CONTROL OF WHITE-FRINGED WEEVIL ADULTS WITH INSECTICIDES

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Summary

In insecticide screening trials foliar sprays of fenitrothion, oxamyl, methomyl and carbofuran showed the highest activity against white-fringed weevil (*Graphognathus leucoloma*) adults. Field trials demonstrated that frequent regular spraying with fenitrothion (1 kg/ha) throughout the period of adult activity reduced adult numbers and egg laying sufficiently to cause a highly significant reduction (1% level) in the subsequent larval population.

INTRODUCTION

White-fringed weevil (*Graphognathus leucoloma*) is a common insect in pastures and lucerne (*Medicago sativa*) in many parts of the North Island. Damage to lucerne stands by this weevil has become increasingly frequent in Northland, Hawkes Bay and Manawatu during recent summers. The rapidly expanding lucerne area in these regions, the likelihood that white-fringed weevil will eventually become established in parts of New Zealand where it does not yet occur and the present absence of control measures, apart from intensive cultivation (Todd 1964), underline the need to develop controls for this pest.

Todd (1964; 1969) showed that although white-fringed weevil larvae are difficult to kill with chemicals, the adults are susceptible to a range of insecticides applied as foliar sprays. This paper reports the results of screening insecticides against white-fringed weevil adults, including several materials not tested by Todd, and preliminary field trials.

METHODS

Insecticide screening

The treatments listed in Table 1 were applied as foliar sprays to 1 m x 1 m plots of lucerne with a knapsack sprayer. The lucerne was 10 to 25 cm high and sufficient spray was applied to give a thorough coverage with minimum runoff. Within four hours of treatment, lucerne stems were removed to a screened, outdoor insectary. The lower tips of the stems were placed in water and white-fringed weevil adults were caged individually on the upper tips in 4 cm diameter plastic pots. Mortality was assessed at 1 to 2 day intervals after treatment for up to 10 days. There were four replicates of each treatment and 10 weevils per replicate.

Field trials

Each trial was restricted to a large plot which was sprayed regularly with fenitrothion (1 kg/ha) throughout the period of adult white-fringed weevil activity, and an adjacent, equal-sized untreated plot. This design was chosen because Braithwaite and Rand (1970) found that small plots were of little value in insecticide trials against clover root weevils

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(*Amnemus* spp.), which are similar in habits to white-fringed weevil, because of movement of adults between plots. They recommended plots of 0.09 to 0.20 ha.

Three trials were carried out as follows:

Trial 1 — 0.4 ha of lucerne at Taporā was sprayed at 8 to 12 day intervals between December 17 1974 and March 29 1975 (11 sprays). Each treatment was applied with a tractor-mounted boom sprayer in 350 to 500 litres of water/ha at 250 kPa. Post-treatment white-fringed weevil populations were assessed by taking 250 soil cores from each plot on May 15 1975.

Trial 2 — 0.09 ha of lucerne at Wharepapa was sprayed at 9 to 15 day intervals between December 18 1974 and April 23 1975 (11 sprays). Treatments were applied in 200 litres of water/ha at 200 kPa with a wheel-mounted precision sprayer. Pre-treatment white-fringed weevil populations were assessed by taking 50 soil cores from each plot on December 10 1974. Post-treatment assessments were made by taking 200 soil cores from each plot on May 14 1975.

Trial 3 — 0.04 ha of pasture at Ruawaro was sprayed at 6 to 12 day intervals between December 20 1974 and April 8 1975 (12 sprays). Treatments were applied either as in Trial 2 or in 300 litres of water/ha with a knapsack sprayer. Pre-treatment (December 13 1974) and post-treatment (May 19 1975) white-fringed weevil populations were assessed as in trial 2.

Soil cores were 10 cm in diameter and were randomly located within each plot. The weevils were extracted by a flotation and wet sieving process.

RESULTS AND DISCUSSION

Screening trial

The results of insecticide screening are shown in Table 1. 0.05% solutions of fenitrothion (which Todd (1969) showed to be highly active against white-fringed weevil adults), oxamyl, methomyl and carbofuran all gave 100% mortality. 0.02% solutions of these four chemicals gave a significantly higher mortality than control. All of the other materials tested, except maldison, produced a significantly higher mortality (1% level) than control as 0.05% solutions but were not significantly different from control at 0.02%. None of the materials tested was effective at 0.005%.

