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Steinernema scapterisci, a Nematode Parasite of Mole Crickets, *Scapteriscus* spp.[1]

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INTRODUCTION: A nematode parasite of mole crickets was first found in Brazil in 1983 by H. G. Fowler, a post-doctoral fellow at the University of Florida, and shortly thereafter in Uruguay by Aquiles Silveiro-Guido during a survey for the University of Florida. The nematode appears to be a major factor that keeps populations of mole crickets under control in South America, the homeland of *Scapteriscus* mole crickets. These mole crickets were accidently introduced into the U. S. around the turn of the century (Walker 1984). In 1985, K. B. Nguyen and I brought the nematode to Florida from Uruguay. We determined that it was a new species and described it as *Steinernema scapterisci* Nguyen and Smart, 1990 (Nguyen and Smart 1989 and 1990a) and have given it the common name "mole cricket nematode."

LIFE CYCLE: The infective juvenile stage (IJ) of the nematode is the only stage capable of infecting a host. The IJ invades a mole cricket and reaches its body cavity either by entering through the mouth and penetrating the gut wall, or by entering the spiracles and penetrating the tracheal wall (Nguyen and Smart 1991b). Once in the body cavity, the IJ nematode releases a bacterium from retention sites in the anterior part of the intestine. The bacteria multiply rapidly killing the mole cricket by blood poisoning. Meanwhile, the IJ changes to a feeding stage and feeds on the bacteria. It molts to the fourth stage, feeds, and molts again to become the adult stage. After males and females mate, the females lay eggs which hatch, producing juveniles which feed on bacteria. These juveniles molt and develop into second generation adults. Eggs laid by the second generation females hatch into first stage juveniles which molt to second stage juveniles (J2). The J2 stores a pellet of bacteria in the anterior part of the intestine, and molts to become IJ which retains the cuticle of the second stage as a protective sheath. The IJ's leave the mole cricket cadaver in search of a live mole cricket to infect. About 50,000 IJ's emerge from one infected mole cricket (Nguyen and Smart 1992).

HOST RANGE: Primary hosts are in the order Orthoptera: mole crickets in the genus *Scapteriscus*; the house cricket, *Acheta domesticus*; and to a lesser extent, field crickets in the genus *Gryllus*. Coleoptera (beetles), Lepidoptera (butterflies and moths), and Hymenoptera (wasps and bees) are non-hosts or poor hosts (Nguyen and Smart 1991a).

CONTROL AND PERSISTENCE IN THE FIELD: The mole cricket nematode was released in small experimental plots in Alachua County in 1985; these were monitored weekly for five years. Populations of mole cricket nymphs collected in pitfall traps were reduced by 85% and 95% after one and two years, respectively (Smart *et al.* 1991). The nematodes persisted in the plots for the duration of the five-year sampling period. Mole cricket populations remained at levels of 5% or less than the initial population levels before nematode application. The effectiveness of the nematode is due in part to (1) small number of mole cricket generations/year (only one generation per year in North Florida) and (2) numerous nematode generations/year (a new generation about every 10 days for approximately eight months of the year).

DISSEMINATION OF THE NEMATODE: Since 1985, *S. scapterisci* has been detected in mole crickets collected from several other sites in Alachua county. Nematode-infected mole crickets in the early stage of infection spread the nematode during their flight (Smart *et al.* 1991). The nematode was also dispersed from inoculative field releases on golf courses and pastures (Parkman *et al.* 1993a and 1993b).

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SURVIVAL IN THE SOIL: Mole cricket nematodes survive in the absence of a host for at least 13 weeks in moist soil (Nguyen and Smart 1990b). The nematode is a living biological organism and it must remain alive to successfully suppress mole cricket populations. Nematode exposure to direct sunlight or other sources of heat prior to or during application has adverse effects on nematode infectivity and survival. Nematodes can survive on soils drying out slowly, from lack of rainfall or irrigation, in an anhydrobiotic stage. In this state, the inactive nematode can survive for extended periods of time until moisture is available.

TIME OF APPLICATION: Ideally, the nematode should be applied when (1) a majority of the mole crickets are adults or pre-adults, and (2) the weather is warm enough for them to be active. For unknown reasons, the nematode parasitizes very few mole crickets in early life stages. Since the nematode does not move very far on its own, infection depends largely on a mole cricket moving to the nematode instead of the nematode moving to a mole cricket.

METHOD OF APPLICATION: The nematodes are applied in water, using sprayers, chisel applicators, or irrigation systems. The object is to get the nematodes into moist soils which are inhabited by great numbers of mole crickets and offer protection for the nematodes from ultraviolet radiation and drying effects of the sun. Fields equipped with an irrigation system which will permit the nematodes to be applied through it, provide the ideal conditions for nematode application. If the nematode is applied through a sprayer, the area should be moist from rainfall or irrigation prior to the treatment. It is very important that the area be irrigated immediately after treatment to wash the nematodes off the foliage and into the soil to prevent them from dying by desiccation or ultraviolet radiation. If the nematodes are applied by chisel injection, the soil should be moist prior to application and should be irrigated afterward. If the nematodes are to be applied when temperatures are hot, they should be applied in late afternoon or on cloudy, overcast days, if at all possible, and ideally, when rain is expected.

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