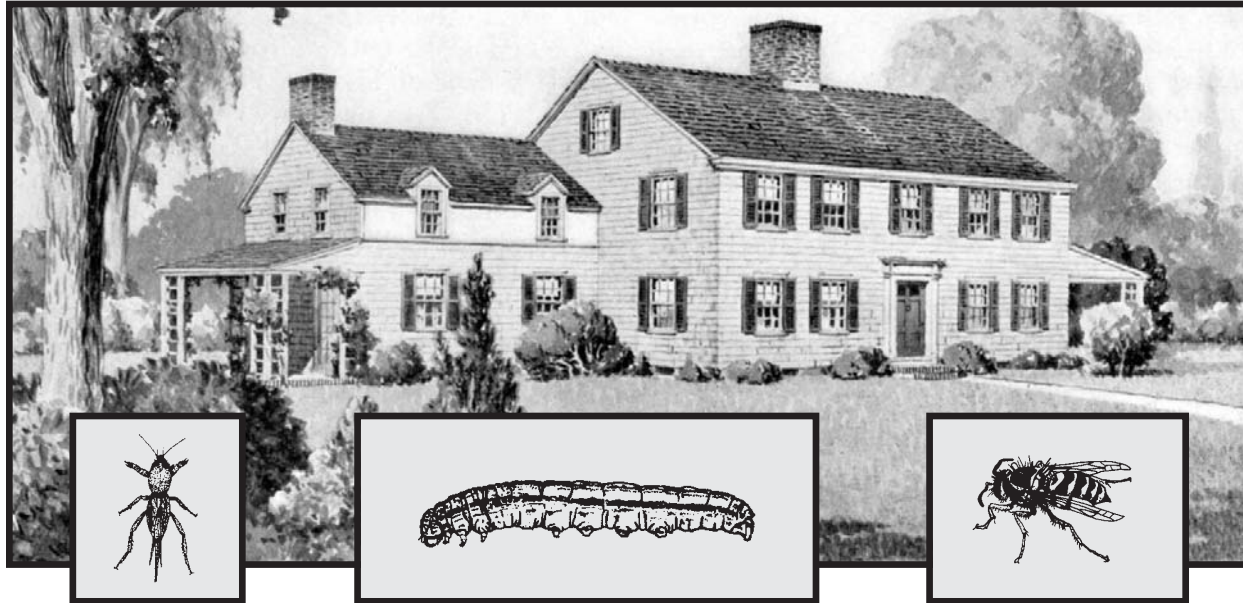


# Control of Insect Pests in and around the Home Lawn



Many different species of insect pests are found in home lawns in Mississippi. These include insects such as chinch bugs and white grubs that directly attack and damage turf grass, pests such as slugs and millipedes that can become a nuisance when they occur in high numbers, and pests such as fire ants, wasps, and ticks that directly attack the homeowner and others using the lawn.

This publication addresses some of the most common pests that are likely to be found on lawns in Mississippi and provides information to help identify them. It also provides some basic biological information about each pest, describes the damage they cause, and gives general information on control and examples of useful pest-control products.

Purchasing insecticides for use in the home lawn can be confusing because there are literally hundreds of insect control products available. It is beyond the scope of this publication to provide a detailed list of every product that is recommended for each pest, so the tables included here provide examples of products that can be used against each pest. Mention of specific products does not imply

their endorsement over other products containing similar active ingredients and having similar use labels. It is important to take the time and care necessary to ensure that a product is suitable for its intended use and effective against the target pest(s). This can be accomplished only by carefully reading the label before purchasing the product. Additional information on choosing and purchasing insecticides is provided at the end of the publication.

After identifying a pest problem and purchasing an insecticide to control the pest, the homeowner still must apply the pesticide. There are several different methods of applying insecticides to home lawns. These include broadcast applications of liquid sprays, hose-end sprays, and broadcast applications of granular products. Each of these requires different application equipment, which must be properly calibrated to achieve the desired rate. When purchasing insecticides for use in the home lawn, homeowners must be sure that they have the necessary equipment. Refer to the section titled "Applying Insecticides to the Home Lawn" for more information.

