A NEW ECOLOGICAL CONTROL METHOD OF TURNIP SAWFLY, *ATHALIA ROSAE* L.

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INTRODUCTION

It was in the course of studies on the physiological mechanism explaining the photoperiodic reaction of insects that interest was attracted by the insects' chronometry, the so-called "biological clock". It is a long since known fact that for every photoperiod responsive insect there exists a light- (photo-) and a dark-(scoto-)phase. When the biological clock was studied these two phases were put to a thorough examination, which revealed that in the photoperiodic reaction important role was played by the scotophase.

In experiments carried out with *Pieris brassicae*, Bünning and Joerrens (1960) discovered that two hours of illumination in a certain period of the scotophase put an end to the diapause. Later Atkisson (1963, 1965, 1966), Barker et al. (1964), Sullivan et al. (1970), then Bonnemaison (1973) confirmed the discovery of Bünning and Joerrens (1960) with other species: *Pectinophora gossypiella*, *Adoxophyes reticulana*, *Pieris rapae*. In possession of this knowledge we carried out laboratory and outdoor model experiments with larva populations of turnip sawfly in the neighbourhood of Keszthely (South-Western Transdanubia). This species belongs to the group of long-day animals which means that with a daily illumination longer than 14 hours 87-95 per cent of the larvae go on developing without a diapause. Larvae developing under the condition of a shorter than 14-hour daytime, after finishing feeding remain in diapause for 6-8 months in the eonymph phase of the praepupa state, and it is only then that they continue developing (Sáringer 1957, 1961, 1964, 1967, 1974, 1983). In laboratory, then field plot experiments we studied the diapause-reducing effect of illumination provided over half an hour at a time in various periods of the scotophase.

MATERIALS AND METHODS

Laboratory experiments

The laboratory experiments were carried out in a thermostat chamber of 23°C under short-day (13 hr of illumination and 11 hr of darkness) conditions in September 1976. The larvae were kept in an aqueous hygrostat. In each experiment series 10 x 10, that is a total of 100 larvae were included. They were placed in photoboxes where illumination was provided by a white light of 300 lux intensity. Cocoon construction, then pupation - after the larvae had finished feeding - also took place in the hygrostat.

In the course or rearing 8-11% of the larvae died. At 23°C larval development lasted 21-25 days. Having spun the cocoons the animals were illuminated only for 13 hr a day.

Field experiments

The field experiments were performed in rape (*Brassica napus* L. f. *biennis* Thell.) plots, 50 x 50 cm in size, sown on

20. 8.. The plots were surrounded with isolators of 50 x 50 cm ground area and 50 cm height made of aluminum sheet, with the top open in the daytime. We had ten plots illuminated for half an hour at a time in various periods of the scotophase, and one control plot. In each plot 100 young larvae (L1) were placed. The half-hour illumination was provided by a white incandescent lamp of 100 watt placed in the centre of the cover of the isolator. The lamps were switched on and off not automatically but by a night assistant. After the larvae had been placed in the plot till they moved into the soil illumination was supplied always in the same period of the scotophase. The larvae were prevented from crawling out of the isolator by a streak of glue smeared on the inside.

Larva mortality during the experiment reached 5-9%. In calculation the diapause percentage - both in the laboratory and in the field experiment - only the living specimens were taken into consideration. The development of larvae was completed in the middle of October. Larvae having finished feeding moved into the soil to pupate, then transformed into adults there. After the larvae moved into the soil we covered the isolators with mosquito-net and waited for the appearance of adults.

RESULTS AND DISCUSSION

The results of laboratory experiments are shown in fig. 1. As seen from the figure the number of diapausing larvae was reduced to the greatest extent by illumination for half an hour at a time in 3rd and 8th hour of the scotophase 23°C. In the 3rd hour only 18.3 + 5.7% of the larvae remained in diapause, and in the 8th hour 21.4 + 3.1%. In the control kept under shortday conditions (13/11/LD) during the larval development the diapause was found to be 100%.

The results of field plot experiments with isolators are seen in fig. 2. The diapause curve of the figure shows that half-hour illumination in the 3rd and 8th hour of the scotophase was invariably the most successful in terms of reducing the diapause percentage to the minimum. In the 3rd hour this value was 37.2 + 8.4%, in the 8th hour 44.6 + 7.9%.

