SCIENTIFIC NOTES
USE OF *STEINERNEMA FELTIAE* IN A BAIT FOR THE CONTROL OF BLACK CUTWORMS (*AGROTIS IPSILON*) AND TAWNY MOLE CRICKETS (*SCAPTERISCUS VICINUS*)

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The insect parasitic nematode, *Steinernema feltiae* Filipjev (=*Neoplectana carpocapsae* Weiser) (Rhabditida:Steinernematidae), symbiotically associated with the bacterium *Xenorhabdus nematophilus* (Poinar and Thomas) is pathogenic to a wide range of insect pests (Poinar 1986). Development of an *in vitro* mass rearing method for this nematode has increased the feasibility for field experimentation and implementation of a biological control method for important pests (Poinar 1986). The present study defines the potential of *S. feltiae* 'All' strain applied in a bait and compared to standard liquid spraying against the tawny mole cricket *Scapteriscus vicinus* Scudder (Orthoptera: Gryllotalpidae) and black cutworm *Agrotis ipsilon* (Hufnagel) (Lepidoptera: Noctuidae).

S. feltiae were produced in greater wax moth larvae, *Galleria mellonella* (L.), by the modified method of Dutky et al (1964). Infective nematodes were stored for 1-2 weeks at 5°C before they were used. The viability of the nematodes was checked at the beginning of each test. Mole cricket adult males and cutworm larvae 6th and 7th instars were placed individually in a 10 x 10 x 12 cm plastic container that contained a 5 cm deep layer of potting soil (moisture ca. 35%). Containers were maintained in the laboratory at 25 ± 1°C. Nematodes were applied 16 h later at 0, 500, 2500 and 5000 nematodes per 100 cm^2 soil surface. The nematodes were either applied to the soil surface in 5 ml water or mixed with 10 g of bait spread on the soil surface. Control containers received 5 ml water applied alone or mixed with 10 g bait. The mole cricket bait was prepared by mixing 1 kg chicken laying mash, 40 ml crude molasses, 500 ml 20% glycerin and 5 g hydroxyethyl cellulose. The cutworm bait was made by mixing 1 kg wheat bran, 20

TABLE 1. MORTALITY OF TAWNY MOLE CRICKET MALES (*SCAPTERISCUS VICINUS*) AND BLACK CUTWORM LARVAE (*AGROTIS IPSILON*) TREATED WITH INSECT PARASITIC NEMATODE, *STEINERNEMA FELTIAE*.

NEMATODE CONCENTRATION/ 100 CM^2 SOIL SURFACE	PERCENT MORTALITY[1] MOLE CRICKET		BLACK CUTWORM	
	SPRAY	BAIT	SPRAY	BAIT
0	5a	0b	0	0
500	8a	70b	45a	80b
2500	58a	100b	80a	100b
5000	75a	100b	98a	100a

[1]Mortality recorded 96 h post treatment. Means followed by the same letter between spray and bait for each insect at each concentration are not significantly different based on student's t-test (P = 0.05).

ml crude molasses, 500 ml 20% glycerin and 1 g hydroxyethyl cellulose. There were 4 trials with 10 replicates per trial. The number of dead insects was recorded 96h post-treatment.

Bait formulations performed significantly better than sprays, especially at low concentrations (Table 1). According to Poinar (1986) infective juveniles of steinernematid nematodes enter insect hosts through the natural openings but in most cases the preferred mode of entry is through the mouth, thus the advantage of using baits. The addition of glycerin and hydroxyethyl cellulose dehydrates the nematodes so that they do not move away from the bait (Biosys, patent pending). Soil temperature, moisture and texture, as well as solar radiation are the most important factors affecting nematode movement, survival and effectiveness (Kaya 1985). Non-optimum conditions in the field may explain the need for using high concentrations of nematodes (exceeding 12 billion nematodes per hectare) for successful applications against tawny mole crickets and cutworms, *A. segetus* Schiff, (Lossbroek and Theuissen 1985). Using present technology, the cost of nematodes at these concentrations is not competitive with chemical pesticides (Kaya 1986). Therefore, nematode-bait formulations may provide a practical and more economical method of applying lower concentrations of nematodes to achieve satisfactory control.

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