Musings on Mole Crickets

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Bottom line: Mole crickets are the most damaging pests of turfgrass in many regions of the world where warm-season turf is dominant. The insects cause damage by feeding on turf roots, stems and leaves and also by tunneling beneath the soil surface, and activity that further damages the root system. Mole cricket control is a year-round process that begins with springtime scouting and mapping of mole cricket "hot spots". This should be followed by weekly sampling for newly hatched mole cricket nymphs during the summer months (when average air temperatures are 75F [24C] or higher). Once nymphs are detected, application of preventive products such as imidacloprid (Merit) or fipronil (Chipco Choice) have shown the best results. Curative products such as acephate (Orthene), bifenthrin (Talstar), cyfluthrin (Tempo), cyhalothrin (Scimitar) and deltamethrin (Deltagard) also show good results, but with less residual activity. The biological control product, Nematac-S, also shows some promise when applied against adult mole crickets in the spring.

The basics

Common name: mole crickets

Scientific classification: Mole crickets are classified in the insect Order Orthoptera, which includes crickets, grasshoppers and katydids. Mole crickets are further classified in the Family Gryllotalpidae.

Turf-loving species of mole crickets: Some of the most damaging mole crickets include:

- African mole cricket, *Gryllotalpa africana*
- Changa (or West Indian) mole cricket, *Scapteriscus didactylus*
- Southern mole cricket, *Scapteriscus borellii*
- Short-winged mole cricket, *Scapteriscus abbreviatus*
- Tawny mole cricket, *Scapteriscus vicinus*

Plants affected: Although some mole crickets are not damaging to plants, there are several species around the world that cause severe damage to turf, peanuts, tobacco, pastures, strawberries and vegetables. Mole crickets attack all turf varieties in both the cool-season and warm-season groups.

Damage caused:

Turf can be damaged in two ways. Most mole crickets feed directly on turf plants (there is no part of the plant that mole crickets don't like, and they will chow down equally happily on roots, leaves, stems, stolons and rhizomes), causing damage such as that illustrated above.

In addition, mole crickets tunnel underground, and can cause equally severe damage by destroying root systems.

Southern mole cricket, *Scapteriscus borellia.* Note that the wings on this insect are fully developed, which means that it is an adult, capable of mating and reproducing. Nymphal (immature) stages of mole crickets either have no wings or much shorter wings, and are not capable of reproduction. Photo by Dr. Bart Drees, Texas A and M. Both adults and nymphs of mole crickets are damaging to turfgrass.

Geographic distribution: Although mole crickets occur in most locations in the world, the large share of the species that are damaging to turf are found in warmer climates – the southern U.S., Central and South America, South Africa, Asia and Australia. It is for this reason that mole cricket damage is usually found on warm-season turf varieties. However, if cool-season turf is grown where turf-loving species of mole crickets occur, they will damage both cool-season and warm-season turf varieties.

Damaging stages: Mole crickets differ from most insect pests in turf because both the **nymph** (immature or juvenile) stages and the **adult** stages are damaging to turf. In contrast, for turf pests such as caterpillars or white grubs, only the immature

stages (caterpillars or grubs) are damaging. This means that mole crickets have a much longer period during which they are serious threats to turf, and therefore they require a long-term, year-round management program.

Environmental triggers:

- **Underground tunneling and feeding begin**: when minimum nighttime temperatures reach **60F (15C)** or higher
- **Flight, mating and egg laying begin:** warm, clear nights in the springtime. Highest numbers appear when average air temperatures reach **75F (24C) and/or following rain.**
- **Eggs begin to hatch:** 4 – 8 weeks after the first adult flights occur.

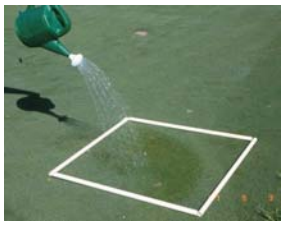
Prevention, prevention, prevention

The most effective control of mole crickets is usually based on a preventive program, where the newly hatched nymphs are targeted with products such as imidacloprid (Merit) or fipronil (Chipco Choice or Top Choice) BEFORE there are any obvious signs of damage. Timing of these insecticides is important — if they are applied too early, their residual activity will be too low when the crickets finally hatch. And if they are applied too late, the crickets will cause unacceptable damage. For best results, there are at least three parameters to keep track of:

