LOW TEMPERATURE ACTIVITY AND INFECTIVITY OF A PARASITIC NEMATODE AGAINST PORINA AND GRASS GRUB LARVAE

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In January 1987, a diseased greasy cutworm larva (*Agrotis ipsilon aneituma*) (Lepidoptera) containing nematodes, was collected from an urban garden in Christchurch, Canterbury. After propagation in wax moth larvae, juveniles and male nematodes were identified as those of the species *Steinernema bibionis* and designated as the CA (Canterbury) strain. The species is known to infect a wide range of insect pests throughout the world (Wouts 1980).

Because grass grub (*Costelytra zealandica*) and porina larvae (*Wiseana* spp.) are major pasture pests throughout New Zealand their susceptibility to the CA strain was investigated.

Wright *et al* (1988) have shown the Canterbury strain to be more active and infective against porina in cool temperatures than strains of two other entomopathogenic species of *Steinernema* and four strains of the closely related genus *Heterorhabditis*. Such a difference in cool temperature activity may be attributable to physiological adaptation to a cooler environment. A quantitative comparison was therefore made between Canterbury and Auckland isolates of *S. bibionis*.

Infective stage activity was measured on 1% water agar in 135 mm petri plates. A 16 mm diameter well in the centre of each contained a macerated grass grub larva in nutrient broth. Within each plate a 10 mm wide peripheral filter paper ring was inoculated with 1600 infective nematodes and the plate incubated for 16 h at either 7.5 ± 0.2 °C or 10.0 ± 0.2 °C. The number of nematodes that migrated into the central zone, arbitrarily set at 85 mm diameter about the stimulant well, was recorded. To reach this zone, infectives would have had to migrate at least 15 mm across the agar surface. Chi-square analysis of four replicate plates for each treatment showed that at both 7.5 and 10 °C, significantly ($P < 0.01$) more Canterbury infectives than Auckland ones had migrated into the central zone (Fig. 1.).

In addition, infective activity against mature porina larvae, and second and third instar grass grub larvae was determined at 10 °C by laboratory bioassays using soil filled, 30 ml vials containing individual larvae. To each, a 2 ml suspension of 2000 infective nematodes of one or other strain was pipetted onto the soil surface. There were 30 replicates for each treatment. Soil moisture in the vials was maintained at 24-27%. After 3 weeks incubation at 10 ± 0.2 °C, larvae were sampled, and the percent mortality of the two strains compared using Chi-square analysis. It was found that grass grub larvae were not susceptible to either strain, as there was no significant difference in percent mortality between untreated larvae (12%) and either CA (15%) or Auckland (17%) nematode treated larvae. However, porina larvae were significantly ($P < 0.1$) more susceptible to CA (93%) than Auckland (77%) infectives, and both strains induced higher mortalities ($P < 0.01$) compared to untreated control mortality (25%).

In general the results indicated that there are intraspecific differences between the strains of *S. bibionis* in cold activity and infectivity. Bedding *et al* (1983) and Molyneux (1986) have found similar intra and interspecific differences between strains of several steinernematid and heterorhabditid species over a range of temperatures.

The Canterbury strain was isolated at a higher latitude with a prevailing cooler climate than two Australian *S. bibionis* strains examined by Molyneux (1986). Because geographical origin was considered by Molyneux (1986) to be important in determining a nematode's ability to migrate and infect at a particular temperature, the Canterbury strain may be more cold active than the Australian ones.

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Field control of grass grub and porina larvae using nematodes has been limited to 1 or 2 months of the year when there is a coincidence of adequate soil moisture and optimal soil temperatures (Kain *et al* 1982; Jackson and Trought 1982; Van Der Mespel *et al* 1986; Jackson and Wouts 1987). The use of the CA strain, active at lower temperatures, may extend the period of infectivity into the cooler months when pasture damage is most evident.

The isolation of the cool-temperature active Canterbury strain confirms the importance of screening different strains of steinernematid and heterorhabditid species for activity against a particular insect and its environment.

Fig. 1: Comparative migration of Canterbury and Auckland nematodes at two temperatures. Figures represent the average number of infectives for each strain/temperature combination which migrated from the outer inoculation ring (>) towards the stimulant well (●).

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