CONTROL OF BLACK VINE WEEVIL (*OTIORHYNCHUS SULCATUS*) LARVAE WITH DIFFERENT RATES OF A PARASITIC NEMATODE (*HETERORHABDITIS BACTERIOPHORA*)

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SUMMARY

The parasitic nematode *Heterorhabditis bacteriophora* (V16), was used in two trials for the control of black vine weevil in potted *Primula polyanthes*. Black vine weevil larvae were seeded into plastic pots containing *P. polyanthes* and after 7 days, nematodes were introduced at a range of application rates between 0 and 2187/cm². After a further four or five weeks, the numbers of surviving larvae were recorded. Larval mortality in Trial 1 increased with increasing nematode application rates up to 100% but in Trial 2 did not increase over 87%. The results indicated that high levels of control of black vine weevil larvae can be achieved in potted *P. polyanthes* using 10-50 nematodes/cm².

INTRODUCTION

Black vine weevil (BVW), *Otiorynchus sulcatus* (F), a cosmopolitan pest of a wide range of plants, is a recognised problem in nurseries in Otago and Southland. Adult feeding on foliage causes irregular notching in leaves but more serious damage is caused by the larvae which feed on roots frequently resulting in complete root-pruning, ring-barking and burrowing within the lower stem of the plant. To control this pest, nurseries have traditionally used the organochlorines dieldrin, DDT and lindane which are no longer available in New Zealand. Substitute organophosphate insecticides often give poor control of BVW larvae (e.g. Parella and Keil 1984). Research overseas (Bedding and Miller 1981; Georgis and Poinar 1984) and in New Zealand (Barratt *et al* 1989) have shown parasitic nematodes to be highly effective for BVW control. The rate of nematodes used by Barratt *et al* (1989) was high (1,230/cm²) while overseas research has indicated that much lower rates (50-100 nematodes/cm²) can provide moderate to good (50-80%) control of BVW larvae (Georgis and Poinar 1984).

The aim of the trials reported here was to determine the minimum rate of *H. bacteriophora* (V16) for effective control of BVW larvae in potted *Primula polyanthes*.

METHODS

BVW larvae were collected from nurseries in Otago and Southland in late February/early March 1989 and established under *P. polyanthes* plants growing in commercial peat based potting mix in either 8x8x10 cm deep plastic pots (Trial 1) or 10.5x10.5x10 cm deep plastic pots (Trial 2). In April five BVW larvae were introduced to each pot by either placing them into 10 mm deep holes made in the surface of the potting mix and lightly covering them with potting mix (Trial 1) or by placing them on the surface of the potting mix and replacing any larvae which had not buried themselves in two hours (Trial 2).

In Trial 1 two size classes of larvae were used to compare their susceptibility to parasitic nematodes. Large larvae had mean head capsule widths of 1.7 ± 0.24 mm and smaller ones 1.1 ± 0.35 mm. After 7 days the nematodes were applied in 50 mls of water poured onto the potting mix surface at rates shown in Table 1. There were 10 replicates

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of each application rate for each size class. The pots were held in a shade house for 5 weeks and watered every 2-3 days.

In Trial 2 BVW larvae were not differentiated by size. Nematodes were applied in 20 mls of water syringed onto the potting mix surface at five rates between 0-200/cm² (Table 1). The pots were held in an open sided insectary for 1 week before being moved into a greenhouse for a further 3 weeks, and were watered as above.

In both trials, the pots were destructively sampled by hand sorting to recover surviving BVW larvae.

The data from both trials were analysed by fitting a generalised linear model using a binomial distribution with a logit link (Nelder and Wedderburn 1972).

RESULTS AND DISCUSSION

In the control pots in Trial 1 establishment of large larvae was significantly greater than that of small larvae ($P < 0.05$) (Table 1). Nematode introduction, even at 1/cm², reduced survival of both large ($P < 0.01$) and small ($P < 0.05$) larvae (Table 1). There was no significant difference between susceptibility of the larger and smaller larvae to parasitic nematodes at any application rate. Mortality of larvae in both size classes approached 100% at 9 nematodes/cm² and complete control was achieved at most rates above this (Table 1).

In Trial 2 maximum larval mortality was achieved at 50 nematodes/cm² (Table 1). Increasing the application rate above this did not increase BVW mortality.

TABLE 1: The effect of *Heterorhabditis bacteriophora* (V16) application rate on black vine weevil (*Otiorhynchus sulcatus* (F)) larval survival in potted *Primula polyanthes*.

Nematodes/cm ²	Trial 1		Trial 2	
	Large larvae	% survival *(SEM)	Nematodes/cm ²	% survival *(SEM)
0	92 (3.8)	76 (6.0)	0	83 (6.8)
1	34 (6.7)	52 (7.1)	10	66 (8.0)
3	22	—	50	11 (5.3)
9	4	4	100	17 (6.3)
27	8	—	200	17 (6.3)
81	0	0		
243	0	—		
729	0	0		
2,187	0	—		

*Predicted values from generalised linear model.

The reason for the difference between the effectiveness of the nematodes in Trial 1 and Trial 2 cannot be identified from factors measured in these trials but does illustrate that environmental conditions may influence nematode performance. The results from both trials indicated that the nematode rate used by Barratt *et al* (1989) was higher than necessary to achieve good control of BVW larvae in potted plants and that 80-100% control can be achieved by 50 nematodes/cm² or lower if conditions for nematode performance are suitable.

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