Field trials

Post-treatment white-fringed weevil counts in field trials are shown in Table 2. The pre-treatment populations of the treated and control plots in trials 2 and 3 differed by less than 10%. At the time of post-treatment counts all of the white-fringed weevils were larvae, which were divisible into two major weight classes: small (less than 25 mg) and large (more than 50 mg). These and other samples suggest that the bulk of the white-fringed weevil populations in the areas studied follows the two-year life cycle described by Todd (1964). Small larvae apparently hatched from eggs laid in the period December 1974 to March 1975, while large larvae arose from eggs laid in the 1973-74 adult season and will pass through their second winter in 1975 before pupating and becoming adults in the 1975-76 summer. The weights of 3 to 5% of the larvae in the post-treatment counts were intermediate between the two major classes. These medium sized larvae may have developed from eggs laid early in the 1974-75 summer. They may be sufficiently large to complete their development and become adults after only one winter. A study is currently being made to determine the population of white-fringed weevil that complete their life cycle within one year in northern New Zealand.

Surface counts made between January and March 1975 consistently showed a 75 to 95% reduction in the adult population of the treated plots below that of control plots. This was reflected in reduced oviposition revealed by the significant reduction (1% level) in the post-treatment populations of small larvae in the treated plots (mean effect over all trials) (Table 2). These trials demonstrate that it is possible to reduce white-fringed weevil infestations by the blanket approach of frequent, regular spraying throughout the period that adults are active. Application of this treatment for two successive years would be necessary because of the two-year life cycle.

The development of practical control measures by foliar sprays against white-fringed weevil adults may depend upon reductions in both the rate and frequency of application. The results in Table 1 and those of Todd (1969) show that highly effective materials such as fenitrothion are active at much lower rates than 1 kg/ha, e.g. a 0.05% solution applied at 300 to 500 litres/ha would represent 0.15-0.25 kg/ha.

TABLE 1: EFFECTS OF FOLIAR SPRAY TREATMENTS ON WHITE-FRINGED WEEVIL ADULTS

<i>Insecticide</i>	<i>Spray strength (% w:v)</i>	<i>% mortality</i>	<i>Insecticide</i>	<i>Spray strength (% w:v)</i>	<i>% mortality</i>
methomyl	0.05	100.0 **	chlorpyrifos	0.05	77.5 **
EC	0.02	80.0 **	EC	0.02	35.0 NS
	0.005	25.0 NS		0.005	10.0 NS
oxamyl	0.05	100.0 **	trichlorfon	0.05	70.0 **
EC	0.02	57.5 *	EC	0.02	22.5 NS
	0.005	25.0 NS		0.005	20.0 NS
fenitrothion	0.05	100.0 **	carbaryl	0.05	62.5 **
EC	0.02	62.5 **	WP	0.02	40.0 NS
	0.005	10.0 NS		0.005	20.0 NS
carbofuran	0.05	100.0 **	maldison	0.05	17.5 NS
WP	0.02	55.0 *			
	0.005	15.0 NS	control	—	7.5
trichloronat	0.05	82.5 **	CV%	39	
EC	0.02	32.5 NS			
	0.005	00.0 NS			

EC = emulsifiable concentrate

WP = wettable powder

Significance cf. control: ** significant at 1% level

* significant at 5% level

NS not significant

TABLE 2: POST-TREATMENT WHITE-FRINGED WEEVIL NUMBERS/m² IN FIELD TRIALS

<i>Trial</i>		<i>Small larvae</i>	<i>Medium larvae</i>	<i>Large larvae</i>
1	control	101	5.9	28
	treated	31	4.9	36
2	control	192	8.0	10
	treated	83	4.9	13
3	control	99	3.7	30
	treated	18	3.7	30

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It should be possible to reduce the frequency of application by concentrating on the main period of adult emergence, but since this extends for about six weeks from early January to mid-February, multiple spraying is still likely to be necessary, as Todd (1969) pointed out. Frequency of application will depend partly upon the persistence of insecticides on the foliage. In the case of lucerne, which is capable of doubling its leaf area in less than seven days at the height of its growing season (Butler and Loper 1973), there will be a large amount of fresh unsprayed growth within a few days of spraying. Nevertheless, white-fringed weevil adults may still come into contact with insecticide persisting on older stems and around the bases of plants, since the adults spend the day hiding beneath clods and surface litter and climb the stems at night to feed. It should also be noted that oxamyl, methomyl and carbofuran, which are all highly active against adults (Table 1), are partly systemic in action.

The frequency of insecticide application will also depend upon the interval between the emergence of adults from the soil and the commencement of egg laying. The average interval between commencement of feeding and commencement of egg laying was 10 days (range 8 to 15 days) in adults reared from pupae and fed lucerne foliage in an outdoor insectary. It should therefore be unnecessary to spray more frequently than every 10 days, even with an insecticide that persists for less, unless there is significant immigration of adults from surrounding areas.

The effects of reducing the rate and frequency of insecticide application on chemical control of white-fringed weevil adults clearly warrant further study.

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