GARDEN WEEVIL LIFE CYCLE AND INSECTICIDES FOR ITS CONTROL IN ASPARAGUS

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SUMMARY

Garden weevil (*Phlyctinus callosus*) has recently become an important pest in asparagus (*Asparagus officinalis*) in the Waikato, Bay of Plenty, Manawatu and Taranaki regions. Information on life history in New Zealand is presented for the first time. Insecticides were compared in laboratory and field trials for control of adult garden weevil in asparagus during the harvest period. Several organophosphate insecticides had moderate to high activity against adult garden weevil but generally failed to sufficiently reduce the percentage of spears damaged. In a field trial esfenvalerate rapidly reduced weevil density and reduced spear damage.

INTRODUCTION

Garden weevil, *Phlyctinus callosus* Boheman (Coleoptera: Curculionidae), was first recorded as a pest in asparagus in the Manawatu (Highsted and Haack 1984). Its occurrence in the Waikato, Bay of Plenty and Taranaki was first noted in 1987 where it has rapidly assumed the status of a major pest in localised areas. Problems of spear damage attributed to other invertebrate pests (black beetle adults, slugs, potato mirids) have been relatively minor (e.g. Watson and Townsend 1981) and either related to establishing asparagus or to mismanagement of weeds and litter. Most pest problems in asparagus relate to post harvest contamination rather than damage to spears.

Garden weevil is native to South America where it is a serious pest of pipfruit and stonefruit. It became a widespread and serious pest of root crops, pipfruit and asparagus in Australia in the early 1980s (Sproul 1982). In New Zealand it has been recorded as a pest on vegetable root crops and some ornamental plants (Ferro 1982).

This paper reports information on the life cycle of garden weevil and results from initial insecticide trials on adult weevils in asparagus.

LIFE HISTORY AND BIOLOGY

The adult garden weevil is about 7 mm long, greyish brown, and distinguished by a white V-shaped stripe near the apex of the elytra. They emerge from the soil in late October and are most numerous in November and December (Fig. 1). Adults may still be present in March and early April.

Females each lay 100-300 eggs (Walker 1980) within 3-4 weeks of adult emergence in or under litter on the ground. Eggs hatch in 10-14 days. The young larvae, less than 0.5 mm in length, burrow into the soil where they feed on the asparagus roots and root hairs. Larvae continue to feed during the winter. Pupation occurs early in October within the soil at depths of 10-15 cm. The pupal stage lasts about 3-4 weeks.

Adult weevils feed nocturnally on emerging spears and ferns. The feeding damage on spears is a characteristic symmetrical scallop 3 mm across and 0.5 mm deep. This damage down-grades the spear from export to second grade and reject. Adult feeding may strip the fern bare and provide an entry point for disease, particularly *Stemphylium* spp.

In asparagus stands, adults have been observed feeding on dicotyledon weed species such as red root (*Amaranthus* sp.) and Californian thistle (*Cirsium arvense*). Observations indicate that weevils may be present in stands but cause little damage to emerging spears if alternative food sources are readily available. The presence of dicot weeds may also satisfy the weevils' requirements for shelter during daylight.

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Fig. 1: Life cycle of garden weevil in asparagus.

METHODS

Trial 1

The biological activity of seven granular insecticides (Table 1) was evaluated at two or more rates by laboratory soil bioassay. Weighed quantities of insecticides were applied to the surface of soil (Arapuni sandy loam) in petri dishes. Each treatment was replicated 10 times. Two field collected garden weevil adults were placed in each petri dish. Weevil survival was assessed at 1, 2, and 6 days and all weevils replaced after each assessment.

