

# Mole Cricket IPM Guide for Florida<sup>1</sup>

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Mole crickets can become serious pests of turfgrasses, pastures, and vegetable seedlings. The first step in determining if you have a mole cricket problem at a site is to compare the existing damage to pictures of known mole cricket damage. If the damage is likely caused by mole crickets, specimens should be obtained and the pest identified. You then should determine if the number of mole crickets is great enough to cause an unacceptable level of damage and decide what control measures should be used. Eventually, a long-term, sustainable integrated pest management (IPM) program should be established. This guide will help you identify mole cricket infestations and manage them effectively and economically while minimizing environmental impacts.

## Section 1: Observe Damage

### Plants Affected

Mole crickets are most often thought of as pests of grasses, such as bahiagrass, bermudagrass, centipedegrass, seashore paspalum, St. Augustinegrass, and zoysiagrass. However, other plants that can be damaged by mole crickets include but are not limited to beet, cabbage, cantaloupe, carrot, cauliflower, chrysanthemum, chufa, coleus, collard, eggplant, gypsophila, kale, lettuce, onion, peanut, pepper, potato, rice, spinach, strawberry, sugarcane, sweet potato, tobacco, tomato, and turnip.

### Damage Caused

Mole cricket feeding and tunneling can damage or kill the affected plants, especially during warm and moist summer months when the nymphs are rapidly developing. Feeding on the underground plant parts can cause an overall decline, dead patches, and little to no root mass. In pastures, mole-cricket-infested grass may be uprooted by feeding livestock, rendering the grass unavailable for additional grazing. When mole crickets tunnel in the upper ten inches of the soil surface, plants can become dislodged or have limited water uptake. Moreover, tunneling can create raised surface ridges that disrupt ball roll on golf courses (Figure 2). It may be a symptom of mole cricket activity when plants appear drought-stricken even after sufficient irrigation (Figures 3). Vegetables and other plants are also affected through underground feeding on roots or tubers, and above-ground feeding on foliage or stems, along with their tunneling activity. Above-ground feeding often results in girdling around the base of the stem, or at times the entire plant may be chewed off and taken into a tunnel as food and consumed. This girdling is especially common in seedlings. Flying adult mole crickets are attracted to lights at night, and they often burrow into moist soil nearby to mate and lay eggs. An initial adult mole cricket infestation thus may be localized around outdoor light sources and/or sprinkler heads. After egg hatch and as the next-generation nymphs mature and disperse, greater areas become damaged.

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# Do you have a mole cricket infestation?

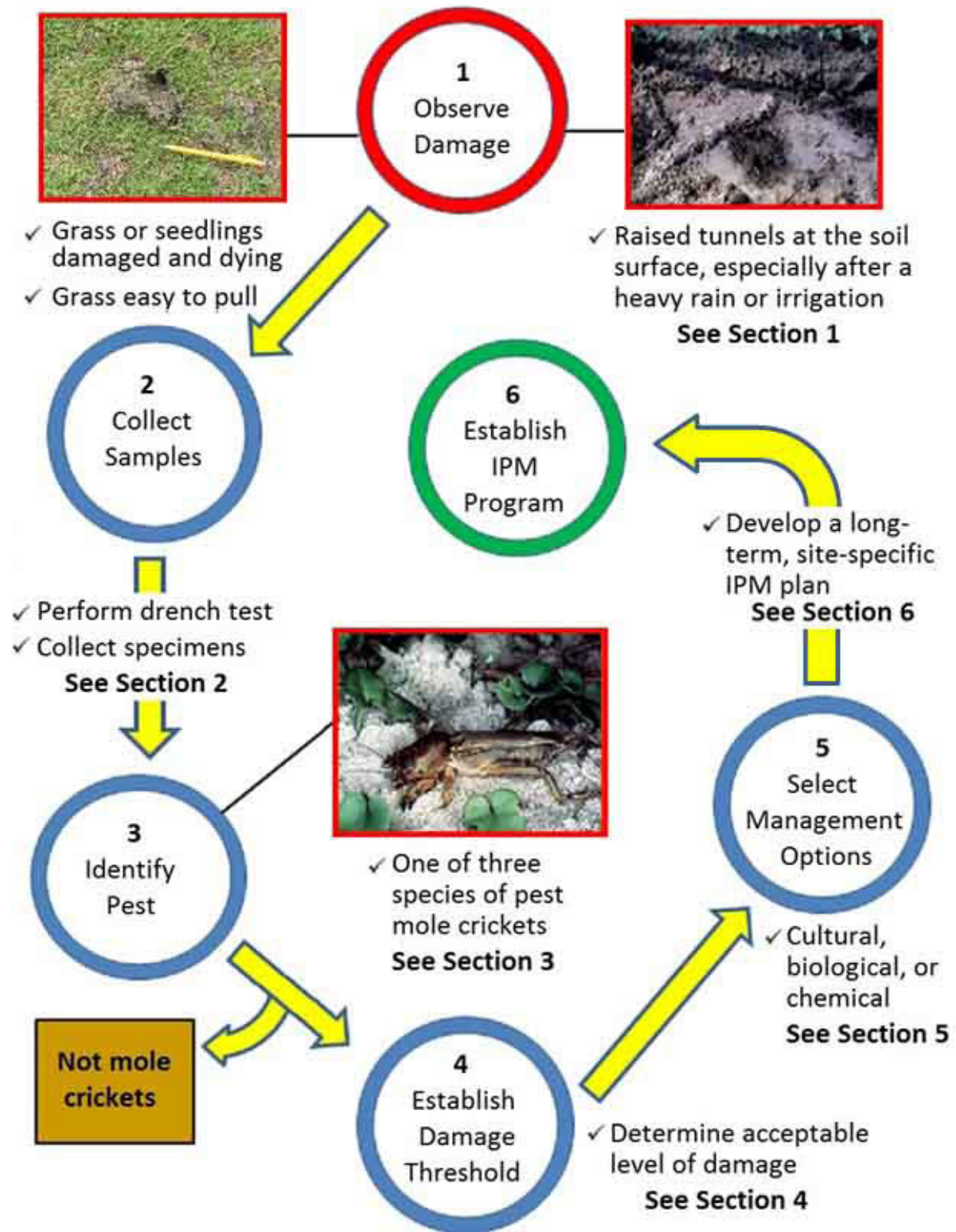


Figure 1. Pest mole cricket management: observe damage, collect samples, identify specimens, establish a damage threshold, select management options, and develop a long-term IPM program.





Figure 2. Characteristic mole cricket tunnels.  
Credits: N. Leppla, UF/IFAS



Figure 3. Dead patches caused by mole crickets feeding on turfgrass.  
Credits: E. Buss, UF/IFAS

## Section 2: Collect Samples

Sampling is a critical part of a well-designed IPM program; it is important to know which pests are present and roughly how many there are. Doing a soap drench can bring mole cricket nymphs and adults to the soil surface, so their species and relative age can be determined. How many insects emerge from the soil may provide an idea of how bad an infestation is, but tunneling severity within a defined area may be more useful for decision-making. Below is a simple drench test for collecting specimens to be identified and for estimating mole cricket population densities. In this procedure, several 4 ft<sup>2</sup> samples are taken from soil that must be moist:

1. Mix ¾ oz. (1.5 tablespoons) of liquid dishwashing soap in a container with 1 gallon of water.

2. Mark out a 2 ft. x 2 ft. area where mole cricket activity is suspected.
3. Evenly pour the soap solution over the marked area.
4. Observe the area for 3 minutes; count and collect the mole crickets that emerge.
5. In many cases, control actions are justified if two or more mole crickets surface during the 3-minute sampling period. See Section 4, “Establishing Damage Threshold,” for more information to help you determine whether to treat.

## Section 3: Identify Pest

Three non-native pest species of mole crickets occur in Florida: the shortwinged mole cricket, *Scapteriscus abbreviatus* Scudder; the southern mole cricket, *Scapteriscus borellii* Giglio-Tos; and the tawny mole cricket, *Scapteriscus vicinus* Scudder. All three are believed to have been unintentionally transported into the southeastern United States around 1900. It is necessary to distinguish the native, non-pest species of mole cricket, genus *Neocurtilla*, from the invasive mole crickets in the genus *Scapteriscus*. Native mole crickets have four dactyls (claws) on the forelegs and the pest mole crickets have two (Figure 4).