1. **Temperature**: egg laying seems to occur when average air temperatures are higher than 70F (21C).
2. **Soil Moisture**: eggs will not survive unless soil moisture is greater than 3%. Unfortunately, these are the same conditions that support good turf growth. Stated another way, if soil moisture is below 3%, there is good news and bad news. The good news — you won't have much a mole cricket problem. But the bad news —your turf will be dead from drought stress anyway.
3. **Rainfall:** Summer rains can be used to help predict when eggs are likely to begin hatching. If rainfall occurs when average air temperatures are >75F (24C), adult mating flights are highly likely. Egg hatch will begin 4 – 8 weeks later.
4. **Monitoring**: because mole crickets are most active beneath the soil surface, their presence is difficult to detect — until it's too late. To avoid this scenario, monitoring for crickets using a 2% soap solution (2.5 oz dishwashing liquid such as Lemon Joy or Dawn in 1 gallon of water [20 ml soap/liter water]) can be helpful. Once average air temperatures reach 75F (24C) or higher, begin monitoring every 1 – 2 weeks for small cricket nymphs using 1 gallon of soap solution/square yard of turf (5 liters/1 m^2). Areas to concentrate on are those locations where adult crickets were seen during the previous spring months (see below). Sandy areas of the golf course are also more likely to be attacked than areas with high clay or silt contents in the soil.

Both Merit and Chipco Choice are highly effective preventive products for mole crickets, especially if they are used when crickets are relatively small. The larger the mole cricket, the harder it is to kill. Chipco Choice (fipronil) probably has a longer residual activity than Merit (Merit will last 2 -3 months), but Merit has the advantage of controlling white grubs as well as mole crickets. If your course has suffered from white grub damage in the past, Merit is probably the best choice. Both Merit and fipronil should be lightly watered in after application.

Monitoring with 2% soap solution.



Mole crickets can be forced to come to the soil surface when they are irritated by application of soapy solutions. A 2% solution of dishwashing liquid or a surfactant can be applied through a hose end sprayer or a watering can.

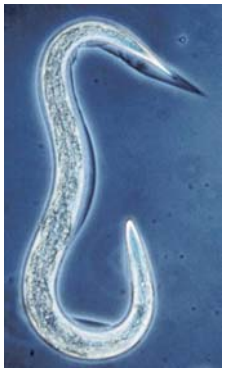
Curative control: only in a pinch

Curative control (once the mole crickets have already caused damage) is a less desirable option, but sometimes you can't avoid it. Sometimes, applications made the previous summer were not effective (due to timing, application, product selection problems), or sometimes you might arrive at a new course where mole cricket control programs were not previously in place.

If you encounter adult mole crickets in the springtime, curative applications will be necessary. Curative control products include acephate (Orthene: which also controls white grubs) or the pyrethroid insecticides (Talstar, Deltagard, Scimitar, Tempo: these products will not control white grubs). All of these products should be lightly watered in. Monitoring with a 2% soap solution during the springtime can help detect adult mole crickets before they cause too much damage. Map the areas where adult mole crickets are observed during the springtime — these will be the most likely areas where eggs will be laid and where small nymphs will appear in the summer months. These are the areas

that should be the focus of future monitoring activities for small nymphs.

Biological control: worth a try



Biological control products have had inconsistent results for most turf pests, but the performance of Nematac S may help to reverse this trend. This product, which is marketed by Becker Underwood, contains beneficial nematodes (microscopic-sized round worms that range in size from 0.4 – 1.1 mm [15/1000" – 40/1000"]) known as *Steinernema scapterisci.* A micrograph of a single nematode appears above.

These nematodes are parasites of mole crickets that were discovered by University of Florida researchers in Uruguay in the 1980s. When the nematodes were brought back to the U.S. and tested in the lab and in the field, it was found that the nematodes killed mole crickets rapidly (within 72 hours), but they did not infect turf plants or cause any damage to turf.

Mole crickets are killed when the nematodes enter the insect's body through openings such as the mouth, anus and spiracles (small breathing holes on the side of the mole cricket body). The larger the mole cricket is, the larger its body openings are, and thus the easier it is for the nematode to gain entry to the mole cricket. It is for this reason that Nematac S is used to target only very large nymphs or adults, usually in the late fall. Once the nematodes move into the mole cricket's body, these small roundworms release a bacterium that then multiples inside the cricket. In a fascinating glimpse at the intricacies of nature, the bacteria are beneficial for the nematode, but will kill the mole cricket dead in 72 hours or less. Once the mole cricket dies, the nematodes go to town reproducing – up to 50,000 nematodes have been produced in a single mole cricket cadaver!