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## Fire Ants

Fire ants are the most common insect pests of home lawns. They occur in practically every lawn in Mississippi! Even if a homeowner manages to achieve a yard completely free of fire ants, it probably won't remain that way for long because newly swarmed fire ant queens will quickly recolonize it. New fire ant colonies thrive especially well in areas that are free of competing colonies. Fire ant control is a never-ending battle in the South, but there are steps that homeowners can take to maintain a lawn and landscape that is relatively free of fire ants.

In terms of both cost and effort, the most effective thing homeowners can do to control fire ants is to make a broadcast application of fire ant bait in the spring, in midsummer, and again in the fall. However, the use of baits must be combined with other methods in order to maintain a landscape that is nearly free of fire ants. In most situations, homeowners can accomplish excellent control of fire ants by combining broadcast bait treatments with spot treatments of individual mounds.

**Baits:** Although baits can be applied as individual mound treatments, broadcast applications are much more effective. This is because in addition to the large, readily visible mounds in an area, there are usually many small, hard-to-detect colonies. When only the large mounds are eliminated by individual mound treatments, they are quickly replaced by the smaller colonies, which thrive in the absence of foraging competition from the larger colonies. Broadcast bait treatments target all colonies in an area, regardless of size. When using granular baits, early spring application is best because it controls recently developed queens before they leave on their nuptial flights and establish new colonies. Follow-up granular bait applications usually are necessary in midsummer and again in the fall.

For small areas, such as home lawns, broadcast fire ant baits are most commonly applied using a small, hand-powered spreader. When using such spreaders be sure to note the settings recommended by the manufacturer for the specific spreader and ant bait being used. Most fire ant baits require application at rates ranging from 1 to 2½ pounds per acre. That is not very much material, and it is easy to over-apply fire ant baits if you do not follow the label and directions. When applying fire ant baits, uniform coverage is not as critical as when you apply fertilizers, herbicides, and other lawn insecticides. The foraging fire ant workers will find the bait even if you miss some narrow strips. Therefore, it is not usually necessary to apply fire ant baits in a crisscross pattern, as is normally done with seed, fertilizers, herbicides, or granular insecticides.

Apply baits when the ground is dry and when ground temperatures are between 70 and 90 °F with no forecast of rain. The insecticides used in granular baits are intended to act slowly. Foraging ants pick up baits, carry them back to the colony, and pass them among the ants in the colony, eventually reaching and killing



the queen. This slow activity allows time for the insecticide to spread throughout the colony. Depending on the specific bait used, maximum control takes 2 to 6 weeks. In summer and fall, apply bait in the afternoon when temperatures are cooler.

When they are properly applied two to three times per year, baits can provide 80 to 90 percent control of fire ants. In relatively small areas, improve fire ant control by combining the use of granular baits with spot treatment of any individual mounds that escape the bait treatments. However, wait several days following the application of a bait treatment before treating individual mounds with contact insecticide treatments. This allows time for foraging worker ants to carry the baits into the colonies and improves the odds of killing the queen(s).

Baits can be used to treat individual mounds, but they will not work as quickly as other types of mound treatments. When applying baits to individual mounds, do not apply the bait directly on top of the mound. Instead, apply the specified amount of bait to the area around the mound so that foraging workers can easily find it.

**Mound Treatments:** Individual mound treatments containing contact insecticides give much quicker control than bait treatments. They are also an effective way to quickly eliminate especially troublesome fire ant colonies. Several different types of individual mound treatments are available, including liquid drenches, granular treatments, dry powders, and even injectable aerosols. Liquid drenches provide the quickest control, but they are time-consuming to mix and apply. Dry powder treatments are easy and convenient to use but may take several days to provide control. When treating individual mounds with any insecticide, do not disturb mounds before treating. If you do, the colony will attempt to take the queen or queens to safety, either moving them deep down in the mound or moving them next to the current mound to establish satellite mounds.

When using liquid drenches, it is important to apply enough liquid to thoroughly soak the mound. Depending on the size of the mound, this ranges from 1 to 2 gallons of mixed drench. When applying liquid drenches, begin by applying about one-quarter of the total volume to a 10- to 12-inch band around the edges of the mound. This prevents the queen from escaping through lateral foraging tunnels and improves control of workers. Then apply the rest of the drench directly to the mound. Failure to use enough drench to thoroughly soak the mound is the main reason for poor control.