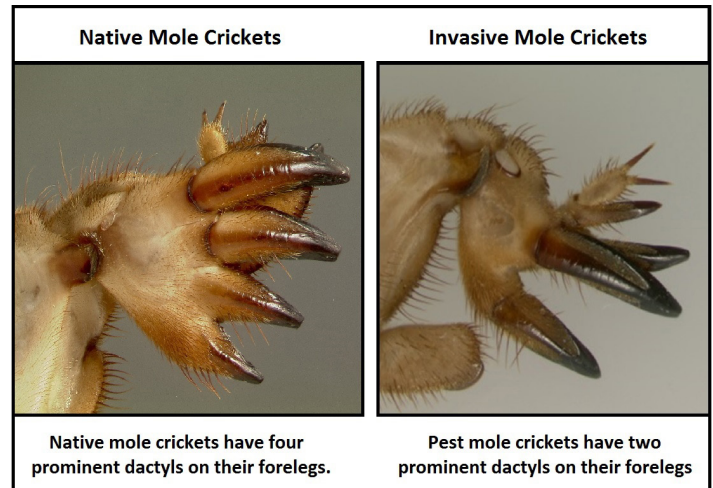


Figure 4. Differences in dactyls between native and invasive mole crickets.

Credits: L. Buss, UF/IFAS















<p><b><i>S. abbreviatus</i></b> <b>(Shortwinged Mole Cricket)</b></p>	<p><b><i>S. borellii</i></b> <b>(Southern Mole Cricket)</b></p>	<p><b><i>S. vicinus</i></b> <b>(Tawny Mole Cricket)</b></p>
		
		
		
		
<p>The adult shortwinged mole cricket is 22-29 mm long and has wings that are shorter than its pronotum (patterned area just behind the head), generally no longer than the mid-abdomen. The forewings completely cover the hind-wings. Adults cannot fly. The pronotum is brown with several darker spots. The area between the two dactyls appears "U-shaped." The shortwinged mole cricket causes limited damage to plants.</p>	<p>The adult southern mole cricket is 25-32 mm long. Forewings are longer than the pronotum, and the hind-wings extend beyond the tip of the abdomen. The pronotum is mottled dark brown, or dark brown with four lighter spots. The area between the two dactyls appears "U-shaped." The southern mole cricket is mainly predacious and, although it feeds on plants, most of the damage is caused by tunneling.</p>	<p>The adult tawny mole cricket is 24-33 mm long. Forewings are longer than the pronotum, and the hind-wings extend beyond the tip of the abdomen. The pronotum is brown with a darker central region. The area between the two dactyls appears "V-shaped." The tawny mole cricket feeds only on plants, and is usually the most abundant, wide-spread, and damaging of the three invasive species.</p>

Figure 5. Identification of invasive mole cricket species.  
Credits: L. Buss, UF/IFAS

## Mole Cricket Life Cycle

**Eggs (Figure 6):** The female builds a circular egg chamber in the soil near one of the tunnels. The 3- to 4-cm-diameter chambers are placed 5-30 cm below the soil surface. Eggs are deposited in a cluster within the egg chamber, each mass containing 25-60 eggs. Eggs are gray to brownish and roughly oval, measuring about 3 mm long and 1.7 mm wide when fresh. Through the absorption of water, the eggs reach a final size of about 3.9 mm long and 2.8 mm wide. Egg development requires 10-40 days, depending on the soil temperature. A female produces 2-5 egg masses in a lifetime.



Figure 6. Shortwinged mole cricket eggs close to hatching.  
Credits: L. Buss, UF/IFAS

**Nymphs (Figure 7):** Recently hatched nymphs, called first instars, are whitish but darken to their mature color during the first 24 hours. First instars may consume the egg shell or cannibalize siblings; however, they soon leave the egg chamber and burrow to the soil surface. Nymphs and adults are similar in appearance, except nymphs have underdeveloped external wings called wing-pads. Development time of nymphs varies, requiring 23-38 weeks during which they go through 8-10 instars before becoming adults.



Figure 7. Shortwinged mole cricket nymphs (note the lack of wings).  
Credits: J. Castner, UF/IFAS

**Adults (Figure 8):** Adult mole crickets are light yellowish to dark brownish and measure 22-33 mm in length, depending on the species. They have enlarged forelegs with dactyls, blade-like projections used for digging. Their antennae are shorter than the body, and they have two long sensory appendages called “cerci” at the tip of the abdomen. Tawny and southern mole crickets become active at dusk when each male emits a “song” from its burrow that attracts a female of the same species. They mate within the burrow, after which the female may eject the male and occupy the burrow. Unlike the other two species, the shortwinged mole cricket male produces only a weak pulsing chirp that attracts a female.



Figure 8. Tawny mole cricket adult.  
Credits: L. Buss, UF/IFAS

## Mole Cricket Seasonal and Geographic Distribution

### THE SHORTWINGED MOLE CRICKET

The shortwinged mole cricket occurs mainly in coastal regions, with sandy soils (Figure 9). Since it is flightless, the species has not spread as extensively as the other two pest mole crickets. It currently has a limited geographical range in Florida, but all life-stages can occur year-round.

### THE SOUTHERN MOLE CRICKET

The southern mole cricket occurs across much of the southeastern United States from southern North Carolina to central Texas (Figure 10). It also has been reported recently in Yuma, Arizona, and Los Angeles County, California. It is distributed throughout Florida, occurring primarily



in moist, sandy areas. This mole cricket usually has one generation per year, but it has two in southern Florida. Peak flights generally occur from April to June, with an additional minor flight around November. However, in south Florida, a second major flight usually occurs in July.

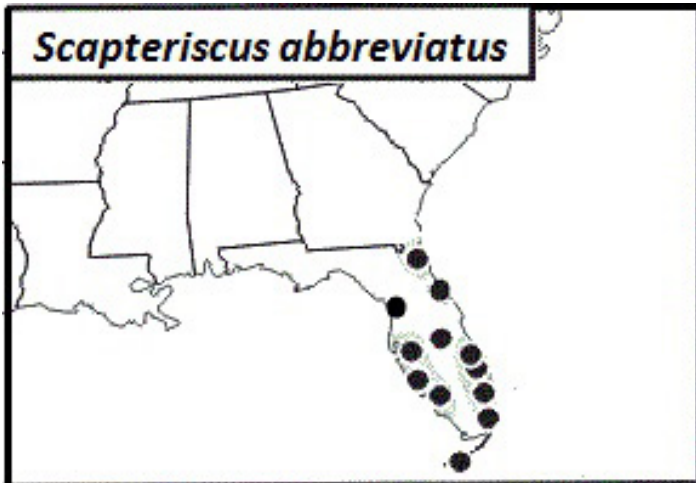


Figure 9. Distribution of the shortwinged mole cricket.  
Credit: T. Walker, UF

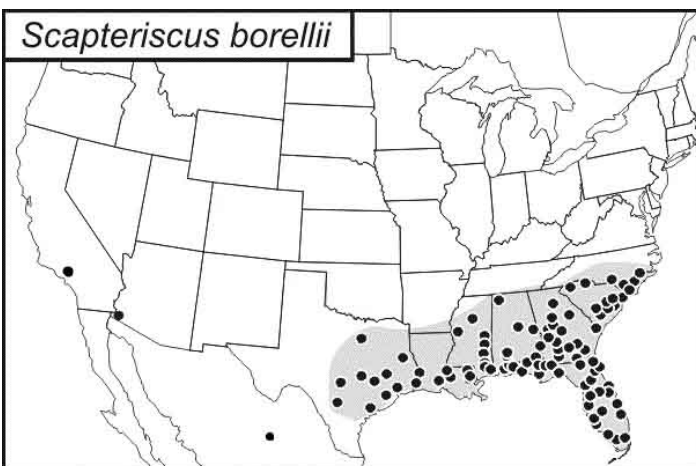


Figure 10. Distribution of the southern mole cricket.  
Credit: T. Walker, UF

## THE TAWNY MOLE CRICKET

The tawny mole cricket occurs within several miles of the Atlantic and Gulf coasts from North Carolina to eastern Texas (Figure 11). However, it is distributed throughout Florida and primarily inhabits well-drained, moist, sandy areas. This mole cricket has one full generation per year with peak flights generally occurring in March-May, with an additional minor flight in the fall. After December, nearly all mole crickets in flight are the tawny mole cricket. Egg hatch occurs in April-June, after which nymphs develop for five months and become adults as early as September.

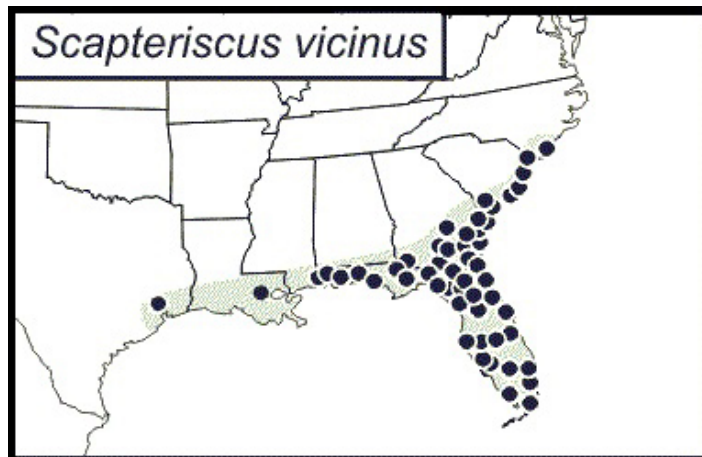


Figure 11. Distribution of the tawny mole cricket.  
Credit: T. Walker, UF

## Section 4: Establish Damage Threshold

The amount of plant damage a homeowner or site manager determines is tolerable is called the “damage threshold.” It varies with the site and expectations for plant quality. On athletic fields and golf courses, the more intensive management practices, lower cutting heights, and esthetic standards may dictate lower thresholds. In vegetable production, on the other hand, acceptable levels of damage may be low during the seedling stage but higher as the plants mature. Thresholds are highly subjective and vary with the condition of the plants.

