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Report for 1955

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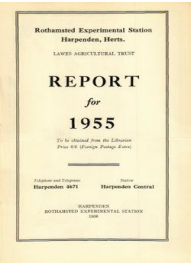
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1955

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1956

Entomology Department

K. Mellanby

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ENTOMOLOGY DEPARTMENT

K. Mellanby

Staff

C. B. Williams, who was head of the department from 1932, retired on 30 June. K. Mellanby was appointed to succeed him.

P. F. Entwhistle (Colonial Office Scholar) and Mrs. Helen Entwistle left the department and proceeded to the West African Cocoa Research Institute in the Gold Coast. Else Haine returned to Germany to a post at the Institut für angewandte Zoologie at Munich. T. R. E. Southwood (Agricultural Research Council Scholar) left to take up an appointment at the Imperial College of Science. Lois M. Cherry, A. J. Cockbain, D. L. Milne (supported by a grant from the South African Government) and M. A. Zaher (Egyptian Government Scholar) joined the department.

R. M. Dobson, B. Johnson and T. R. E. Southwood obtained the degree of Ph.D. of the University of London.

C. G. Johnson visited Germany and the Netherlands in October and read a paper at the Deutsche Pflanzenschutz-Tagung in Kassel on the distribution and dispersal of aphids in the air.

P. W. Murphy returned from Austria, where he had been working in Dr. Kühnelt's laboratory in Vienna. F. Raw continued his period of secondment to the West African Cocoa Research Institute in the Gold Coast.

Insect Migration

(C. B. Williams and R. A. French)

Light traps were worked at Rothamsted until October, to compare results with those obtained by C. B. Williams in Inverness-shire. R. A. French has continued his work on the migration of Sphingida in Western Europe.

Gall Midges of Economic Importance

(H. F. Barnes, Barbara M. Stokes and D. L. Milne)

It was a " good emergence " year for the wheat blossom midges, and under insectary conditions individuals of *S. mosellana* emerged from larvae of the previous thirteen years, most coming from the larvae of 1952. Fortunately there was not complete coincidence of midge-emergence and ear-burst on Broadbalk. However, the annual sampling of the wheat confirmed the prediction made in 1952 that the next outbreak of the wheat blossom midges would occur in 1955 or 1956. The increase of larvae in the crop being about five-fold, there being roughly 27,000 larvae per 500 ears compared with about 5,000 in 1954; this resulted in a 16·7 per cent grain infestation, as against 4·7 in 1954. The unusually long dry spell of weather caused the fully-fed larvae to remain in the ears much longer than usual, in fact until after the drought was broken on 13 August, when the larvae descended suddenly to the soil. This enabled

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valuable data to be obtained on the accuracy of the " presampling " technique in use during the last 15 years.

The sampling of Broadbalk has been completed for the 29th successive year. The data for annual infestations 1927–55, as well as tables showing the percentage ear infestation in relation to the percentage grain attack, the numbers of larvae present in relation to the percentage grain attack and estimated loss in yield, have been incorporated into *Gall Midges of Economic Importance, Vol 7: Gall Midges of Cereal Crops*, which was published early in 1956.

Barbara Stokes has continued her biological study of *Mayetiola* spp. living on the stems of cereals and grasses. It had previously been established that one of the species collected at Rothamsted, *M. destructor*, the Hessian Fly, attacks wheat, barley, rye and couch grass as well as some exotic graminaceous plants and that the host plants are interchangeable. Succeeding generations of the midges have been maintained, changing the host plants with different generations.

More *M. destructor* midges have invariably emerged from experiments in which wheat has been used as host plant than from those in which couch grass has been used, although the origin of the parent midges has frequently been couch grass. Similarly, more midges have developed successfully on young plants than on mature eared ones. It has become obvious that more eggs have been laid on the younger leaves than on the older in the four-leaf stage of each host plant tested. Other experiments showed that, whereas the midges oviposited freely on cultivated oats, wild oats (*A. fatua* and *A. ludoviciana*) and on wild wall barley and to a more limited extent on other common grasses, no midges have ever succeeded in completing development on these plants. Subsequent examination of the plants has shown, that although the eggs developed and the larvae hatched, no larva succeeded in establishing itself on any of these plants.

It has been found that there are three flights of Hessian fly a year at Harpenden, although it is possible for the midges that emerge first in each generation to accomplish a fourth generation in 12 months. Little evidence has yet been obtained as to the comparative numerical size of the various flights, but it appears likely that as a rule the first or spring flight (in May) is the largest. This is because a proportion of the larvae of each generation develops slower than the rest and gives rise to adult midges synchronously in the spring with those of later generations. The second flight occurs in July, while the third centres round September.

