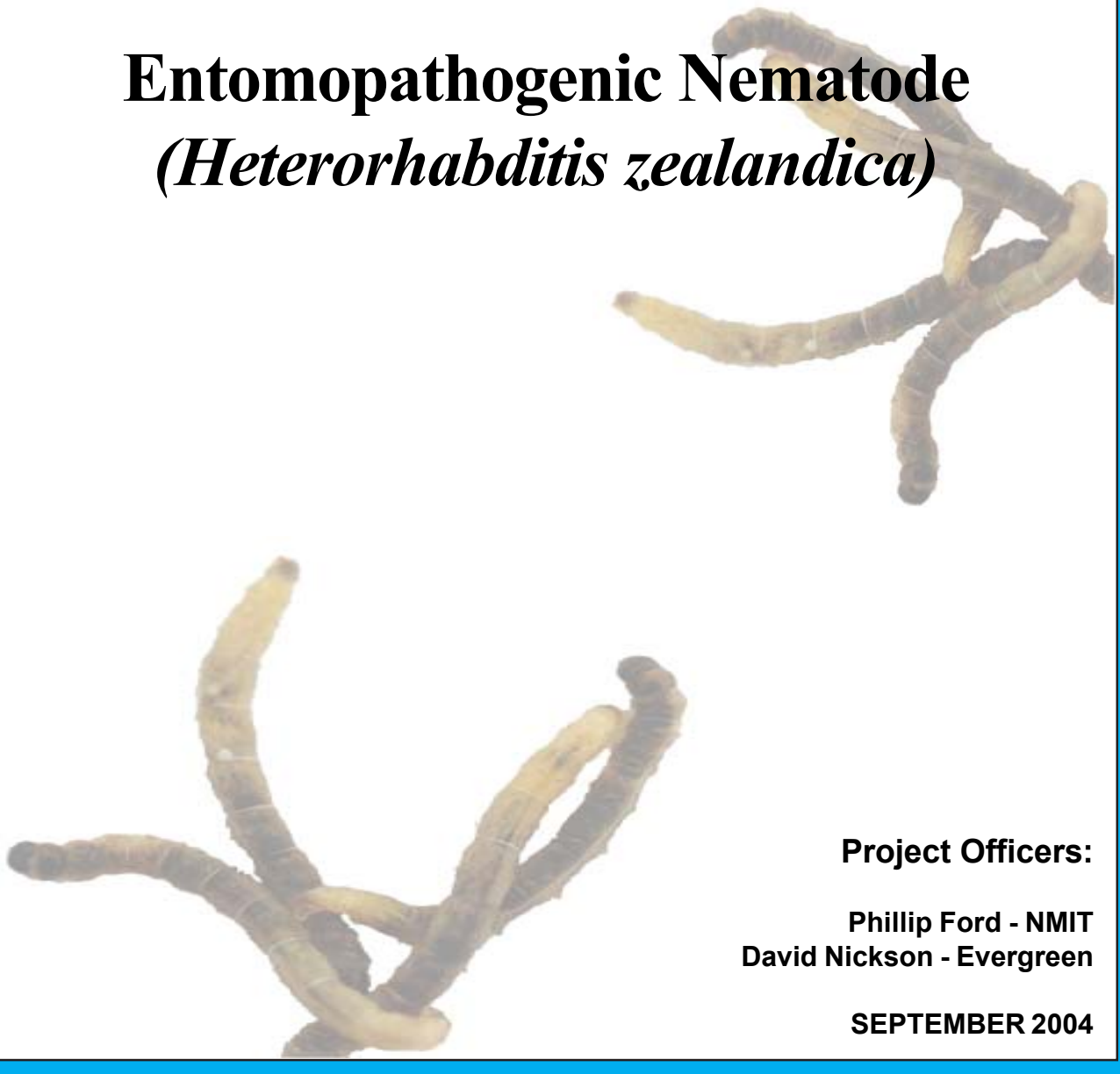
Victorian Golf Association

Biological Control of Winter Corbie (*Oncopera rufobrunnea*) in turf with the Entomopathogenic Nematode *(Heterorhabditis zealandica)*



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SEPTEMBER 2004

Introduction

The Winter Corbie is a sporadic pest of turf and pasture in southern Australia and in some years it can cause major damage. The larval stage is a caterpillar that lives in web-lined tunnels in the soil, emerging at night to forage on plant leaves. Foliage can be formed into pellets for consumption in the tunnels. Most species of grass and legume seem to be targeted, with the main damage occurring in late winter and through the springtime (August – October). When fully developed, larvae can be 40-50mm long with a thin grey-blue body and dark head. At this stage they will pupate in their tunnels, emerging about 1 month later as a mottled red-brown moth.