The damage mole crickets cause is related to the species, stage, and number of mole crickets that infest the site. Tawny mole crickets, for instance, cause a relatively high degree of destruction, and a range of 2-4 adult mole crickets per 4 ft<sup>2</sup> is a general upper limit warranting management action for turf, though most managers set the damage threshold somewhat higher for pastures. The plant damage nymphs cause increases as they grow and disperse. Continue sampling and re-evaluating thresholds throughout the mole crickets’ life cycle to watch for increases both in the number of mole crickets and the damage they are causing. Ultimately, the severity of a mole cricket infestation and the associated damage threshold will dictate which control options will be most effective and economical.

## Section 5: Select Management Options

Options for managing mole crickets in turfgrass include cultural control, biological control, and chemical control. Properly integrating several options will provide the greatest level of long-term control. After verifying the species,

stage, and relative abundance of mole crickets, and deciding on a reasonable action threshold, select management practices from the following options:

## Cultural Control

Cultural controls are steps taken in the management of a site that can make it less attractive or supportive for mole crickets. Steps may include selecting tolerant plant cultivars, altering soil moisture, reducing attractive lighting, and changing various growing practices. Cultural controls, such as lighting, may be implemented individually or used in conjunction with other methods.

## TOLERANT CULTIVARS

No turfgrass species or cultivar is completely resistant to mole cricket damage, although centipedegrass, St. Augustinegrass, and zoysiagrass are considered the least frequently injured. Bahiagrass, bermudagrass, and seashore paspalum tend to be the most susceptible to damage caused by mole crickets. Table 1 describes some susceptible and tolerant turfgrass cultivars.

Table 1. Some tolerant and susceptible cultivars of turfgrass species.

Turfgrass	Generally Susceptible Cultivars	Generally Tolerant Cultivars
Bahiagrass	Pensacola, Tifton 9, and Sand Mountain	Argentine and Paraguay 22 (tolerance can be low)
Bermudagrass	Tifdwarf, Tifgreen, Sunturf, Texturf-10 and Texturf-1F	Ormond, Tifsport, Tifeagle, Tifway, Tifton-44
Centipedegrass	Most cultivars generally tolerant	
Seashore Paspalum	Most cultivars generally susceptible	
St. Augustinegrass	Bitterblue	Most cultivars generally tolerant
Zoysiagrass	Royal and Meyer	Diamond, Palisades, Emerald, Cavalier

## SOIL MOISTURE

Soil moisture can affect mole crickets, significantly increasing plant damage at irrigated sites. Mole crickets remain closer to the soil surface when the soil is moist but tunnel deeper when the soil is dry. Rain after a long dry period causes an increase in the number of mole crickets in flight and may increase the number attracted to lights. During periods of egg-laying, females prefer to lay more eggs in irrigated areas than in non-irrigated ones. Egg survival decreases under drought conditions. Long-term control of soil moisture generally is not an option because it would

disrupt plant growth, but the response of mole crickets to soil moisture can be used to time pest management practices. For example, insecticides could be more effective if applied after irrigation that brings mole crickets closer to the soil surface. Alternatively, flooding can drown the mole crickets or force them to move to higher ground where insecticides can be applied as spot treatments.

## LIGHTING

Mole crickets fly at dusk for 1-2 hours during which they are attracted to light, especially ultraviolet and mercury-vapor lamps. To limit the incidence of mole crickets in turfgrass, lights should be turned off at a site during times of peak flight. Conversely, lights can be used to attract mole crickets for spot treatment with insecticides. If lights are necessary, yellow bulbs or filters can be used to minimize attraction of mole crickets.

## TILLAGE

The objective of tilling is to expose mole crickets to predation or desiccation and kill them mechanically. Feeding by birds may be promoted by tilling, for example. In addition to exposing or damaging the insects, tilling can destroy their burrows and cause them to relocate. Tilling generally is not used on turfgrasses but can be effective on agricultural sites. Till when eggs and young nymphs are present because these life stages are more palatable to birds and less able to resist desiccation, so they are more likely to be killed than adults.

## PLANT HEALTH

The plant's health can affect its tolerance to damage by mole crickets. Maintaining proper fertilization, irrigation, and soil conditions is important. For turfgrasses, leaving sufficient shoot growth after mowing is important because cutting too close increases stress on the grass. Mowing height recommendations are given in table 2. For pastures, overgrazing should be avoided as this can cause significant stress to the grass.

Table 2. Turfgrass mowing height recommendations.

Turfgrass	Recommended mowing height
Bahiagrass	3-4"
Bermudagrass	Cultivar and utility dependent
Centipedegrass	1-1.5"
St. Augustine Dwarfs	2-2.5"
St. Augustine Standards	3.5-4"
Zoysiagrass	2-2.5"
<i>Source: Dr. Trenholm, UF/IFAS</i>	



## RECORD KEEPING

Areas that historically have been infested by mole crickets are likely to be re-infested. It therefore is important to document and map these preferred mole cricket habitats. Monitor these areas intensively so that you can implement control measures quickly before damage thresholds are exceeded.

## Biological Control

Biological control is the use of living natural enemies to control pests. Natural enemies can be predators, parasites, pathogens, or competitors. Populations of some natural enemies may be augmented by habitat manipulation. In some cases, natural enemies can be produced in large quantities and released at sites that have too few established natural enemies to effectively limit pest populations, keeping it below the damage threshold. For pest mole crickets in Florida, widespread applications have been made of the entomopathogenic mole cricket nematode, *Steinernema scapterisci*, in addition to releases of the Larra wasp, *Larra bicolor*, and Brazilian red-eyed fly, *Ormia depleta*. These non-native natural enemies were imported, tested for safety and released by the UF/IFAS Mole Cricket Research Program. All are currently present in Florida, but none are available commercially. Specifics on the importation and introduction of these three introduced natural enemies are given by Frank and Walker (2006).

## MOLE CRICKET NEMATODE

This nematode (Figure 12) was introduced from South America and widely applied across Florida as a biopesticide until 2012. It infects large nymphs and adults, reproducing inside them to yield additional generations of nematodes. These parasites are not normally observed outside the host; they are spread throughout an area by the infected mole crickets.



Figure 12. *Steinernema scapterisci* nematodes emerging from an adult mole cricket in the laboratory.  
Credits: L. Buss, UF/IFAS

## LARRA WASP

This wasp (Figures 13 and 14) was introduced from South America into south Florida in 1981, and again into north Florida in 1988, to control pest mole crickets. It parasitizes only *Scapteriscus* spp. and does not sting people, so it was safe to release. The adult wasp is black with a red abdomen, and its wings are clear to smoky blue. A female usually lays one egg on each mole cricket it finds. The egg hatches in 6-7 days, the larva feeds on the mole cricket for 10-11 days and kills it, then pupates in a cocoon in the soil. A new adult emerges roughly 6 weeks later during the warmer months, but those that pupate in the fall may become adults by the following April. Larra wasps lay eggs only on mole cricket adults and medium to large nymphs.



Figure 13. Larra wasp laying an egg onto a tawny mole cricket adult.  
Credits: L. Buss, UF/IFAS



Figure 14. Larra wasp larva feeding on a tawny mole cricket adult.  
Credits: L. Buss, UF/IFAS

Larra wasps require a nectar source for their survival. The shrubby false button weed, *Spermacoce verticillata* (a.k.a. larraflower), is the preferred nectar source (Figure 15). White flowered pentas, *Pentas lanceolata*, and partridge pea, *Chamaechrista fasciculata*, are good alternative nectar sources. If either of these plants or other nectar sources are available, larra wasps will appear and forage at least 200 yards from them to locate mole crickets. Larraflower can be invasive, so it should be contained. Partridge pea may be toxic if consumed by livestock.

## Distribution

By the end of 2008, the larra wasp had spread into much of north and central Florida and had penetrated into parts of south Florida (Figure 16). It also expanded its range into



southern and eastern Georgia and coastal areas of Alabama and Mississippi. More recently it has been reported from eastern South Carolina and southeastern North Carolina. In northern Florida, larra wasp adults are active from late April until the first hard frost; in southern Florida, activity may persist year-round, offering even greater mole cricket suppression.



