

## Biological Control of Pasture Mole Crickets with Nematodes<sup>1</sup>

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### Pasture Damage by Mole Crickets

Foreign mole crickets cause serious damage to bahiagrass pastures in Florida (Figure 1). There are three pest mole crickets (*Scapteriscus* spp.) found in Florida: the southern, tawny, and short-winged mole crickets (Figure 2). Of these three, the tawny is the most damaging (Figure 3) (for more detailed information on these mole crickets see “Mole Crickets in Lawns” a publication of the University of Florida Cooperative Extension Service available at your county Cooperative Extension office or on-line at <http://edis.ifas.ufl.edu/LH039>). In a 1998 survey by the South Florida Beef and Forage Program, 64% of cattle producers each reported approximately 290 acres of their ranch as being damaged by mole cricket infestation. At an estimated cost of \$200 per acre for pasture renovation, this amounts to \$3,712,000 for every 100 beef cattle producers in south-central Florida. According to a 1997 USDA Agriculture census, there are about 1200 ranches (> 500 acres) in south central Florida. Therefore, total pasture renovation cost within the region is approximately \$44.5 million (\$3,712,00 x 1200/100) and renovation

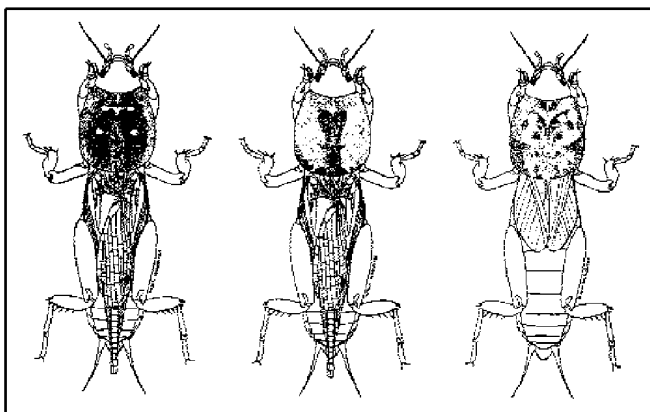
may be necessary every 4-5 years. Additional loss in revenue incurred from reductions in forage and hay production as a result of mole cricket damage is about \$44.5 million, annually, based on hay production of 4 T/A and a price of \$50/T (290 acres x 4 T/A x \$50/T x 1200 ranches x 0.64). While chemical control strategies can be effective, they provide only short-term relief and may leave harmful residues in the environment.



Figure 1. Mole cricket damage to bahiagrass pasture.

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**Figure 2.** (L-R) Southern, tawny, and short-winged mole cricket.



**Figure 3.** The tawny mole cricket is the most destructive mole cricket to pastures in Florida.

## Management of Mole Crickets with Insecticidal Nematodes

Fortunately, the UF/IFAS patented insecticidal nematode (*Steinernema scapterisci*) can control these mole crickets without any risks to the environment. These nematodes carry a bacterium (*Xenorhabdus* sp.) that kills pest mole crickets within a few days after infection. The nematodes are selective for pest mole crickets, do not affect other insects, invertebrates, or vertebrates, and can provide long-term protection by multiplying inside mole crickets that they kill. The offspring from these nematodes emerge from the dead mole crickets and infect other mole crickets (Figure 4).

The University of Florida has issued a license agreement to a company that plans to make these nematodes commercially available by the spring of 2002.



**Figure 4.** This mole cricket was killed by insecticidal nematodes. The nematodes are leaving the mole cricket in search of other mole crickets to infect.

## Storage and Handling

Nematodes are delicate living organisms and no matter how they are packaged, they must be properly handled, stored, and field-applied. Ideally, the nematode product should be refrigerated at about 39°F, or at least stored under air-conditioning, until application. Since nematodes tend to lose viability with time, storage should not exceed six weeks. These nematodes are sensitive to high temperatures and UV light, so the nematode product should be transported to the field under air conditioning, or in insulated containers with ice packs. They should not be exposed to direct sunlight or prolonged heat.

## Field Application

For best results, the nematodes should be applied about 1/2 an inch below the soil surface to protect them from UV light and from drying out (Figure 5). An ordinary sod-seeder can be modified into an application rig by adding a tank, a pump, hoses and nozzles. The nematode product should be premixed in a pail of water before adding it to the water tank. The sprayer mixture should be agitated and injected into the ground at the rate of 800 million nematodes per acre in 50-100 gallons of water. These nematodes were shown to persist and continue to kill pest mole crickets 8 years after being applied to a pasture in Florida. There are ongoing studies to evaluate the effectiveness of strip-application of nematodes for mole cricket control. If effective, strip-application will considerably reduce the cost of applying these nematodes to pastures.



**Figure 5.** An instrument used for applying nematodes into a field infested with mole crickets.

### Alternative Methods of Application

Although not suitable for large areas, a method of spreading nematodes on small land holdings is to trap, infect, and release infected mole crickets during the early spring flights. If sound emitters that mimic the songs of male mole crickets and attract adult mole crickets become available commercially, they can be used to call mole crickets to traps consisting of large funnels with a bucket underneath (Figure 6). Mole crickets that land on the funnels fall into the buckets containing moist sand to which nematodes have been added. After 24 hours the infected mole crickets can be sieved from the sand and released in areas where mole crickets are known to be a problem. Since the nematodes will live in the sand for a few days, the procedure can be repeated for three or four nights. The mole crickets that become infected in the buckets and are redistributed to new areas will die and release thousands of nematodes that will then infect other mole crickets.

A variation of the capture and redistribution method is to apply the nematodes to the soil in a small area known to be heavily infested with mole crickets. Eventually, the nematodes will spread from that area to through the entire field.

Neither of these is a preferred method for spreading nematodes, but if the land owner can wait for two or three years for the nematodes to spread, either will work and be less costly. The latter method does not need the sound emitters.



**Figure 6.** Two mole cricket callers used for collecting mole crickets to monitor the rate of nematode infection after an application of the nematode *Steinernama scapterisci* into the field.

### Time of Application

The nematodes enter the mole cricket's body through natural openings such as the mouth and spiracles (breathing holes). Therefore, nematodes are more effective on adult and pre-adult mole crickets, which have larger openings, than on nymphs. The best time to apply the nematodes in south-central Florida is in the fall (September to November) or early spring (February to March) when adult tawny mole crickets are most abundant. While application is not restricted to those months, there is little surface activity by mole crickets in December and January as they “overwinter” deeper in the soil. Early fall application may be preferable because it allows for a longer period of time for mole crickets to become infected before the female tawny mole crickets lay their eggs from March to May. Following infection with nematodes, the mole crickets die within a few days, and young nematodes emerge from dead mole cricket bodies in about 10 days. These fresh nematodes will infect other mole crickets to repeat the cycle and provide long-term control.