With the higher values obtained in the field the lower temperatures measured in September and October (max. 23°C, min. 14°C daytime, max. 19.2°C and min. 8.4°C at night) also had something to do.

The coincidence of results from the two model experiments suggests the possibility of using a similar method of control in commercial fields. As it is known the larvae of sawfly live on plants and are thus easy to reach by light. Half an hour of illumination in the 3rd and 8th hour after dark could be provided in the rape field in September and October by various methods. Headlights of tractors and cars as well as illuminators hanging on parachutes may be taken into consideration as sources of light. Latter seem to be the simplest to apply. Since the Hungarian Army is in possession of such illuminators, they might be acquired in the future for experiments carried out in large-scale farms.

Knowing the light sensitive development phase of turnip sawfly larvae (Sáringer 1967), namely, that the larva having finished feeding perceives the light conditions until moving into the soil, we should ensure illumination for half an hour at a time, especially in the second half of the larval development, in the right period. Since owing to the protraction of egg laying larvae of various development stage simultaneously occur in the nature, it is necessary to provide for the illumination as long as the larvae are on the plants.

As a consequence of the half-hours of illumination females developing from non-diapausing larvae will swarm in autumn at a time when the rape is no longer suitable for egg laying. Reduction of individual numbers by the method described takes place without pesticides and is therefore important from the point of view of environment protection too. Although at the time of illumination at night the larvae do not stop feeding day and night, that is the larva population of the current year cannot be reduced with this method, yet, when applied regularly for several years and over large areas if may decrease the individual number so much that autumn damage need not be reckoned with.

The method itself can be ranked with the ecotechnical methods of insect control.

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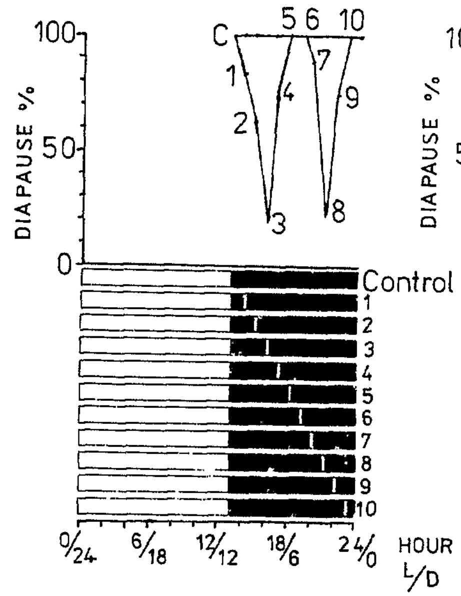

Fig. 1.

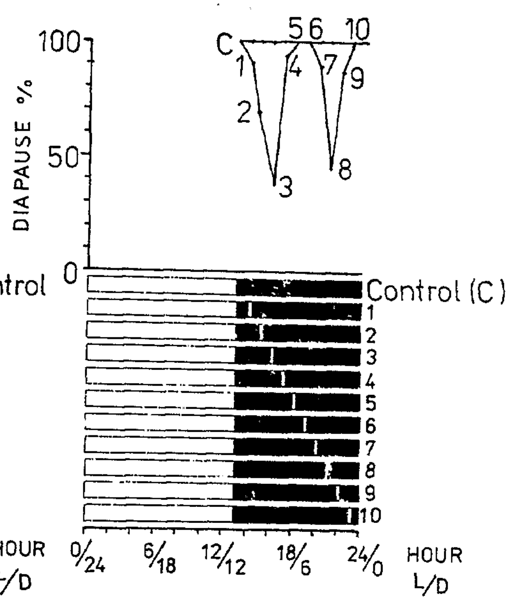

Fig. 2

Fig. 1.(left). Diapause curve of turnip sawfly (Athalia rosae L.) larvae illuminated in various periods of the scotophase in laboratory at 23 °C.

Fig. 2 (right). Diapause curve of turnip sawfly (Athalia rosae L.) larvae illuminated in various periods of the scotophase in the open, during September-October