The percentage of headed straws and non-headed tillers infested by Hessian fly on Broadbalk and Hoosfield wheat–alternate fallow has now been studied for two years, and the results are being written up.

The testing of the host-plant range of *Dasyneura affinis* of violets and *D. violae* of pansies, that have been suggested to be only one species, has been completed by Barbara Stokes. It has been shown that *D. affinis* breeds on *Viola odorata* but not on *V. tricolor* and its variety *hortensis* or on *V. arvensis*, the host plants of *D. violae*. Conversely, it has not been possible to breed *D. violae* on *V. odorata*, the host plant of *D. affinis*. Cross-mating tests between the two midges gave negative results. It has been concluded that *D. affinis* and *D. violae* are distinct species, in

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spite of the fact that they cannot be separated on morphological characters.

D. L. Milne is continuing the investigation started last year on the gall midges affecting seed production in clover. The points of immediate interest are whether or not the *Dasyneura* species which is common in white-clover flower-heads is the same species as the well-known *D. leguminicola*, the red clover seed midge, and, if it is not, whether it is identical with *D. gentneri* recently described in the United States from Ladino clover. Biological studies and surveys of incidence are being made in order to assess the economic importance of this white clover midge and, if possible, to find suitable cultural methods of avoiding attacks.

Mr. K. M. Harris, Dr. I. W. B. Nye and Mr. J. A. Bullock each spent a fortnight, preparatory to taking up appointments in West and East Africa, studying gall midges, with particular reference to those of Sorghum inflorescences.

It is obvious from the number of enquiries concerning the wheat blossom midges and the saddle glass midge that the dry summer caused an unusually large number of the larvae of these pests to be removed from the fields during harvesting. Apart from these, the most interesting requests for information concerned the occurrence of *Mayetiola joannisi* on *Poa* on the Rugby Football Union ground at Twickenham and the presence of gall midge larvae in the stems of poppies grown for oil in the Eastern Counties. The latter have been successfully reared but not yet identified.

Numerous consignments of gall midges have also been received from overseas, both for identification and incorporation in the collection. Among the former may be mentioned large series reared from Coccids in Nigeria and from *Stachytarpheta cayennensis* and *jamaicensis* in Trinidad and a *Contarinia* species damaging seed production of *Phleum pratense* in Finland. Among the latter are four recently described species from *Cryptomeria japonica*, *Abies sachalinensis* (*mayriana*) and *Picea jezoensis* in Japan, and three species, two of which have been recently described, from cones of *Picea glauca* in Canada.

Problems of Insect Dispersal

(C. G. Johnson, L. R. Taylor and A. J. Cockbain)

Suction traps

In 1954 accurate measurements of air-flow in all types of suction trap, under all relevant running conditions, were obtained. In 1955 experiments on the proportion of different classes of insects caught under these various conditions were made. It is expected that these measurements will allow a full assessment of errors in aerial density estimation due to varying efficiency of traps. This, it is hoped, will be the final stage in the development of the suction trap.

High-altitude dispersal

The analysis of past trapping at Cardington has continued, particularly on the vertical density gradient of insects in relation to atmospheric stability; on general relations of density to height

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during the day and season; and on the speed and frequency of the clearance of insects from the air.

In addition, an exceptionally successful trapping season gave almost continuous day and night records of the vertical gradient and the temperature-lapse rate. For the first time since this work began, attention was paid to all the other insects trapped, as well as aphids, thus broadening the study.

Periodicity and Temperature in the Ecology of *Aphis fabae* Scop.

(C. G. Johnson, L. R. Taylor and A. J. Cockbain)

Moulting rhythms and the period between moulting and flight have been integrated into the general picture of diurnal aerial density change. From these two variables alone in their relation to temperature it is now possible to reconstruct typical diurnal changes in aerial density (including the characteristic double peak) without reference to flight behaviour after take off. These reconstructed curves can be matched with observed density changes as shown by suction traps.

The period between moulting and flight is very important in this respect. Its length depends largely on temperature, especially over the critical range of 16–20° C. This range is undoubtedly also critical throughout the whole ecology of the Aphid, and future work is being planned with this in mind.

Wireworm Studies

(F. Raw, J. W. Stephenson and J. R. Lofty)

The studies of wireworm populations on the ley and arable rotations in Highfield and Fosters have been continued and, after next years' observations, will be concluded. This year's samples indicated a general reduction in the wireworm populations of both fields.