Figure 15. Larra wasp feeding on *S. verticillata* nectar.  
Credits: L. Buss, UF/IFAS

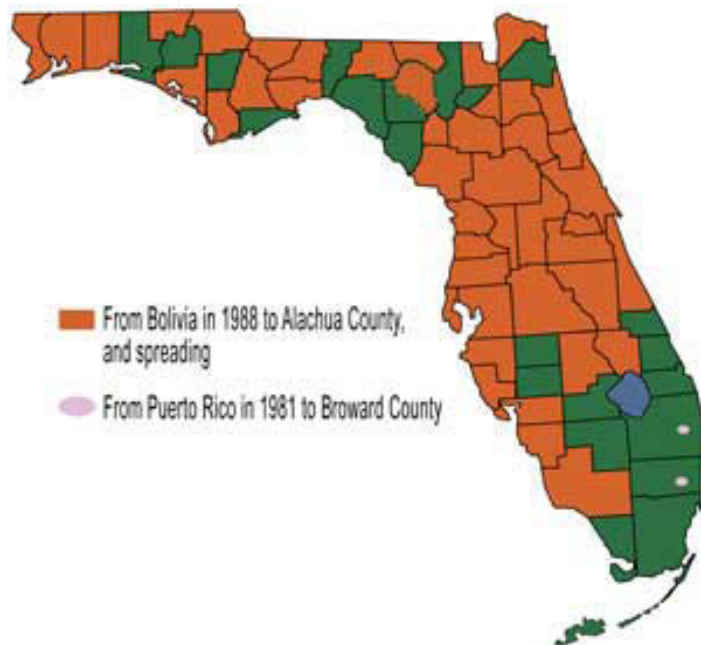


Figure 16. Distribution of larra wasp in Florida.  
Credits: J. H. Frank, UF/IFAS

## BRAZILIAN RED-EYED FLY

This tachinid fly was introduced from South America to suppress invasive mole crickets. The Brazilian red-eyed fly is distributed in the southern and central parts of Florida with the northern boundary reaching Alachua County (Figure 17). The fly parasitizes a pest mole cricket adult by depositing a larva nearby, the larva finds the adult, develops inside it, and kills it. Golf courses inhabited by the Brazilian red-eyed fly have considerably less damage than those without the fly.

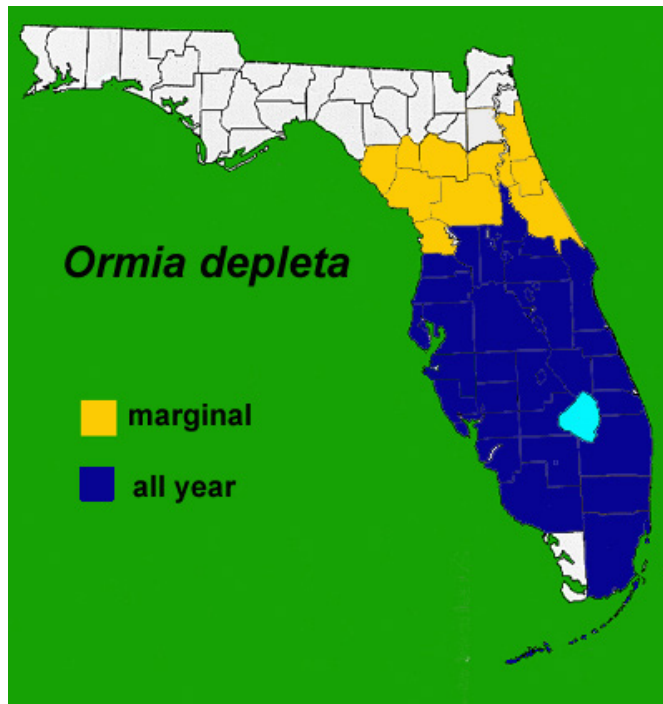


Figure 17. Distribution of Brazilian red-eyed fly in Florida.  
Credit: J. H. Frank, Univ. Fla



Figure 18. Brazilian red-eyed fly pupa next to mole cricket.  
Credit: L. Buss, UF

## MOLE CRICKET PREDATORS

Naturally occurring predators of mole crickets include raccoons, opossums, armadillos, birds, spiders, tiger beetles, and many other insectivorous animals. Unfortunately, foraging by some of these predators, especially armadillos, can cause considerable damage to turfgrass.



Figure 19. Brazilian red-eyed fly adult.  
Credit: L. Buss, UF

## Chemical Control

Mole cricket IPM includes the use of insecticides when necessary; however, applications can be expensive and disruptive to biological control. Apply an insecticide only when the plant damage threshold is met or exceeded, and follow the instructions on the label. Time applications and target them to infested areas, thus reducing costs and environmental risks. On golf courses, for example, it's frequently most effective to apply insecticides only to fairways, greens, and tees, leaving roughs and driving ranges untreated to maintain populations of beneficial organisms. Small nymphs feeding and growing during the summer months are more susceptible to insecticides than large nymphs present in late summer and fall.

The tables below list the insecticide active ingredients for products in the National Pesticide Information Retrieval System (<http://npirspublic.ceris.purdue.edu/>) that are currently registered for use in Florida on pest mole crickets in residential lawns, golf courses and athletic fields, pastures, and on vegetables. Registrations for Florida specified 2014 as the year of last registration. Listed are biologically active ingredients that kill pest mole crickets. To minimize resistance to insecticides, products should be rotated based on the Insecticide Resistance Action Committee (IRAC) group numbers. The tables and associated appendix in this publication serve as guides only: keep in mind that the information in them is likely to be outdated because both regulations and registrations are constantly changing.

The appendix includes registered insecticide products formulated with the active ingredients listed in the tables. Restricted-use insecticides must be applied by a licensed

applicator. You must read and understand the current product label before applying any insecticide. The label lists all specific sites and pests for which an insecticide may be applied legally. It also displays a signal word indicating the relative toxicity of the product to mammals: slightly toxic (CAUTION), moderately toxic (WARNING), or highly toxic (DANGER).

### Residential Lawns<sup>1</sup>

Active Ingredient	IRAC Number	Active Ingredient	IRAC Number
Azadirachtin	29	Esfenvalerate	3A
<i>Beauveria bassiana</i>	Biopesticide	Fipronil	2B
Beta-cyfluthrin	3A	Gamma-cyhalothrin	3A
Beta-cyfluthrin & imidacloprid	3A 4A	Imidacloprid	4A
Bifenthrin	3A	Imidacloprid & lambda-cyhalothrin	4A 3A
Bifenthrin & imidacloprid	3A 4A	Indoxacarb	22A
Bifenthrin & zeta-cypermethrin	3A 3A	Lambda-cyhalothrin	3A
Bifenthrin imidacloprid & zeta-cypermethrin	3A 4A 3A	Permethrin	3A
Carbaryl	1A	Piperonyl butoxide, esfenvalerate & prallethrin	27A 3A 3A
Carbaryl & bifenthrin	1A 3A	Thiamethoxam	4A
Clothianidin	4A	Thiamethoxam & azoxystrobin (fungicide)	4A
Clothianidin & bifenthrin	4A 3A	Thiamethoxam & lambda-cyhalothrin	4A 3A
Cyfluthrin	3A	Trichlorfon	1B
Cypermethrin	3A	Zeta-cypermethrin	3A
Deltamethrin	3A		

<sup>1</sup> Insecticide applications on residential lawns may require a period of time before use is permitted. Be sure to read the entire label before applying any insecticide.



## Golf Courses and Athletic Fields<sup>1</sup>

Active Ingredient	IRAC Number	Active Ingredient	IRAC Number
Acephate	1B	Fipronil	2B
Allyl isothiocyanate & capsaicin	--	Imidacloprid	4A
Beauveria bassiana	Biopesticide	Indoxacarb	22A
Beta-cyfluthrin	3A	Lambda-cyhalothrin	3A
Bifenthrin	3A	Permethrin	3A
Bifenthrin & imidacloprid	3A 4A	Piperonyl butoxide & permthrin	27A 3A
Bifenthrin & zeta-cypermethrin	3A 3A	Piperonyl butoxide & pyrethrins	27A 3A
Bifenthrin imidacloprid & zeta-cypermethrin	3A 4A 3A	Pyrethrins	3A
Carbaryl & bifenthrin	1A 3A	Thiamethoxam	4A
Chlorpyrifos	1B	Thiamethoxam & azoxystrobin (fungicide)	4A --
Cyfluthrin	3A	Trichlorfon	1B

<sup>1</sup> Insecticide applications on golf courses and athletic fields may require a period of time before use is permitted. Be sure to read the entire label before applying any insecticide.

## Pastures<sup>1</sup>

Active Ingredient	IRAC Number
<i>Beauveria bassiana</i>	Biopesticide
Carbaryl	1A
Piperonyl butoxide & pyrethrins	27A 3A
Pyrethrins	3A

<sup>1</sup> Insecticide applications on pastures may require a period of time before grazing or cutting are permitted. Be sure to read the entire label before applying any insecticide.

