ATTEMPTED GRASS GRUB CONTROL BY TREATMENT OF ADULTS

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Summary

The failure of field treatments of insecticides directed against adult grass grub (*Costelytra zealandica*) beetles is interpreted as being due to very limited contact, particularly of females, between emerging beetles and insecticide deposit on the pasture surface. The discovery of an attractant for male beetles may open up new possibilities of attacking the adult phase.

THE POSSIBILITY of controlling grass grub (*Costelytra zealandica*) by directing insecticide treatment against the adult beetle rather than against the larva has been discussed at this conference on several previous occasions. Reasons for suggesting this approach are that:

- (a) The adult spends at least some time above ground and may therefore be more *accessible* than the larval stage, and
- (b) Adults are considerably more *susceptible* than larvae to insecticides (Perrott, 1964).

The results of several years' work on this problem have recently been published (Fenemore and Perrott, 1970). In field trials, repeated applications were made commencing before adult emergence (or oviposition) had begun and continuing until primary emergence was known to be virtually complete. The main insecticides used were DDT and "Dursban" which was shown to have high contact activity. The essential features of these treatments are given in Table 1. The results of these three replicated trials in two seasons were entirely negative and it is instructive to attempt to elucidate the reasons for this. Rates are in lb a.i. per acre.

First, it has been shown from daily records of field emergence cages that, although early flights are composed almost entirely of males, there is little or no difference in time of maturation between the sexes. At the time these early flights of males are taking place, the females are also emerging, but only just to the soil surface where they are quickly mated (often within a minute or two of their very first emergence). What is even more significant from the control point of view, is that, after mating, the female promptly burrows back beneath the surface, and may not emerge again until after maturation and laying of her first batch of eggs, though information on this point is meagre. It is apparent, then, that females, at least, will make only very limited contact with an insecticide deposit on the pasture surface early in their lives. Their behaviour may change later but this will be too late if effective suppression of oviposition is to be achieved.

TABLE 1: SUMMARY OF TREATMENTS APPLIED AND METHOD OF ASSESSMENT IN THREE FIELD TRIALS AGAINST GRASS GRUB ADULTS

<i>Treatment (lb/application)</i>	<i>Formulation</i>	<i>Application Dates</i>	<i>Stage of Insect and Date of Sampling</i>
TRIAL 1: TAPAWERA, 1967 (ULV spray application)			
diazinon 1	80% ULV	14/11/67	eggs and 1st instar 5/12/67
"Dursban" 1	65% in xylene	14/11/67	
"Dursban" 0.5	65% in xylene	14/11 and 26/11/67	
"Dursban" 0.25	65% in xylene	14/11 and 26/11/67	
TRIAL 2: TAPAWERA, 1968 (ULV spray application)			
phoxim 1	80% ULV	14, 22 and 28/11/68	2nd and 3rd instar larvae 24/4/69
"Dursban" 1	73% in xylene	14, 22 and 28/11/68	
"Dursban" 1	73% in xylene	14, 22, 28/11 and 5/12/68	
TRIAL 3 (High volume spray application — 50 gal/ac)			
"Dursban" 1	48% EC	11, 18, 25/11 and 2/12/68	eggs 12/12/68
phoxim 1	50% EC	11, 18, 25/11 and 2/12/68	
DDT 1	20% EC	11, 18, 25/11 and 2/12/68	

The second main aspect relevant to failure of field treatments so far seems to be the required duration of time of contact with an insecticide deposit for lethal effect. In any test of contact activity of an insecticide, where the insects are exposed to a treated surface or medium, the duration of such contact will be just as important in determining the dose acquired as the concentration of toxicant employed. In fact, where concentration is held constant, time of exposure can be varied and plotted against effect produced to provide an estimate of LT_{50} (time to kill 50% of insects exposed) or LT_{90} , etc.

This has been done on a filter paper substrate for some of the insecticides used in field trials against adults. Minimum exposure times for complete mortality from both "Dursban" and phoxim at 200 $\mu\text{g}/\text{sq. cm}^*$ were 20 to 40 min (Fenimore and Perrott, 1970).

A technique has also been developed for determining duration of contact required between a beetle and an individual granule of insecticide formulation for lethal effect (Perrott, 1970). Exposure time/mortality

*Equivalent to ca. 18 lb/ac but availability of the deposit is unknown.

curves obtained for granular formulations of dichlorvos and isobenzan gave results as follows:

isobenzan (mean wt/granule 10 µg) LT 100-40 min
dichlorvos (mean wt/granule 650 µg) LT 100-20 min

It is clear, therefore, that, unless quite extended contact can be achieved between adult grass grub beetles and deposit of insecticide in granular or any other form, effective control cannot be expected.

One means (possibly the only means) of bringing about such contact would be by the use of an attractant. Until recently, no good attractants for grass grub beetles were known, but a powerful attractant has now been reported as occurring in a commercial adhesive (Osborne and Hoyt, 1969). This material is reputed to attract primarily male beetles, but whether it is identical with any natural sex attractant is not as yet known.

In laboratory and field experiments with the adhesive in Nelson in the spring of 1969, no contact between the material and attracted beetles was achieved. This could have been caused by the use of too high a concentration, but until this point is resolved there would be little point in adding the attractant to an insecticide formulation.

In any case, the provision of a powerful attractant for grass grub adults opens up new possibilities for tackling the adult stage which may not involve the use of insecticides at all.

REFERENCES

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