Wheat Bulb Fly Studies

(F. Raw and J. R. Lofty)

The experiments started in 1954 on Pennell's Piece and Broadbalk were concluded after this year's harvest. In the Pennell's Piece factorial experiment designed to investigate the effect of various soil conditions on the choice of oviposition site, plots which had had the highest egg populations the previous year now had the highest proportions of infested plants and gave the lowest yields. The percentages of plants infested varied from 76 for plots with cultivated, rough tilth to 41 for those with uncultivated smooth tilth; the proportionate yields of grain for these plots being 0·86 to 1·0.

The areas of Broadbalk which had been covered with mosquito netting during the oviposition period of the previous year while in fallow had a mean of 3 per cent of plants infested compared to a mean of 12 per cent on the adjacent uncovered areas. The yields of covered to uncovered areas were in the ratio 1·03 to 1. It is thought that had the intensity of infestations been as heavy as that of the previous year the value of this technique as a method of

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directly assessing the effect of wheat bulb fly attack would have been more convincingly demonstrated.

Studies on Millipedes

(J. W. Stephenson)

Investigations of the bionomics of millipedes have continued. Data on their activity in the field and on their life histories and feeding habits under laboratory conditions have been obtained, and observations on the direct effects of millipede activity on soil structure have commenced.

A new technique of culturing millipedes in sealed plaster-of-Paris cells is being developed, and, it is hoped, will prove useful to future workers on this and other groups of soil arthropods.

Experiments with "choice-chambers" have shown that some millipedes have decided preferences for particular types of rotted grasses as food, e.g., *Brachydesmus superus* prefers *Dactylis glomerata* to *Poa trivialis*.

Studies on Bettles

(R. M. Dobson and Z. Teofilovic)

Observations on the bionomics of the cabbage stem flea beetle (*Psylliodes chrysocephala* (L)) have been incorporated in a thesis by R. M. Dobson and parts are now being prepared for publication. Preliminary studies of the volume changes in developing eggs of this species were made by Z. Teofilovic in preparation for possible future work.

Analysis of field data showed that the species compositions of populations of crucifer-infesting flea beetles (Phyllotreta spp.) varied not only according to time and place but also between different coexisting adjacent crops. Routine identifications of species of *Carpophilus* (Nitidulidae) associated with stored products have continued, and one new species has been described.

Earthworm Studies

(R. M. Dobson and J. R. Lofty in conjunction with E. Crompton (lately of Soil Survey) and National Agricultural Advisory Service)

The experiments in Lancashire to investigate the rôle earthworms play during the rehabilitation of marginal grassland have continued. In these experiments, after a general application of lime and phosphate to all plots, the effects of dung and balanced artificials at two levels of earthworm population are being studied. At the site near Lancaster, lime was applied during summer 1954, phosphate and dung during summer 1955 and artificials will be applied during spring 1956. Half of each plot was sprayed with lead arsenate to kill worms during November 1955. At Rivington the experiment is one year behind, and so far only lime has been applied. Survey of both sites during spring 1955 showed the principal earthworm at both localities to be *Bimastus eisenii* and the population at Lancaster to be about 15 times as great as that at Rivington (291,000 to 19,000 worms/acre).

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In addition to the field experiments, preliminary studies of the life cycle of *B. eisenii* have been carried out in the laboratory.

Effects of Insecticides on Soil Fauna

(R. M. Dobson and J. R. Lofty)

By invitation of Messrs. Plant Protection Ltd., observations are being made on the soil fauna of a field experiment at Haslemere. The experiment, designed to study the long-term effects of BHC applied every year and every 4th year to a four-course rotation (wheat, swedes, barley and ley) has been running for 8 years, and preliminary observations indicate large differences in the fauna of plots under different treatments.

Host Plant Selection in the Wheat Bulb Fly (*Leptohylemyia coarctata* Fall.)

(Barbara M. Stokes)

Experiments were started to test the possible preferences between wheat and the other host plants of the wheat bulb fly.

Wheat Bulb Fly (*Leptohylemyia coarctata* Fall.)

(D. B. Long)

Larval studies

The survey of larval infestations of winter wheat begun in 1954 was continued on Rothamsted soils. The infestation generally was substantially less than that of the previous year, some of the Broadbalk plots having one-tenth of their former level. The greatest infestation was found, as in 1954, in the four-course experiment on Hoosfield, where 69 per cent of the plants contained larvae, 97 per cent having been attacked at the time of sampling involving the destruction of 42 per cent of the existing shoots. The wheat plots of the six-course experiment on Long Hoos 4, and the Wheat and Fallow experiment all carried a slightly lower level of infestation.