Adult moth dispersion flights occur in the summer. After mating, female moths lay eggs in small batches under ground cover. The eggs are elliptical, creamy white darkening to black before hatching, and about 1mm long. First instar larvae emerge in autumn, to begin the annual life cycle. There is only one generation per year (Goodyer, 1983, McQuillan and Ireson, 1987).

Work by Dr. Robin Bedding, with the Commonwealth Scientific and Industrial Research Organisation (CSIRO) Entomology Division, identified several Entomopathogenic Nematode (EN) species and strains with high lethality against a range of insect pests. *Heterorhabditis zealandica* (Strain X1) is one such strain. At the same time Bedding developed, patented and commercialized a number of processes that allow the mass breeding and storage of the nematodes.

In short, the CSIRO work has created highly pathogenic EN strains that are commercially available at costs comparable to insecticides, and with a long shelf life.

Entomopathogenic nematodes are host to symbiotic bacteria, which help kill the insect target. These bacteria also preserve the insect cadaver for several weeks, allowing the generation of new populations of infective juvenile nematodes. These are eventually released into the soil on the breakdown of the insect cadaver, and can theoretically give rise to a 'second wave' of insect pest control. It should be noted that in this trial (and virtually all other Australian trials), the pest kill assessments are only based on the 'first wave' of control (ie: the control achieved by the ENs actually bought and applied).

ENs have been particularly effective in the Australian turf market, controlling many of the major cockchafer, beetle and weevil pests that occur over the warmer months (see previous VGA Turf Board publications).

But in a previous trial on at Torquay Golf Club (2002), ENs failed to control the Winter Corbie. This failure was attributed to low soil temperatures (16-17^{o}C) at the time. The activity of the nematode decreases at soil temperatures below 18-19^{o}C.

The aim of this trial was to test again the ability of two EN species (*Steinernema feltiae* and *Heterorhabditis zealandica*) to control the Winter Corbie. The damaging stage of the pest begins in early spring, with soil temperatures below 18^{o}C, so a secondary aim was to test the effectiveness of an 'activator' in stimulating the EN activity at sub-optimal soil temperatures. The activator is a hydrolysed yeast product.

Materials and Methods

A sportsfield (Cartledge Reserve, Heidelberg, Victoria) with high levels of Winter Corbie infestation was found in October, 2003. Treatments were applied at 4pm on 15th October, 2003. It is essential that ENs are not exposed to high UV levels or low humidity, so late afternoon application is required. Soil temperature was 17.5°C.

Two EN products (*Steinernema feltiae* and *Heterorhabditis zealandica*) were applied at a rate of 500,000 nematodes per square metre, in 1 litre of water per plot, with 1 g per litre of a hydrolised yeast product added at the mixing stage. The nematode treatments were irrigated into the turf with approximately 3 litres of water per square metre about 30 minutes after treatment, and a similar level of irrigation was applied the following day. Rainfall in the following several days ensured soil moisture was adequate during the entire period of the trial.

(cyfluthrin, Baythoid®) was applied at a product rate of 0.35ml/sqm (3.5 l/ha), as a foliage treatment with no follow-up irrigation. A set of Control plots completed the treatments (these were not irrigated).

Insect numbers were counted at 14 days after treatment. Counting both living and dead insect numbers allows a '% Kill' estimation. It is considered valid for the two nematode treatments because of the preservative effect of the bacteria that the ENs carry. The insects in the control plots were counted in the same manner as the EN plots. The % Kill figure is not calculated for cyfluthrin, as many of the dead insects were probably not found. It would be expected that bird predation of insects dying on the surface and decomposition of many insects killed on the surface or in the soil would make such counts unreliable.

Results and Discussion

Table 1 shows the raw data of counts of 0.1 square metre samples, taken from the center of each treatment plot, to a depth of 75mm. The raw data is presented to show the mortality on both larvae and pupae, as some might assume there is a difference in mortality at these different stages.

Table 1: Insect counts from 0.1m^2 samples from each treatment plot.