## Vegetables<sup>1</sup>

Active Ingredient	IRAC Number
<i>Beauveria bassiana</i>	Biopesticide
Bifenthrin	3A
Carbaryl	1A
Piperonyl butoxide & pyrethrins	27A 3A

<sup>1</sup> Insecticide applications on vegetables may require a period of time before harvesting and consumption are permitted. Be sure to read the entire label before applying any insecticide.

## Section 6: Establish IPM Program

Develop a long-term, site-specific IPM program by combining cultural, biological, and chemical control measures to suppress pest mole crickets to levels that assure plant damage thresholds are not exceeded and that minimize costs and risks to humans and the environment. The program is based on plant selection and growing practices and mole cricket biology and management options.

The following are guidelines to consider in developing an IPM program for turfgrass:

1. Use a tolerant grass cultivar or species, such as centipede-grass or zoysiagrass.
2. Maintain healthy grass with proper irrigation and cutting.
3. Perform routine soil testing and add fertilizer or lime as needed.
4. Reduce watering during winter months; mole crickets require moist soil.
5. Plant a nectar source such as larraflower or partridge pea to attract and support Larra wasp populations.
6. Eliminate lights from sunset to well past dark during months of peak mole cricket flight.
7. Sample regularly for mole crickets; 2-4 per 4 ft<sup>2</sup> may require management.
8. Apply insecticides if plant damage thresholds are exceeded; evaluate their effectiveness.
9. Target and map areas that become infested.
10. Rotate insecticide chemical classes to delay pesticide resistance.

## Acknowledgments

We thank Dennis Howard, Chief, Bureau of Pesticides and Bob Moore, Environmental Specialist in the Pesticide Registration Section, Bureau of Pesticides, Division of Agricultural Environmental Services, Florida Department of Agriculture and Consumer Services, for guidance and assistance with searching the National Pesticide Information Retrieval System. Fred Fishel, Director, UF/IFAS Pesticide Information Office, provided access to the system. He and John Capinera, Chair, UF/IFAS Entomology and Nematology Department, contributed helpful reviews of the

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application are permitted by consulting the product's label and always wear proper personal protective equipment.

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## Appendix

The National Pesticide Information Retrieval System (<http://npirspublic.ceris.purdue.edu/>) was used to compile the list of registered insecticide products in this appendix. This retrieval system is available by subscription. The first search criterion was “pest to be controlled,” so we used the keyword “mole cricket” and selected all four resulting variations—mole crickets, mole crickets (larvae), mole crickets (nymphs), and mole crickets (adults). Most of the products have not been tested for efficacy by the University of Florida. The application sites and respective site-specific keywords or categories were as follows:

- **Residential Lawns:** For the specific keyword we used “lawn.” For sites, we selected all ornamental lawns and turf, including bahiagrass, bermudagrass, centipedegrass, ryegrass, and St. Augustinegrass.
- **Golf Courses and Athletic Fields:** For the specific keywords we used “golf or athletic.” For sites, we selected all ornamental turf, athletic fields, golf course turf, annual ryegrass, bahiagrass, bermudagrass, centipedegrass, St. Augustinegrass, and zoysiagrass options except those signaling golf course sand traps, water treatment, grown for sod, stump treatment, soil fumigation, or seed treatment.
- **Pastures:** Within the list generated by the agriculture site category, “forage, fodder, hay and silage grasses,” we selected forage-fodder grasses, pastures, bermudagrass, bahiagrass, and rangeland.
- **Vegetables:** Within the agriculture site category, we selected cucurbits, fruiting vegetables, leafy vegetables, root crop vegetables, seed and pod vegetables, and miscellaneous vegetables, and within those categories we included all crops that might be infested by mole crickets.

The insecticide lists given below serve as a guide only; keep in mind that the information given will likely become outdated because both regulations and registrations are constantly changing. **The applicator holds full responsibility in verifying the legal usage and assumes all associated liability when applying any pesticide.** Before applying an insecticide listed, verify your target pest and specific site of

Partial Mole Cricket IPM Program for North Central Florida.

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
<b>Event</b>												
Adult flights												
Egg hatch												
Nymph development												
<b>Action</b>												
Sample												
Reduce watering												
Reduce lighting												



## Insecticide Products Registered for Residential Lawns.

### Azadirachtin

SAFER BRAND BIONEEM MULTI-PURPOSE INSECTICIDE & REPELLENT CONCENTRATE  
SAFER BRAND GRUB KILLER READY-TO-SPRAY  
NEEMIX 4.5

### *Beauveria bassiana*

BOTANIGARD ES  
MYCOTROL O

### beta-Cyfluthrin

BAYER ADVANCED TRIPLE ACTION INSECT KILLER FOR LAWNS  
BAYER ADVANCED POWER FORCE MULTI-INSECT KILLER  
TEMPO ULTRA GC INSECTICIDE (RESTRICTED USE)

### beta-Cyfluthrin & Imidacloprid

BAYER ADVANCED COMPLETE BRAND INSECT KILLER FOR SOIL & TURF  
BAYER ADVANCED COMPLETE INSECT KILLER FOR SOIL & TURF  
BAYER ADVANCED LAWN COMPLETE INSECT KILLER FOR SOIL & TURF

### Bifenthrin

ACTISHIELD LIQUID INSECTICIDE  
BASELINE FLORIDA INSECTICIDE  
BASELINE INSECTICIDE  
BASIC SOLUTIONS LAWN & GARDEN INSECT KILLER GRANULES  
BIFEN I/T INSECTICIDE/TERMITICIDE  
BIFEN L/P INSECTICIDE GRANULES  
BIFEN XTS  
BIFENTHRIN GC GRANULES (RESTRICTED USE)  
BISECT G (RESTRICTED USE)  
BISECT L  
BONIDE EIGHT INSECT CONTROL FLOWER & VEGETABLE ABOVE & BELOW SOIL INSECT GRANULES  
BONIDE INSECT & FEED  
BROADCIDE FLOWABLE INSECTICIDE GC (RESTRICTED USE)  
BROADCIDE GRANULAR INSECTICIDE GC (RESTRICTED USE)  
CARPETMAKER X-X-X WITH 0.069 TALSTAR GRANULAR INSECTICIDE  
COMPARE-N-SAVE CONCENTRATED INDOOR/OUTDOOR INSECT CONTROL  
COMPARE-N-SAVE LAWN INSECT CONTROL GRANULES  
FERTILIZER W/TALSTAR 0.069%  
FERTILIZER W/TALSTAR 0.096%  
FERTILIZER W/TALSTAR 0.2%  
FERTI-LOME BROAD SPECTRUM INSECTICIDE  
FORTIFY INSECT CONTROL  
FORTIFY PHOSPHORUS FREE INSECT CONTROL PLUS LAWN FOOD 18-0-5  
GREEN THUMB PREMIUM FERTILIZER + INSECT CONTROL 30-3-4  
GREEN THUMB PREMIUM INSECT CONTROL GRANULES  
GREEN THUMB SUMMER INSECT CONTROL + LAWN FERTILIZER (25-0-5)  
GROWERS FERTILIZER WITH 0.083% BIFENTHRIN  
HEAVY WEIGHT MULTI-INSECT & FIRE ANT KILLER GRANULES  
HI-YIELD BUG BLASTER BIFENTHRIN 2.4  
HI-YIELD BUG BLASTER II TURF INSECT CONTROL GRANULES  
HI-YIELD VEGETABLE & ORNAMENTAL INSECT CONTROL GRANULES  
HJE BIFENTHRIN PL GRANULAR  
HY-END BIFEN S  
KGRO READY TO USE HOME PEST INSECT CONTROL  
LAWNSTAR GRANULAR INSECTICIDE  
LESCO CROSSCHECK 0.069% PLUS FERTILIZER  
LESCO CROSSCHECK EZ GRANULAR INSECTICIDE  
LESCO CROSSCHECK PL GRANULAR INSECTICIDE  
LESCO CROSSCHECK PLUS MULTI-INSECTICIDE  
LESCO TALSTAR 0.069% PLUS FERTILIZER  
LESCO TALSTAR 0.096% PLUS FERTILIZER  
MASTERLINE BIFENTHRIN 7.9 TERMITICIDE/INSECTICIDE  
MAXXTHOR SC  
MAXXTHOR SG  
MENACE 7.9% FLOWABLE (RESTRICTED USE)  
MOLE CRICKET - CHINCH BUG LAWN SPRAY RTS  
MONTEREY TURF & ORNAMENTAL INSECT SPRAY