The lower larval infestation was partly attributable to the cold, wet autumn of 1954 and partly to the late sowing that the weather enforced. At the time of the hatching of the larvae the gammexane component of the seed dressing used against wireworm had not completely dispersed as normally occurs with an earlier sowing. This provided a residual measure of plant protection, the young wheat bulb fly larvae frequently moving away from attacked plants before fully penetrating a shoot. This, coupled with the small size of the plants, which seldom had more than a single shoot, made conditions unfavourable for the establishment of the larvae. The effect of the adverse circumstances was well shown in the wheat bulb fly experiment set up on Long Hoos 7, where the plants were in the single unopened-shoot stage when sampled in early April, and only 3 per cent of the wheat plants following fallow had been attacked.

In experiments involving the study of movement throughout larval life it was found that a larva which at its largest is seldom more than 0·25 inches may nevertheless traverse a minimum of 33 inches of soil. It was also shown that larvae tended to move

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along rows of plants rather than across them. Pot experiments carried out to study the effect of different soil types on larval infestation using freshly hatched larvae showed that the infestation of wheat on Rothamsted clay-loam, although not quite so successful as that on the Woburn sandy-loam, was yet appreciably more successful than that on the Fen peaty-loam. These studies are being continued.

Adult studies

Field observations on the adult fly were continued. The adult population closely followed the lower level of larval infestation, the numbers obtained by regular sweeping being about one-tenth of those caught in 1954, but in contrast to the former year, in 1955 females predominated. The diurnal movement of flies to and from the crop was again noted, the greatest number of flies always being taken at 6.0 a.m. B.S.T. In this respect the females were noted to differ in behaviour from the males. Flies tended to return in the evening to the lee side of the whole crop rather than to the emergence plots. The lower level of infestation prevented the successful conclusion of experiments on movements of the fly population.

A study of oviposition sites planned in an experiment on Long Hoos 7 failed owing to the generally low level of infestation, but it was found that flies tended not to lay eggs near a vertical screen such as that provided by an adjacent stand of crops or a hedge. The effect of such a screen 3 feet high was found to extend up to 6 feet from its base. Experiments begun the previous year on the oviposition rhythm were continued in the laboratory with freshly caught flies which showed the peak laying time to be in the 2 hours before dusk.

Eggs

Studies begun in 1954 on water relations between the egg and its environment during development were continued, and in this respect the effects of certain ovicides are being investigated.

Effects of Population Density on Insects

(D. B. Long)

The work on the effects of population density on larval forms has been continued, and cultures of the sawflies of pine, larch and gooseberry have been established in order to extend the field of the work. A study has been started (with M. A. Zaher) on the effects of the population density on adult lepidoptera.

During August R. Cayrol from l'Institut National de la Recherche Agronomique of Versailles spent a month at the laboratory in connection with his work on population fluctuations in Lepidoptera.

Photo-colour response in lepidopterous larvae

The study of the colour changes in the spots of the older larvae of the Emperor Moth (*Saturnia pavonia* L.) when exposed to light has been continued. It has been found that the response is dependent on low energy wavelengths at the red end of the spectrum between the limits of yellow and infra-red which in themselves do not produce a colour change.

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Forest Soil Investigations

(P. W. Murphy)

From June 1954 to September 1955 P. W. Murphy worked with Professor Kühnelt at the Zoological Institute of the University of Vienna; the visit was made possible by a grant from the Forestry Commission.

Field work was concerned mainly with an investigation of the fauna occurring in forest sites on rendzina soils in the Vienna Woods close to the city. The experimental sites have been used as sources for material in a number of investigations carried out at the Zoological Institute, and on this account there is a considerable amount of information available concerning faunal composition, etc. The object of the study was to determine faunistic changes taking place during the development of the rendzina profile. In addition, a number of undisturbed samples of characteristic profiles have been collected in various parts of Austria for Dr. D. A. Osmond of the Soil Survey of England and Wales.

During the winter months time was devoted to the development of a culture method suitable for small soil-inhabiting animals such as the Acarina, and a new technique has been devised which is proving very successful for biological studies in the laboratory. Up till now there has been no really suitable culture method to provide the necessary environmental conditions required by these organisms, and it is hoped that it will be of value for studies of food habits, etc., of oribatid and other soil-inhabiting mites.

An English translation of Professor Kühnelt's book *Bodenbiologie mit besonderer Berücksichtigung der Tierwelt* is almost complete; it incorporates Professor Kühnelt's revisions of the original text.