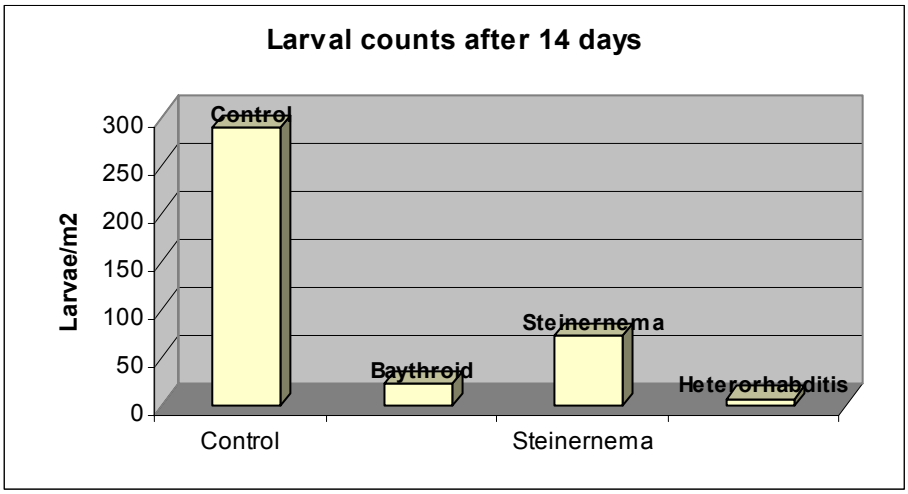
	Control	**Cyfluthrin**	**Steinernema**	**Heterorhabditis**
Block 1				
No. living larvae	17	2	5	0
No. living pupae	23	0	0	0
No. dead larvae	0	5	15	7
No. dead pupae	0	2	2	0
% Kill	0%	N/A	77%	100%
Block 2				
No. living larvae	11	2	5	0
No. living pupae	1	1	3	2
No. dead larvae	0	11	22	26
No. dead pupae	0	4	7	3
% Kill	0%	N/A	78%	94%
Block 3				
No. living larvae	26	2	5	0
No. living pupae	9	0	4	0
No. dead larvae	2	7	23	27
No. dead pupae	0	0	2	0
% Kill	5%	N/A	74%	100%

An interesting aspect of the data, and a reason for showing the actual counts, is the almost complete absence of living Corbie grubs in the *H. zealandica* plots. Only two living pupa were found, alongside 63 dead pupae and larvae in the three *H. zealandica* replicates.

The data is presented in subsequent tables as combined larval and pupal counts. Table 2

Table 2: Number of living Corbies and % Kill.

	No. living insects per square metre	**% Kill**
Control	290	2%
Cyfluthrin	23	*
Steinernema	73	76%
Heterorhabditis	7	98%
LSD (P=0.05)	143	6%



All three treatments caused a highly significant reduction in insect numbers compared to the untreated control. There was no significant difference between cyfluthrin and the two EN treatments. In terms of % Kill, both EN species gave very high levels of control, but *Heterorhabditis zealandica* (Strain X1) gave a significantly higher kill rate than the *Steinernema*. This is a pleasing result, as it means that the one EN product can be marketed to the turf industry, rather than two products.

The trial work suggests that the activator has worked in stimulating EN efficacy in slightly sub-optimal soil temperatures. Previous work based on four field trials aimed at controlling a number of insect species, showed a significant increase in the percentage of killed insects when the activating product was added, compared to EN treatments without the activator. Additional replicated work showed a significant increase in the number of ENs counted in the soil where the activator was used, compared to treatments without the activator.

Conclusions

The data clearly shows that the three treatments cyfluthrin, *Steinernema feltiae* and *Heterorhabditis zealandica* Strain X1 have a high level of efficacy in controlling this particular Corbie grub.

The major significance of the data is that it shows *Heterorhabditis zealandica* Strain X1 (with activator included) controls a representative of the lepidoptera (moth) order, at a soil temperature below the normal effective range for this particular nematode species.

The recommendations in this report are based on a set of trials and conditions as laid down within this report and should not be taken as a decisive or conclusive recommendation. Each club's circumstances are different and it is hoped that this research assists clubs and superintendents to make relevant decisions that are best suited to their club's particular needs.

Acknowledgement:

The Victorian Golf Association Turf Research and Advisory Board wishes to thank Mr Phillip Ford (Northern Metropolitan Institute of TAFE) and Mr David Nickson (Evergreen) for their co-operation in this trial work. We would also like to thank Ecogrow for the supply of ENs.

The Association also records its thanks to the members of the Turf Research & Advisory Board and the Victorian Golf Foundation which funded the publication of this report

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