### Bifenthrin Cont.

ONYX INSECTICIDE  
ONYXPRO INSECTICIDE (RESTRICTED USE)  
ORTHO ANT, FLEA & TICK KILLER FOR LAWNS READY TO USE GRANULES  
ORTHO BUG B GON MAX INSECT KILLER FOR LAWNS  
ORTHO BUG BGON MAX LAWN & GARDEN INSECT KILLER 1  
ORTHO MAX PRO  
PRO-MATE BIFENTHRIN  
PRO-MATE TALSTAR GC 0.069% WITH FERTILIZER (RESTRICTED USE)  
PRO-MATE TALSTAR LG 0.069% WITH FERTILIZER  
QUALI-PRO BIFENTHRIN I/T 7.9 F  
SCOTTS PROFESSIONAL FERTILIZER X-X-X WITH ORTHO MAX PRO  
SENTRYHOME YARD AND PREMISE SPRAY CONCENTRATE  
SERGEANT'S YARD & PREMISE SPRAY CONCENTRATE

### Bifenthrin & Imidacloprid

ALLECTUS G INSECTICIDE  
PRO-MATE ALLECTUS 0.225% PLUS TURF FERTILIZER  
THE ANDERSONS TURF PRODUCTS FERTILIZER WITH ALLECTUS INSECTICIDE  
LESCO ALLECTUS 0.225 INSECTICIDE PLUS FERTILIZER  
SIGNATURE ALLECTUS 0.225 G PLUS TURF FERTILIZER  
TURFPRIDE ACCUBLEND FERTILIZER WITH 0.225G ALLECTUS INSECTICIDE  
TCS GROWSTAR ALLECTUS 0.225 G PLUS TURF FERTILIZER INSECTICIDE  
LESCO ALLECTUS 0.18 G PLUS FERTILIZER  
TCS GROWSTAR ALLECTUS 0.18 G PLUS TURF FERTILIZER INSECTICIDE  
PRO-MATE ALLECTUS 0.15% PLUS TURF FERTILIZER  
TURFPRIDE ACCUBLEND FERTILIZER WITH 0.15G ALLECTUS INSECTICIDE

### Bifenthrin & Zeta-Cypermethrin

ORTHO BUG B GON INSECT KILLER FOR LAWNS (2)  
TALSTAR XTRA GRANULAR INSECTICIDE  
ORTHO BUG B GON INSECT KILLER FOR LAWNS & GARDENS  
TALSTAR XTRA GC GRANULAR INSECTICIDE (RESTRICTED USE)  
TALSTAR XTRA GRANULAR INSECTICIDE

### Bifenthrin, Imidacloprid & Zeta-Cypermethrin

TRIPLE CROWN T&O INSECTICIDE

### Carbaryl

CARBAIT 5  
SA-50 MOLE CRICKET BAIT  
**CARBARYL & BIFENTHRIN**  
FORTIFY ABOVE & BELOW INSECT & GRUB CONTROL  
THE ANDERSONS TURF PRODUCTS DUOCIDE INSECT CONTROL

### Clothianidin

CHINCH BUG KILLER WITH ARENA  
GREEN LIGHT CHINCH BUG KILLER1 WITH ARENA  
GREEN LIGHT GRUB CONTROL WITH ARENA

### Clothianidin & Bifenthrin

ALOFT GC G (RESTRICTED USE – NOT LABELED FOR USE IN FLORIDA)

### Cyfluthrin

BAYER ADVANCED POWER FORCE MULTI-INSECT KILLER  
BAYER ADVANCED VEGETABLE & GARDEN INSECT SPRAY  
BAYER ADVANCED TRIPLE ACTION INSECT KILLER FOR LAWNS & GARDENS  
TEMPO 20 WP GOLF COURSE INSECTICIDE (RESTRICTED USE)

### Cypermethrin

CYPER TC INSECTICIDE  
CYPER-LO EC  
DEMON MAX  
UP-CYDE PRO 2.0 EC TERMITICIDE/INSECTICIDE (RESTRICTED USE)

## Deltamethrin

DELTAGARD G INSECTICIDE GRANULE  
 DELTAGARD T&O GRANULAR INSECTICIDE  
 HI-YIELD IMPORTED FIRE ANT CONTROL GRANULES CONTAINING DELTAMETHRIN  
 HI-YIELD TURF RANGER INSECT CONTROL GRANULES CONTAINING DELTAMETHRIN  
 SUSPEND SC INSECTICIDE  
 TERRO HOME INSECT KILLER

## Esfenvalerate

FENVASTAR ECOCAP  
 ONSLAUGHT MICROENCAPSULATED INSECTICIDE

## Fipronil

CHIPCO CHOICE INSECTICIDE (RESTRICTED USE)  
 QUALI-PRO FIPRONIL 0.1G (RESTRICTED USE)

## gamma-Cyhalothrin

OPTIMATE CS  
 SPECTRACIDE ACRE PLUS TRIAZICIDE INSECT KILLER FOR LAWNS & LANDSCAPES  
 SPECTRACIDE BUG STOP HOME BARRIER REFILL  
 SPECTRACIDE TRIAZICIDE INSECT KILLER FOR LAWNS  
 SPECTRACIDE TRIAZICIDE INSECT KILLER ONCE & DONE!

## Imidacloprid

AGRISEL IMIDAPRO 25C INSECTICIDE  
 ANDERSONS GOLF PRODUCTS TURF FERTILIZER 14-0-14 WITH MERIT  
 ARMOR TECH IMD 25C  
 BAYER ADVANCED LAWN SEASON-LONG GRUB CONTROL  
 BAYER ADVANCED SEASON LONG GRUB CONTROL  
 BONIDE SYSTEMIC INSECT SPRAY WITH SYSTEMAXX  
 CRITERION 0.5 G INSECTICIDE  
 CRITERION 2F INSECTICIDE  
 CRITERION 75 WSP INSECTICIDE  
 DELPHI INSECTICIDE  
 DOMINION 2L TERMITICIDE/INSECTICIDE  
 ENFORCE 0.5G TURF AND ORNAMENTAL INSECTICIDE  
 ENFORCE 75WSP TURF AND ORNAMENTAL INSECTICIDE  
 EQUIL ADONIS 2F INSECTICIDE  
 EQUIL ADONIS 75 WSP INSECTICIDE  
 FERTILIZER W/MERIT 0.15%  
 FERTILIZER W/MERIT 0.2%  
 FERTI-LOME SYSTEMIC INSECT SPRAY  
 FORTIFY SEASON LONG GRUB CONTROL  
 GARANT T&O 2F INSECTICIDE  
 GARANT T&O 75 WSP INSECTICIDE  
 GORDON'S GRUB NO-MORE GRANULES  
 GORDON'S PROFESSIONAL TURF & ORNAMENTAL PRODUCTS IMIDIPRO  
 GRUBEX  
 GRUBEX II  
 HI-YIELD GRUB FREE ZONE II  
 HI-YIELD GRUB FREE ZONE III  
 HI-YIELD SYSTEMIC INSECT SPRAY  
 IMIDASTAR 2L T&O  
 IMIGOLD 0.5 G  
 IMIGOLD 2 F  
 IMIGOLD 70 DF TURF, ORNAMENTAL AND GREENHOUSE INSECTICIDE  
 INVICT BLITZ ANT GRANULES  
 INVICT XPRESS GRANULAR BAIT  
 KNOCKOUT READY TO USE GRUB KILLER GRANULES  
 LADA 2F INSECTICIDE  
 LESCO BANDIT 0.5 G INSECTICIDE  
 LESCO BANDIT 2F INSECTICIDE  
 LESCO BANDIT 75 WSP INSECTICIDE  
 LESCO MERIT 0.2 PLUS TURF FERTILIZER  
 LESCO MERIT 0.2 PLUS TURF FERTILIZER  
 LESCO SYSTEMIC INSECTICIDE CONTAINS MERIT  
 MALICE 0.5G  
 MALICE 75 WSP  
 MALLETT 7.1% PF INSECTICIDE

## Imidacloprid Cont.

MARTIN'S DOMINION TREE & SHRUB  
 MERIT 0.5 G INSECTICIDE  
 MERIT 2F INSECTICIDE  
 MERIT 75 WP INSECTICIDE  
 MERIT 75 WSP INSECTICIDE  
 MIDASH 25C T&O  
 PHOENIX HAWK-I 75WSP  
 PHOENIX HAWK-I 2L  
 PRIMERAONE IMIDACLOPRID 2F INSECTICIDE  
 PROFESSIONAL TURF SOLUTIONS WITH MERIT FERTILIZER  
 PROKOZ ZENITH 0.5 G INSECTICIDE  
 PROKOZ ZENITH 2F INSECTICIDE  
 PROKOZ ZENITH 75 WSP INSECTICIDE  
 PRO-MATE MERIT 0.2% PLUS TURF FERTILIZER  
 PROTHOR SC 2  
 QUALI-PRO IMIDACLOPRID 0.5G INSECTICIDE  
 QUALI-PRO IMIDACLOPRID 75 WSB  
 REGAL MERIT 0.2 PLUS  
 SCOTTS FERTILIZER X-X-X WITH GRUBEX PRO  
 SCOTTS PROFESSIONAL FERTILIZER X-X-X WITH GRUBEX  
 SIGNATURE FERTILIZER WITH 0.2% MERIT  
 SPECTRACIDE GRUB KILLER CONCENTRATE  
 SPECTRACIDE TREE & SHRUB INSECT CONTROL  
 TCS GROWSTAR MERIT 0.2 PLUS TURF FERTILIZER  
 THE ANDERSONS GRUBOUT DG 0.2% INSECTICIDE  
 THE ANDERSONS TURF PRODUCTS FERTILIZER WITH 0.2% MERIT INSECTICIDE  
 TURF PRIDE ACCUBLEND FERTILIZER WITH 0.2% MERIT  
 TURFTHOR WP  
 TURFTHOR WSP  
 XYTECT 2F INSECTICIDE  
 XYTECT 75WSP INSECTICIDE