University of Florida research indicates that these newly produced nematodes are capable of surviving in the soil and attacking future generations of mole crickets. If this observation holds up consistently, then it means that after one or two applications of Nematac S, the beneficial nematodes will be permanently established in the soil, and no future applications will be necessary.

That said, it would be unwise to depend completely on a product such as Nematac S, at least not until you have evaluated it in a smaller area first. This is especially true if mole crickets have been a serious problem for you in the past. The data indicates that the nematodes can keep mole cricket populations low enough that insecticide applications can be reduced. However, in most cases, some conventional insecticide applications may still be required. For a product description and label information, go the website:
www.beckerunderwood.com/products/nematac.shtml

Wetter is better

Regardless of which product is applied or which control strategy is adopted, the soil should be moist BEFORE application. This is because mole crickets will come to the soil surface if there is sufficient moisture there. When they are at the soil surface, they are easier to kill than when they are lower in the soil profile. You should ideally begin pre-irrigating a few days before insecticide application to make sure that mole crickets are as close to the surface as possible.

References

1. Hertl, P. and RL Brandenbrug. 2002. Effect of soil moisture and time of year on mole cricket surface tunneling. Environmental Entomology 31(3):476
2. University of Florida mole cricket website. http://molecrickets.ifas.ufl.edu/
3. Xia, Y. and RL Brandenburg. 2000. Effect of irrigation on the efficacy of insecticides for controlling two species of mole crickets on golf courses. J. Economic Entomology 93(3):852

Insecticides labeled for use against mole crickets. Products in **green type** are contact (foliar applied) products, while products printed in **red type** are systemic (soil applied) products.

Active ingredient	Trade name	Type of control
acephate	Orthene	Curative
bifenthrin	Talstar	Curative
cyfluthrin	Tempo	Curative
deltamethrin	Deltagard	Curative
fipronil	Chipco Choice	Preventive and Curative
imidacloprid	Merit	Preventive and Curative
lambda cyhalothrin	Scimitar	Curative

A season-by-season summary of mole cricket biology and management

		LOCATION			
	Life Stage	**Soil**	**Air**	**Turf surface**	**Management**
SPRING	**ADULTS** Heavy bodied, winged, reddish-brown to gray insects with short, thick front legs adapted for digging. Up to 1.5“ in length, and roughly 1/2” in width (3.8 X 1.2 cm)	**Prior to night flights, underground tunneling and feeding are initiated in the spring, when night temperatures reach 60F (15C). Following night flights, females burrow into the soil and lay up to 150 eggs there**	**Mating & flight occur over a period of 2 or more months, during warm, clear nights, with peak flights when average air temps reach 75F (24C). Flights are heaviest following rain. Most adults die in a few weeks**	**The adults of some species leave their burrows at night to feed on above-ground plant parts such as leaves, stolons and stems**	Map mole cricket activity (tunneling and mounds). If Nematac-S is used, it should be applied during spring to target adults or large nymphs. A follow-up application of conven-tional insecticides, targeting small nymphs in summer (see below) may also be necessary.
SPRING	**EGGS** Gray, light yellow or brown, eggs are shiny, oval-shaped and about 1/10” (3 mm) long	**Eggs are laid about 2 weeks after night flights and mating, 4” (10cm) or deeper in the soil.**			There are no management strategies targeted at the eggs
SUMMER	**NYMPHS** Similar in appearance to adults, but smaller (1/4” – 1-1/2” [6 – 38 mm long) and with wings either absent or undeveloped.	**Nymphs hatch from eggs in the soil, 20 to 30 days after they are laid. Hatch is delayed if soil is dry or temps are cool. Nymphs feed on roots and tunnel in the upper soil profile during this period.**		**The nymphs of some species leave their burrows at night to feed on above-ground plant parts such as leaves, stolons and stems**	Target newly hatched nymphs for best control with either curative or preventive insecticides. Use weekly soap flushes in previously mapped mole cricket “hot spots” to detect small nymphs. Pre-irrigate **before** insecticide application if soil is dry.
FALL & WINTER	**ADULTS** Nymphs molt to become adults in fall or winter, depending on the species	**Feeding & tunneling continue until minimum air temps go below 60F (15C). At this point, overwintering begins, and feeding ceases.**	**Adults may fly in the fall, but there is little mating and no eggs are laid.**	**Adults of some species leave their burrows at night to feed on leaves, stolons and stems. This activity slows down as weather cools.**	Management of mole crickets at this stage is not recommended.