EVALUATION OF AN ENTOMOPHAGOUS NEMATODE (*STEINERNEMA BIBIONIS*) FOR THE CONTROL OF PORINA LARVAE (*WISEANA* SPP.) IN THE OTAKI DISTRICT

G.J. VAN DER MESPEL¹, W.M. KAIN², W.M. WOUTS³

¹Horticultural Research Centre, Levin

²Research Division, MAF, Palmerston North

³Entomology Division, DSIR, Auckland

SUMMARY

Steinernema bibionis (Bovien) was sprayed in an aqueous suspension onto pasture infested with late flying porina (*Wiseana copularis*) larvae at three rates in May, August, October, December 1982 and March and May 1983. Control of larvae was obtained at all rates with the May applications but treatments at other times gave no significant depression in pest levels. These studies have shown that *S. bibionis* can give effective but short term control of porina larvae and have confirmed that in moist soils, soil temperature and developmental stage of the pest are important determinants of efficacy, with the latter having an overriding influence.

INTRODUCTION

Soil moisture (Petersen 1982), soil temperature and developmental stage of the pest (Kain *et al* 1982) are important variables influencing the level of control obtained from the use of entomophagous nematodes. Studies carried out on early flying porina (*W. cervinata*) larvae during the late summer to early winter period showed that under cold and wet conditions the level of pest control obtained was poor (Kain *et al* 1981). However, in these studies the relative importance of soil temperature and moisture, and developmental stage of the pest could not be determined.

The studies reported here were undertaken to investigate the optimal time of application for the control of late flying porina (*W. copularis*, J. Dugdale *pers. comm.*) larvae, present in the pasture from February to December, and to determine the effects of nematode applications on larval populations of the following generation.

Studies were carried out on a site heavily infested with porina, in the hill country of the Otaki-Waikanae district, which has a mild damp summer and winter climate.

METHODS

Two trials were conducted. One evaluated applications in May, August, October and December 1982 and the other applications in March and May 1983. For the first trial *S. bibionis* were raised in flasks on artificial media impregnated in polyurethane chips and the infective juvenile nematodes extracted by washing and differential sedimentation in water (Bedding 1981; Wouts 1981). For the second trial the nematodes were cultured in the larvae of the greater wax moth (*Galleria mellonella*) and collected in water (Poinar 1979).

Both trials were of a randomised block design with six replicates. *S. bibionis* suspensions were applied at three rates (15, 30 and 60 x 10⁴/m²) to plots (4 m x 3 m) separated by 0.25 m buffer strips. Applications were made in 2500 litres of water/ha through a 1 m wide boom fitted with three large orifice teejet fan nozzles connected to a constant pressure propane gas experimental sprayer.

Soil moisture (0-5 cm) was recorded at time of application, and soil temperature (10 cm) and precipitation were monitored continuously throughout the trials.

Treatment efficacy was assessed in September and December 1982 for the first two applications of Trial 1, in December 1982 for the third, and in August 1983 for all applications in both trials. The assessments were made by counting the number of

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porina burrows per plot. Burrows were closed one week prior to assessment to ensure that only inhabited burrows were counted.

RESULTS AND DISCUSSION

Effective control ($p < 0.05$) of porina assessed on density of inhabited burrows resulted only from May applications (Table 1) when small larvae (predominantly 1 to 2 cm in length) were present. Applications at other times when porina were present as eggs, small surface living or mature larvae were not effective ($p > 0.05$). The poor control obtained from March applications, and the ineffectiveness of all 1982 treatments assessed in the following larval generation suggest that this nematode did not persist in the soil at levels which gave effective short or long term control.

TABLE 1: Mean density and percentage () reduction of porina burrows/m².

Application date	Developmental stage (approx)	Assessment date	Untreated control	Rate of nematodes/m ² (x10 ⁴)			
				15	30	60	LSD 5%
May 1982	Small larvae	Sept 1982	11.5	3.7(68)	3.3(71)	1.8(84)	6.4
		Dec 1982	2.0	1.2(40)	1.0(50)	0.7(65)	1.1
		Aug 1983	21.7	27.6 (0)	29.8 (0)	16.7(23)	10.1
Aug 1982	Mature larvae	Sept 1982	13.3	12.1 (9)	13.2 (1)	11.1(17)	5.1
		Dec 1982	3.2	2.2(33)	2.6(20)	2.6(20)	0.8
		Aug 1983	28.2	26.5 (6)	32.4 (0)	22.2(21)	13.2
Oct 1982	Mature larvae	Dec 1982	1.3	1.0(23)	1.3 (0)	1.3 (0)	0.7
		Aug 1983	22.8	16.6(27)	25.1 (0)	26.5 (0)	17.0
Dec 1982	Prepupae	Aug 1983	35.7	38.8 (0)	23.7(34)	26.8(25)	12.3
Mar 1983	Eggs and hatchlings*	Aug 1983	46.5	40.4(13)	36.2(22)	32.7(30)	17.6
May 1983	Small larvae	Aug 1983	42.5	21.8(49)	23.9(44)	13.9(67)	14.0

*Surface living larvae

The relationship between porina control and rate of nematode application, (Fig. 1) as in studies on porina larvae at Pahiatua (Kain *et al* 1981) appeared to be asymptotic.

These studies (Tables 1 and 2) suggest that where soil moisture is not limiting, developmental stage of the insect and soil temperature are important variables affecting degree of control. The excellent control of porina obtained by Kain *et al* (1981) at Pahiatua with March applications was attributed to higher soil temperatures than those at later applications in April and May. Stage of larval development at Pahiatua in March is similar to that occurring in May at Otaki-Waikanae, as determined by size and

TABLE 2: Weather data in relation to application dates.

Date	Soil temp (°C at 10 cm) over 7 days post application		Soil moisture (0-5 cm) at application time (%)	Rainfall over 7 days post application	
	Mean	Range		Amount (mm)	Number of rain days
11 May 1982	11.3	9.2-13.1	50	28.0	4
24 Aug 1982	9.6	6.0-10.0	52	17.1	4
20 Oct 1982	10.2	7.0-12.5	41	63.5	6
22 Dec 1982	14.9	12.4-16.0	56	51.2	2
24 Mar 1983	15.1	13.1-17.0	30	10.2	4
26 May 1983	9.2	7.1-11.9	45	28.1	4

Fig. 1: The relationship between application rate of *S. bibionis* and percent reduction in inhabited porina burrows.

time of peak flights (Carpenter and Wyeth 1980). This, plus comparisons of different application times matched for similar stages of development (May 1982 *cf* May 1983) and soil temperature (August 1982 *cf* May 1983; October 1982 *cf* May 1983) show that, contrary to laboratory results (Kain *et al* 1981), developmental stage has an overriding influence compared with soil temperature in determining the effectiveness of the nematode *S. bibionis* for porina control.

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