## Imidacloprid & lambda-Cyhalothrin

LESCO INSECTUS PLUS FERTILIZER  
 BONIDE DURATURF INSECT & GRUB CONTROL  
**Indoxacarb**  
 ADVION INSECT GRANULE  
 PROVAUNT

## lambda-Cyhalothrin

BORDER INSECTICIDE  
 CUTTER BACKYARD BUG CONTROL CONCENTRATE  
 CYZMIC CS  
 DEMAND CS INSECTICIDE  
 DEMAND EZ INSECTICIDE  
 DEMAND G INSECTICIDE  
 EQUIL LAMBDA 9.7 CS INSECTICIDE  
 GRENADE ER  
 LAMBDA-CY EC INSECTICIDE  
 LAMBDASTAR 9.7% CS  
 MARTIN'S CYONARA LAWN & GARDEN INSECT CONTROL  
 MARTIN'S CYONARA LAWN & GARDEN INSECT CONTROL READY TO SPRAY  
 PATROL  
 SCIMITAR CS INSECTICIDE  
 SENTRY HOMEGUARD YARD SPRAY  
 SPECTRACIDE BUG STOP INDOOR PLUS OUTDOOR INSECT KILLER CONCENTRATE  
 SPECTRACIDE FIRE ANT KILLER YARD PROTECTION GRANULES  
 SUNNILAND CHINCH BUG GRANULES  
 SURRENDER BRAND PESTABS INSECTICIDE  
 TERRO ANT KILLER PLUS MULTI-PURPOSE INSECT CONTROL 2

## Permethrin

ADAMS PLUS YARD SPRAY  
 ASTRO INSECTICIDE  
 BIO SPOT YARD & GARDEN SPRAY  
 BONIDE EIGHT INSECT CONTROL YARD & GARDEN READY TO SPRAY  
 DRAGNET SFR TERMITICIDE/INSECTICIDE  
 ENFORCER OUTDOOR INSECT KILLER CONCENTRATE



## Permethrin Cont.

GORDON'S BUG NO-MORE MULTI-PURPOSE  
GROUNDWORK CONCENTRATE MULTI-INSECT KILLER2  
HI-YIELD 38 PLUS TURF, TERMITE & ORNAMENTAL INSECT CONTROL  
HI-YIELD INDOOR/OUTDOOR BROAD USE INSECTICIDE  
MARTIN'S PERMETHRIN SFR TERMITICIDE/ INSECTICIDE  
OPTI-GRO GROUND ASSAULT (RESTRICTED USE)  
P-37 II INSECTICIDE CONCENTRATE  
PERMASTAR PRO PERMETHRIN TERMITICIDE/INSECTICIDE  
PERMETHRIN 10% RAPID KILL INSECTICIDE CONCENTRATE  
PERMETHRIN 3.2 AG (RESTRICTED USE)  
PERMETHRIN 3.2 EC (RESTRICTED USE)  
PERMETHRIN E PRO TERMITICIDE/INSECTICIDE  
PERM-UP 3.2 EC INSECTICIDE (RESTRICTED USE)  
PRE STRIKE YARD & GARDEN SPRAY  
PRELUDE TERMITICIDE/INSECTICIDE  
PRENTOX PERM-X 1-E  
PROZAP INSECTRIN X CONCENTRATE  
REALITY TERMITICIDE/INSECTICIDE  
SA-50 SOUTHERN AG PERMETROL 10% PERMETHRIN EC  
SUNNILAND CHINCH BUG SPRAY  
TENGARD SFR ONE SHOT TERMITICIDE/INSECTICIDE  
TENKOZ PERMETHRIN 3.2 EC INSECTICIDE (RESTRICTED USE)  
VET KEM YARD SPRAY SIPHOTROL  
ZODIAC YARD & GARDEN SPRAY

## Piperonyl butoxide, Esfenvalerate & Prallethrin

ONSLAUGHT FAST CAP SPIDER & SCORPION INSECTICIDE

## Thiamethoxam

MAXIDE PROFESSIONAL GRADE DUAL ACTION GRUB KILLER  
MERIDIAN 0.33G  
MERIDIAN 25WG

## Thiamethoxam & Azoxystrobin

CARAVAN G

## Thiamethoxam & lambda-Cyhalothrin

AMDRO QUICK KILL LAWN & LANDSCAPE INSECT KILLER GRANULES  
MAXIDE DUAL ACTION INSECT KILLER  
MAXIDE PROFESSIONAL GRADE DUAL ACTION INSECT KILLER  
TANDEM

## Trichlorfon

BAYER ADVANCED 24 HOUR GRUB KILLER PLUS I READY-TO-SPREAD  
GRANULES  
DYLOX 420 SL TURF AND ORNAMENTAL INSECTICIDE  
DYLOX 6.2 GRANULAR INSECTICIDE  
DYLOX 80 TURF AND ORNAMENTAL INSECTICIDE

## Zeta-Cypermethrin

AMDRO PEST BLOCK HOME PERIMETER READY-TO-SPRAY  
AMDRO POWERFLEX YARD & PERIMETER OUTDOOR INSECT KILLER  
AMDRO QUICK KILL LAWN & LANDSCAPE INSECT KILLER CONCENTRATE

## Insecticide Products Registered for Golf Courses and Athletic Fields.

### Acephate

ACEPHATE 90 PRILL  
 ACEPHATE 90 SP SOLUBLE POWDER  
 ACEPHATE 90 WDG  
 ACEPHATE 90 WSP INSECTICIDE  
 ACEPHATE 97 DF  
 ACEPHATE 97% PRILLS  
 ACEPHATE 97UP INSECTICIDE  
 BRACKET 90 WDG  
 BRACKET 97  
 BRACKET 97  
 CHEMINOVA ACEPHATE 75SP  
 CHEMINOVA ACEPHATE 90SP  
 ORTHENE 97  
 ORTHENE TURF, TREE & ORNAMENTAL 97 SPRAY  
 ORTHENE TURF, TREE & ORNAMENTAL WSP  
 TENKOZ ACEPHATE 97 INSECTICIDE  
 TIDE ACEPHATE 90 WDG

### beta-Cyfluthrin

TEMPO ULTRA GC INSECTICIDE (Restricted Use)

### Bifenthrin

BIFEN 2 AG GOLD (Restricted Use)  
 BIFENTHRIN GC GRANULES (Restricted Use)  
 BISECT G (Restricted Use)  
 BROADCAST FLOWABLE INSECTICIDE GC (Restricted Use)  
 BROADCAST GRANULAR INSECTICIDE GC (Restricted Use)  
 FIREBIRD PRO (Restricted Use)  
 GROWERS FERTILIZER WITH 0.083% BIFENTHRIN  
 LESCO TALSTAR 0.073% PLUS FERTILIZER (Restricted Use)  
 MENACE GC 7.9% FLOWABLE (Restricted Use)  
 ONYXPRO INSECTICIDE (Restricted Use)  
 PHOENIX FIREBIRD PRO (Restricted Use)  
 PRO-MATE TALSTAR GC 0.069% WITH FERTILIZER (Restricted Use)  
 QUALI-PRO BIFENTHRIN GOLF & NURSERY 7.9F (Restricted Use)  
 TALSTAR GC GRANULAR INSECTICIDE (Restricted Use)  
 TALSTAR SELECT INSECTICIDE (Restricted Use)  
 TURF PRIDE ACCUBLEND FERTILIZER WITH 0.069% BIFENTHRIN  
 INSECTICIDE PROFUSION PROCESS  
 TURF PRIDE ACCUBLEND FERTILIZER WITH 0.096% BIFENTHRIN  
 INSECTICIDE PROFUSION PROCESS  
 UP-STAR GC GRANULAR INSECTICIDE (Restricted Use)  
 UP-STAR SC LAWN AND NURSERY INSECTICIDE/MITICIDE (Restricted Use)