Trial 2

Soil bioassay techniques were used to assess the field activity of four insecticide sprays (Table 2). All products were applied onto 10 x 10 m plots in a weed free asparagus stand in spring 1987. Applications were made with a hand held 2.4 m boom Mistifier sprayer fitted with Spraying systems flat fan nozzles (No. 730154) operating at 210 kPa and delivering 300 litres/ha. Plots were replicated six times. Ten petri dishes filled to 5 mm depth with soil (Arapuni sandy loam) were placed on each plot immediately prior to treatment application. Two weevils were added to each dish and mortality assessed after 48 hours. The number of spears with feeding marks was assessed 1 and 3 days post-treatment from 10 spears from the central two rows of each plot.

Trial 3

The trial was sited in a 9 year old commercial stand (cv. 'New Zealand Beacon') on an Arapuni sandy loam soil. Each treatment (Table 3) was replicated five times in randomised blocks. Plot size was 10 x 7 m. Spray treatments were applied at dusk on 24 November in the manner outlined for Trial 2. Granular formulations were applied by hand held shaker. The rates of terbufos and isazophos were higher than those in the bioassay (Trial 1) because a previous field trial had shown no reduction in weevil density nor spears damaged at these bioassay rates (Prestidge unpub. data). The stand was picked for processing prior to treatment application. The number of spears with feeding marks was assessed 2, 4, 6 and 12 days post-treatment from the centre two rows of each plot.

Adult weevil populations were estimated using a modified sack count method (Blank 1982). Two hessian squares 30 x 30 cm were pegged out on the centre two rows of each plot. Counts were made of the live weevils sheltering under the hessian on days 1, 3, 5, 7 and 13 post-treatment. The weevils were not disturbed during counting.

RESULTS

The results from the initial laboratory soil bioassay indicated that isazophos, lindane, phorate and terbufos had high activity against adult weevils (Table 1) although the latter only gave good control at the higher rate of application.

The insecticides chlorpyrifos and lindane applied in Trial 2 (Table 2) gave good weevil control, especially at higher rates, but did not significantly reduce the percentage of spears damaged.

Control of garden weevil in Trial 3 was variable (Table 3) possibly due to heavy rain falling on day 5. Dichlorvos, the only chemical registered for use in asparagus, did not kill the weevil. Esfenvalerate gave the highest level of control and reduced spear damage to low levels relative to untreated plots. Chlorpyrifos, isazophos, methidathion and terbufos all gave intermediate levels of weevil control and a moderate reduction in damaged spears. Weevil density on untreated plots rapidly declined. This was probably due to movement of adults from the untreated plots into the treated areas as the grower sprayed the remainder of his stand (25 ha) 3 days after treatment application.

TABLE 1: Trial 1. The biological activity of granular insecticides for adult garden weevil as determined by laboratory soil bioassay.

Chemical	Trade name/ formulation	Rate (kg ai/ha)	% Mortality		
			Day: 1	2	6
carbofuran	Furadan 10G	0.25	0	0	N/A
		0.5	0	0	N/A
diazinon	Dyzol 20G	0.25	0	0	N/A
		0.5	0	0	N/A
fensulfothion	Dasanit 5G	0.25	5	0	N/A
		0.5	0	0	N/A
isazophos	Miral 10G	0.25	100	100	100
		0.5	100	100	100
lindane	Lindane 20G	0.25	0	0	0
		0.5	5	10	N/A
		1.00	100	100	100
		2.00	35	35	90
phorate	Thimet 20G	0.25	95	100	100
		0.5	90	100	100
terbufos	Counter 10G	0.25	0	5	N/A
		0.5	85	100	100

N/A — not assessed.

TABLE 2: Trial 2. Evaluation of chemicals for the control of garden weevil in asparagus.

Chemical	Trade name/ formulation	Rate (kg ai/ha)	% Mortality			% Spear damage	
			@ Day			@ Day	
			1	2	4	1	3
acephate	Orthene 75 WP	0.25	0	0	0	26	60
		0.50	10	45	0	46	48
azinphos-methyl	Gusathion M-50 WP	0.25	0	5	0	34	30
		0.50	10	30	0	42	40
chlorpyrifos	Lorsban 40 EC	0.25	0	50	0	40	30
		0.50	85	100	75	48	68
lindane	Lindane 50 WP	1.0	100	100	100	32	44
untreated			0	5	0	54	56
SED						10	16

TABLE 3: Trial 3. Field evaluation of chemicals for the control of garden weevil in asparagus.

