ROTHAMSTED RESEARCH

Report for 1931

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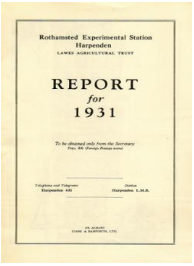

Insecticides

Rothamsted Research

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clover are as a rule attacked by the red clover seed midge, but the white clovers are not. The extent of damage depends on the time of flowering of the clovers; possibly it could be avoided by delaying flowering until the flight of midges is over.

H. C. F. Newton is investigating the causes of plant immunity, and has begun a series of amputation experiments to ascertain which organ or organs on the insect enables it to differentiate between the varieties of plants.

The Pigmy Mangold Beetle (*Atomaria linearis*) has of late years been a troublesome pest of mangolds, but its life history could not be worked out because neither the eggs nor the larvae could be found in the soil. This has now been done by H. C. F. Newton, so that further knowledge of the pest can be obtained which may lead to the discovery of suitable remedies.

Other Activities. The department has kept in touch with the problems in the British Empire, and during 1931 has helped by identifying gall midges, on which H. F. Barnes is a recognised specialist, from Trinidad, Brazil, Algiers, Russia, Germany, Sicily, Cyprus, Turkey, Sierra Leone, Uganda, Nigeria, Malay and Formosa.

INSECTICIDES

Pyrethrum. For some years past F. Tattersfield and J. T. Martin have closely studied pyrethrum (*Chrysanthemum cinerariaefolium*), the flowers of which when dried and ground, form one of the most effective and convenient of all insecticides. Its popularity may be gauged from the fact that its production in Japan, the chief source of supply, rose from 279,931 lb. in 1911 to 11,622,906 lb. in 1928; its cultivation has also been started in France, Switzerland, Spain and the Argentine. Attempts are being made in conjunction with J. C. F. Fryer, of the Ministry of Agriculture to develop pyrethrum growing in this country; the results are distinctly promising. A very poor sandy soil gave an excellent sample. The manurial treatments so far tried have not markedly affected either yield or toxic quality of the flowers.

Climatic factors are, however, important. In tropical countries Uganda, Tanganyika and Trinidad, the plant grows but will not produce flowers; on the uplands of Kenya, however, good crops of flowers of high toxic value were obtained. In temperate conditions the number and the pyrethrin content of the flowers are reduced by reducing the illumination (e.g. by cutting off the hours of daylight) and finally with sufficiently low illumination (1,000 watt lamp only), no flowers are produced.

The toxic properties are due to two closely allied substances called pyrethrin I and II, which are esters of a ketonic alcohol, pyrethrolone, and two acids, one monobasic and the other dibasic. Neither the pyrethrolone nor the acids are toxic, only the combination of the two. The pyrethrin content of the flower heads depends on the plant; the order of merit of the different plants tested has been much the same in each of the three years of the experiment. There is some evidence that cuttings from high yielding plants will in turn produce high pyrethrin yields, though whether the property is transmissible by breeding is not yet certain.

Hitherto pyrethrum (made up as talc-pyrethrum dust) has suf fered from the serious drawback that it is liable to lose its toxicity

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after a time. F. Tattersfield finds that the cause of the loss is oxidation of the poisonous principle, and this is specially marked in the light ; it is much slower in the dark. The loss is greatly reduced, however, by adding small quantities of certain antioxidants such as pyrocatechol, resorcinol, hydroquinone, pyrogallol and tannic acid ; on the other hand phenol and phloroglucinol were less effective.

Fish-poison Plants. A number of plants are used by the natives of tropical countries for catching fish by poisoning them. Many of these plants have been examined by F. Tattersfield and found to contain one of the most potent insecticides known, rotenone. Derris is the best known of these plants ; its root, which is the most effective part, usually contains some 2 or 3 per cent. of rotenone ; the quantity is variable, however, and in samples received in our laboratory it has ranged from 1 to nearly 6 per cent. Another plant, "cubé," *Loncho-carpus nicou* from Peru, contained as much as 6.4 per cent.

Certain other plants were found also to possess insecticidal properties, among them *Mundulea suberosa*, from India, and *Neorautanenia fisifolia*, from S. Rhodesia, but they seem less effective than the Derris and Haiari groups.

These insecticidal plants have undoubtedly a great future. They are far and away the best and safest insecticides and are very potent both against animal pests and against plant pests. The pyrethrin producers can be grown at home, and the rotenone producers in our tropical empire, notably in Malaya and British Guiana, and their cultivation would open up the possibility of an important new industry. F. Tattersfield has been highly successful in studying these plants, and it is deplorable that the work has had to be curtailed owing to reduction of grants just as it was beginning to yield results. It would have suffered much more but for the public spirited action of Mr. George Monro, who induced his company to make a grant of £100 for three years in order to keep the investigation going in readiness for active development whenever the opportunity arises. The Empire Marketing Board out of its slender resources made a grant of £50 to enable us to examine in detail some of the samples now being grown experimentally in British Guiana.

BEE RESEARCH

An important investigation into the causes of swarming has been begun by D. M. Morland. Young bees are hatched out in an incubator in weekly batches of 1,000 ; they are marked with distinctive marks and introduced into an observation hive ; their subsequent careers are then observed. They all go through a definite course. For the first part of their lives they act as wet nurses to the brood—the young larvae that will shortly become bees. Then, after a time, they pass on to household duties, such as the cleaning and ventilation of the hive. Still later they become food finders, going out foraging for nectar.

All goes well so long as the number of larvae is enough to keep the nurses fully occupied. But in late spring the number of eggs laid is very high, and each egg may in 21 days become a wet nurse seeking larvae to feed. As the number of eggs becomes less the number of larvae falls off, and then the nurse bees, apparently as the only way of using up their superfluous food and energy, start producing queen cells.

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