### Bifenthrin & Imidacloprid

ALLECTUS GC GRANULAR INSECTICIDE (Restricted Use)  
 ATERA GC 2+1 SC INSECTICIDE (Restricted Use)  
 LESCO ALLECTUS 0.18 GC PLUS FERTILIZER (Restricted Use)  
 TCS GROWSTAR ALLECTUS 0.225 GC PLUS TURF FERTILIZER (Restricted Use)  
 TURFPRIDE ACCUBLEND FERTILIZER WITH 0.15GC ALLECTUS (Restricted Use)  
 TURFPRIDE ACCUBLEND FERTILIZER WITH 0.225GC ALLECTUS (Restricted Use)

### Bifenthrin & zeta-Cypermethrin

TALSTAR XTRA GC GRANULAR INSECTICIDE (Restricted Use)

### Bifenthrin, Imidacloprid & zeta-Cypermethrin

TRIPLE CROWN GOLF INSECTICIDE (Restricted Use)

### Carbaryl & Bifenthrin

ANDERSONS GOLF PRODUCTS DUOCIDE INSECT CONTROL (Restricted Use)

### Chlorpyrifos

CHLORPYRIFOS 4E AG (Restricted Use)  
 DREXEL CHLORPYRIFOS 4E-AG (Restricted Use)  
 NUFARM CHLORPYRIFOS SPC 1.0% MCB INSECTICIDE  
 NUFARM CHLORPYRIFOS SPC 2 INSECTICIDE (Restricted Use)  
 NUFARM CHLORPYRIFOS SPC 2.32% G INSECTICIDE  
 NUFARM CHLORPYRIFOS SPC 4 INSECTICIDE (Restricted Use)  
 QUALI-PRO CHLORPYRIFOS 4E (Restricted Use)  
 SA-50 CHLORPYRIFOS 1% MOLE CRICKET BAIT  
 VULCAN (Restricted Use)

### Cyfluthrin

TEMPO 20 WP GOLF COURSE INSECTICIDE (Restricted Use)

### Fipronil

CHIPCO CHOICE INSECTICIDE (Restricted Use)  
 QUALI-PRO FIPRONIL 0.1G (Restricted Use)

### Imidacloprid

AGRISEL IMIDAPRO 2SC INSECTICIDE  
 ANDERSONS GOLF PRODUCTS TURF FERTILIZER 14-0-14 WITH MERIT INSECTICIDE  
 ARMOR TECH IMD 2SC  
 ARMORTECH IMD75  
 CRITERION 0.5 G INSECTICIDE  
 CRITERION 2F INSECTICIDE  
 CRITERION 75 WSP INSECTICIDE  
 ENFORCE 0.5G TURF AND ORNAMENTAL INSECTICIDE  
 ENFORCE 75WSP TURF AND ORNAMENTAL INSECTICIDE  
 EQUIL ADONIS 2F INSECTICIDE  
 EQUIL ADONIS 75 WSP INSECTICIDE  
 FERTILIZER W/MERIT 0.15%  
 FERTILIZER W/MERIT 0.2%  
 GARANT T&O 2F INSECTICIDE  
 GARANT T&O 75 WSP INSECTICIDE  
 GORDON'S PROFESSIONAL TURF & ORNAMENTAL PRODUCTS  
 IMIDIPRO SYSTEMIC INSECTICIDE  
 GRUBEX PRO  
 HAWK-I 2L  
 HAWK-I 75WSP  
 HI-YIELD GRUB FREE ZONE  
 HI-YIELD GRUB FREE ZONE III  
 IMIDASTAR 2L T&O  
 IMIGOLD 0.5 G  
 IMIGOLD 2 F  
 IMIGOLD 70 DF TURF, ORNAMENTAL AND GREENHOUSE INSECTICIDE  
 INVICT BLITZ ANT GRANULES  
 INVICT XPRESS GRANULAR BAIT  
 LADA 2F INSECTICIDE  
 LESCO BANDIT 0.5 G INSECTICIDE  
 LESCO BANDIT 2F INSECTICIDE  
 LESCO BANDIT 75 WSP INSECTICIDE  
 LESCO MERIT 0.2 PLUS TURF FERTILIZER  
 LESCO MERIT 0.2 PLUS TURF FERTILIZER  
 LESCO SYSTEMIC INSECTICIDE CONTAINS MERIT  
 MALICE 0.5G  
 MALICE 75 WSP  
 MALLET 2F INSECTICIDE



### Imidacloprid Cont.

MALLET 75 WSP INSECTICIDE  
MERIT 0.5 G INSECTICIDE  
MERIT 2F INSECTICIDE  
MERIT 75 WP INSECTICIDE  
MERIT 75 WSP INSECTICIDE  
MIDASH 2SC T&O  
PHOENIX HAWK-I 75WSP  
PHOENIX HAWK-I 2L  
PRIMERAONE IMIDACLOPRID 2F INSECTICIDE  
PROFESSIONAL TURF SOLUTIONS WITH MERIT FERTILIZER  
PROKOZ ZENITH 0.5 G INSECTICIDE  
PROKOZ ZENITH 2F INSECTICIDE  
PROKOZ ZENITH 75 WSP INSECTICIDE  
PRO-MATE MERIT 0.2% PLUS TURF FERTILIZER  
PROTHOR SC 2  
QUALI-PRO IMIDACLOPRID 0.5G INSECTICIDE  
QUALI-PRO IMIDACLOPRID 75 WSB  
REGAL MERIT 0.2 PLUS  
SCOTTS FERTILIZER 0-0-7 WITH GRUBEX PRO  
SCOTTS FERTILIZER 22-0-8 WITH GRUBEX PRO  
SCOTTS PROFESSIONAL FERTILIZER 0-0-7 WITH GRUBEX  
SCOTTS PROFESSIONAL FERTILIZER 22-0-8 WITH GRUBEX  
SIGNATURE FERTILIZER WITH 0.2% MERIT  
TCS GROWSTAR MERIT 0.2 PLUS TURF FERTILIZER  
THE ANDERSONS GRUBOUT DG 0.2% INSECTICIDE  
THE ANDERSONS TURF PRODUCTS FERTILIZER WITH 0.2% MERIT INSECTICIDE 24-0-12  
THE ANDERSONS TURF PRODUCTS FERTILIZER WITH 0.2% MERIT INSECTICIDE 22-3-8  
TURF PRIDE ACCUBLEND FERTILIZER WITH 0.2% MERIT  
TURFTHOR 0.5G  
TURFTHOR WP  
TURFTHOR WSP  
XYTECT 2F INSECTICIDE  
XYTECT 75WSP INSECTICIDE

### Indoxacarb

ADVION INSECT GRANULE  
DUPONT ADVION INSECT GRANULE  
DUPONT PROVAUNT INSECTICIDE  
PROVAUNT

### lambda-Cyhalothrin

LAMBDA SELECT (Restricted Use)  
LAMBDA-CY EC INSECTICIDE-RUP (Restricted Use)  
NUFARM LAMBDA-CYHALOTHRIN 1 EC INSECTICIDE (Restricted Use)  
QUALI-PRO LAMBDA GC-O (Restricted Use)

### Permethrin

PERMETHRIN 10% RAPID KILL INSECTICIDE CONCENTRATE  
PROZAP INSECTRIN X CONCENTRATE

### Piperonyl butoxide & Permethrin

FLEX 10-10 INSECTICIDE  
KICKER  
PYNAMITE SYNERGIZED 10/10 CONCENTRATE  
PYRANHA 1-10 PX CONCENTRATE  
VECTOR-BAN PLUS MULTI PURPOSE INSECTICIDE

### Pyrethrins

MGK EVERGREEN PYRETHRUM CONCENTRATE

### Thiamethoxam

MERIDIAN 25WG  
MERIDIAN 0.33G

### Thiamethoxam & Azoxystrobin

CARAVAN G

### Trichlorfon

DYLOX 420 SL TURF AND ORNAMENTAL INSECTICIDE  
DYLOX 6.2 GRANULAR INSECTICIDE  
DYLOX 80 TURF AND ORNAMENTAL INSECTICIDE

### Insecticide Products Registered for Pastures

	Beauveria bassiana	Piperonyl butoxide & Pyrethrins
BOTANIGARD ES		PYRENONE CROP SPRAY
MYCOTROL O		Pyrethrins
	Carbaryl	PYGANIC CROP PROTECTION EC 5.0II
DREXEL CARBARYL 5% BAIT		

### Insecticide Products Registered for Vegetables

	Beauveria bassiana	Carbaryl
BOTANIGARD ES		DREXEL CARBARYL 5% BAIT
MYCOTROL O		Piperonyl butoxide & Pyrethrins
	Bifenthrin	PYRENONE CROP SPRAY
SURRENDER G		Pyrethrins
BONIDE HOUSE GUARD		PYGANIC CROP PROTECTION EC 5.0II
BONIDE EIGHT INSECT CONTROL FLOWER & VEGETABLE		
VEGETABLE GARDEN SOIL INSECTICIDE		