Chemical	Trade name/ formulation	Rate (kg ai/ha)	% reduction in garden weevil					% reduction in spear damage				
			Days post treatment									
			1	3	5	7	13	2	4	6	12	
untreated ¹			5	21	19	8	1	84	84	87	15	
chlorpyrifos	Lorsban 40EC	2.0	17	59	4	0	0	19	5	3	20	
		4.0	80	44	66	49	61	52	52	3	47	
dichlorvos	Nuvan 100EC	0.75	0	0	0	2	0	0	5	0	0	
esfenvalerate	Hallmark 50EC	0.015	50	81	62	48	0	76	62	40	20	
		0.0185	64	82	61	26	87	81	62	17	0	
		0.025	74	90	73	70	74	81	80	54	73	
isazophos	Miral 10G	2.0	3	70	32	14	61	29	29	3	73	
		3.0	54	31	44	10	-	29	38	31	73	
		4.0	32	52	41	30	74	19	19	17	73	
methidathion	Ultracide 40WP	0.5	85	53	0	9	0	62	9	0	0	
		0.75	80	54	21	9	34	48	5	0	0	
		1.0	72	68	28	36	21	48	33	22	20	
terbufos	Counter 20G	1.5	25	52	7	0	74	19	5	0	73	
		3.0	21	2	16	5	87	24	0	8	47	
		8.0	0	59	21	49	47	39	38	17	47	
LSD			31	19	17	25	78	17	12	12	54	

¹Weevils per hessian sack; percentage spears with weevil damage.

DISCUSSION

Garden weevil represents a new pest in asparagus. Its increase in incidence and pest status over the last 2 years in the Waikato, Bay of Plenty, Taranaki and Manawatu regions, is probably associated with the spread of adults as growers share packhouse facilities, machinery and picking boxes. In Australia, garden weevil is an important pest in apples (Sproul 1982) and it may be unfortunate that in New Zealand many packhouses are sited in apple orchards where weevils have been observed on asparagus produce.

Insecticidal control of garden weevil in asparagus presents problems. During the harvest season, stands resemble a bare cultivated field. Emerging spears are harvested in 3-5 days. Weevils which emerge from the soil feed extensively during the peak production period. Most growers harvest daily and any recommendations on insecticidal use during this time must include pesticide residue information. Further work is required on this aspect. Insecticide application during daily harvesting may pose a real or perceived threat to the safety of asparagus pickers especially when chemicals with high mammalian toxicities are used. The use of systemic insecticides applied during the fern stage to control larvae may reduce the weevil population sufficiently and overcome some of these problems. It is unlikely that non-systemic insecticides would control larvae considering the depth in the soil at which larvae live and feed. After close-up, insecticides could be used to control adult weevils without risk of pesticide contamination on the following year's crop.

In the current trials, only esfenvalerate gave a sufficiently rapid reduction in weevil density and spear damage to be considered for use by growers. Isazophos, chlorpyrifos, methidathion and terbufos reduced garden weevil populations but did not reduce spear damage sufficiently. Use of larger sized plots which prevented weevil invasion from untreated areas may have resulted in a greater reduction in spear damage with

application of the organophosphate insecticides. Multiple applications of insecticide however, may be necessary to control the weevil over its extended period of adult emergence.

The sack counting technique is unlikely to give a good quantitative estimate of weevil density because the sacks act as a refuge site. Some insecticides alter insect behaviour. For example, esfenvalerate increased weevil activity on the soil surface during the daytime. Generally however, the relationship between the number of spears damaged and weevil density under the sacks was well correlated ($r^2 = 0.6-0.7$).

Because of the nocturnal behaviour of the weevil, evening applications of insecticide, accompanied by high water rates, are likely to be the most effective. There is also potential for the development of baits to control weevils.

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