Some of the virus diseases are carried by aphids but the virus seems to undergo some change in the aphid's body. This is being investigated by Dr. Hamilton : the work is complicated and retarded by the difficulty of rearing aphids on artificial foods and by their small size which makes it difficult to follow the movements of the virus particles round their bodies and into their saliva. Polonium (Radium D) is now introduced with the food solution of the aphids so as to follow better the course through the body ; in this work useful assistance has been rendered by Dr. Chadwick of the Cavendish Laboratory.

The study of intracellular inclusions has been further advanced. Soon after infection minute particles of protein appear in the cytoplasm, are carried about the cell by its streaming, and coalesce when brought together. By successive fusions a large spherical body is gradually built up. This mode of origin lends support to the view that these " inclusions " are essentially products of interactions between the host cell and the virus. Hitherto these bodies have been found only in plants infected with certain virus diseases. If, however, normal plants are supplied with chemicals known to be protoplasm coagulants, symptoms develop within the cells which are similar to the first stages of a virus attack. The effect produced varies in degree with different reagents, but with molybdic acid or its salts it is possible to parallel all the intracellular phenomena which characterize aucuba mosaic disease. This work is to be continued.

Wart disease of potatoes. Some years ago Miss M. D. Glynne devised a rapid test for susceptibility to wart disease by means of which she can ascertain in a few weeks whether a variety is susceptible or immune. This method has now been used for some years for testing the potatoes sent in to Ormskirk for trial and it continues to give satisfactory results.

INSECT PESTS

The chief line of work in the Entomological Department is the study of the factors determining the size of insect populations. Insect pests are always with us, but so long as their numbers are small they are comparatively harmless. Sometimes, however, one species begins to multiply, and its power to increase is so enormous that the harmless few speedily become a serious pest causing great loss of crops. Hitherto the factors responsible for this rapid multiplication have been but little known and consequently it has not been possible to take preventive steps beforehand or even to warn farmers of the probability of attack. This subject is now under full investigation at Rothamsted. Soon after Dr. C. B. Williams entered on his duties as Head of the Department on July 1st, 1932, he began an investigation into the relation of insect numbers to weather conditions. The great difficulty has hitherto been to find some numerical

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expression of the abundance of insects ; Dr. Williams is trying to overcome this by taking daily samples of all flying insects under definite standard conditions, and identifying and counting them. He does this by means of a light trap, operating from sunset to sunrise and fitted with a mechanism for dividing its period of operation into eight sub-periods, so as to show the actual hours during which each catch of insects is obtained. The trap is near to the meteorological enclosure so that the precise meteorological conditions during each sub-period are known. All the working conditions, including the intensity of the light, are standardised so that the catches of each season may be comparable with those of any other. It is hoped in time to obtain data from which relations between weather conditions and rate of multiplication of insect populations may be worked out.

It does not necessarily follow that a large catch of insects means a large multiplication of the local population. Insect migrations are known to occur and steps are now being taken to follow them. A migration of small cabbage white butterflies (*Pieris rapae* with a few *P. brassicae*) was observed at Rothamsted in mid-August, 1932 : the horde was traced to the Norfolk coast where it had arrived presumably from the Continent ; it had travelled westwards passing over Rothamsted and the resulting larvae did a good deal of damage to cabbages in September.

Another factor affecting the size of the insect population is the degree of parasitism : this is being studied by Dr. Barnes using certain of the midges as the test insect. Some of his results are embodied in the following table :

Insect.	1928.	1929.	1930.	1931.	1932.
Dasyneura alopecuri Reuter—					
Relative Abundance	1498	4748	1366	965	1216
Percentage parasitism	38.0	2.3	19.0	26.5	3.0
Rhabdophaga heterobia H.Lw.—					
Relative Abundance	1573	1235	341	840	1480
Percentage parasitism	51	64	62	61	53

Similar studies have been made with *D. pyri* Bouché ; *D. arabis* Barnes ; *Sitodiplosis mosellana* Géhin, and *Contarinia tritici* Kirby.

An interesting observation was made on two of the grass plots by Dr. Sharga in studying one of the Thrips (*Aptinothrips rufus*) infesting the grasses. Where the grassland had been treated with lime about 12 to 20 per cent. of the thrips were parasitised by a nematode *Tylenchus aptini*, Sharga : where, however, the grassland had received no lime, the thrips were free from parasites. This is now being further investigated by Miss Lysaght. Another subject of investigation in the Department is to find how the insects are attracted to the host plant. Apparently they have some sense of smell, but among different varieties of the same plant some are attractive and others are not. The property is transmissible to the offspring and Dr. Barnes has tested willows supplied from Long Ashton. Thus some willows are resistant to the attack of a willow midge that ordinarily does much damage ; these are being studied by

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Dr. Barnes. Mr. Newton is endeavouring to find what difference in the willow accounts for the difference in attractiveness to the midge.

Dr. Margot Metcalfe completed her studies on the red clover, cocksfoot and ryegrass gall midges, and worked out the biology of three gall midges found on Park Grass plots, two being new to science. She now has a Commonwealth Research Fellowship tenable at the Carnegie Institute and Johns Hopkins University.

BEE RESEARCH

Further work has been done on the recording of the daily life of the hive. The observations with marked bees have continued, and the results agree closely with those set out in last year's reports. Two more continuous weighing devices have been installed to record the mass movements of the bees by recording the changes in weight of the hive, and some interesting relations have been found between hours of sunshine and hours of nectar gathering. Search is being made for some method of recording the entrances and exits of bees to and from the hive.

A vigorous effort is being made to find the funds for a bacteriologist to study the Foul Brood diseases which are now causing great losses to beekeepers.

INSECTICIDES

Dr. Tattersfield and his staff continue their studies of plant products poisonous to insects : these have the advantage that they are safer in use than mineral poisons, being relatively harmless to human beings and domesticated animals.

Pyrethrum is one of the most interesting in that it can be grown in this country and its manurial requirements seem to be very low : it will indeed grow on poor sandy soils, but whether it would be economically advantageous as a crop is not yet known.

Culture experiments have been made by Dr. Martin to find the effects of temperature, dormancy and degree of illumination on the growth of the plant. By varying these conditions it was possible to obtain a short harvesting period, such as is usual in this country, or a long harvesting period, such as is usual on the Kenya uplands, or a complete absence of flowering, as is characteristic of tropical lowlands Trinidad, Uganda and elsewhere.

Further work has been done on the loss of virulence of pyrethrum dusts on exposure to air and light. This has already been traced by Dr. Tattersfield to oxidation and he has shown that it can be retarded in pyrethrum-talc dusts by an admixture of antioxidants. He finds, however, that the effect of pyrethrum extracts upon the insect is not materially increased by the addition of an antioxidant. The effect of light upon pyrethrum dusts is being studied ; it is found that as the activity declines, the yellow colour of the dusts fades and the question arises whether the pigment protects the poison.

The fish poison plants from the tropics have been further investigated. The rotenone content is still the best measure of toxicity but further tests with insects are being made. The problem is very important because some samples of these plants are almost devoid of insecticidal power, e.g., one sample of *Derris elliptica* contained no rotenone and was harmless to insects ; some cultivated

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