**Broadcast Insecticide Treatments:** Broadcast insecticide treatments are applied over the entire lawn area. They are generally more time-consuming and costly than baits, and are more commonly used in highly managed areas, such as athletic fields and golf courses, rather than in home lawns. Broadcast insecticide treat-

ments may be formulated as liquids, which are mixed according to label directions and sprayed over the turf area, or as granular treatments, which are spread over the turf area using a spreader.

It is important not to confuse granular insecticides with insecticide baits. Most fire ant baits are formulated as granules containing an insecticide and with vegetable oil or some other food substance, which the ants will actively collect and carry back to the colony. Granular insecticides are simply granules containing insecticide. They are not attractive to ants. Instead, the insecticide in the granules moves into the soil and

provides control of foraging ants and newly settled queens through contact activity. Getting uniform coverage is more important when applying broadcast insecticide granules than when applying granular baits.

Many insecticides used as broadcast treatments for fire ants also control other lawn pests, such as chinch bugs, white grubs, or mole crickets. Before choosing a broadcast insecticide, read the label carefully to be sure that it provides control of the particular group of pests present.

### Baits for fire ant control\*

Brand Name (insecticide), percent active ingredient (ai)	Rate/Mound**	Rate/Acre***
Amdro Bait (hydramethylnon), 0.73% ai	2 – 5 tbsp	1 – 1.5 lb
Award (fenoxycarb), 1.0% ai	1 – 3 tbsp	1 – 1.5 lb
Hi-Yield Fire Ant Bait (fenoxycarb), 1.0% ai		
Justice Bait (spinosad), 0.015% ai	4 – 6 tbsp	2.5 – 5 lb
Come & Get It Bait (spinosad), 0.015% ai		
Distance (pyriproxyfen), 0.5% ai	1– 4 tbsp	1– 1.5 lb
Extinguish (methoprene), 0.5% ai	3 – 5 tbsp	1 – 1.5 lb
Ascend (abamectin), 0.011% ai	5 – 7 tbsp	1 lb

\* Avoid applying baits immediately before or after irrigation or rainfall. Baits may require 4 to 8 weeks to provide maximum results.

\*\* Baits are more effective when applied as broadcast treatments.

\*\*\* There are 43,560 square feet in 1 acre.

### Mound drench treatments for fire ant control\*

Insecticide	Brand Name	Rate
acephate (75% SP)	Orthene 75 TTO (75%)	2 tsp/gal
carbaryl (22.5% concentrate)	Sevin Concentrate Bug Killer	0.75 fl oz/gal
permethrin (2.5% concentrate)	Bonide Eight Insect Control	0.66 fl oz/gal
permethrin (38% concentrate)	Hi-Yield 38 Plus	1.6 fl oz/gal

\* Depending on the size of the mound, it takes 1 to 2 gallons of water-insecticide mix to drench a fire ant mound effectively. Drench the mound and an area about 10 to 12 inches around the edges of the mound. Do not disturb mounds before drenching.

### Dry mound treatments for fire ant control\*

Insecticide	Brand Name	Amount/Mound
acephate	Orthene Fire Ant Killer (50%)	1 tbsp
cyfluthrin	Bayer Fire Ant Killer (1.0%)	1 tsp
deltamethrin	Bengal Ultra Dust Fire Ant Killer (0.05%) Terro Fire Ant Killer (0.05%)	1 tbsp

\* Sprinkle dry product over and around mound as directed on label. Do not disturb the mound before or after treatment.

### Broadcast treatments for fire ant control\*

Insecticide	Brand Name	Rate/1,000 sq ft
TREATMENTS APPLIED AS SPRAYS		
carbaryl (22.5% concentrate)	Sevin Concentrate Bug Killer	3 – 6 fl oz
cyfluthrin (0.75% concentrate)	PowerForce Multi-Insect Killer	6 fl oz
lambda-cyhalothrin (0.5% concentrate)	Triazicide Soil & Turf Insect Killer Concentrate	2 fl oz
permethrin (38% concentrate)	Hi-Yield 38 Plus Turf, Termite, & Ornamental Insect Concentrate	0.80 fl oz
TREATMENTS APPLIED AS GRANULES		
bifenthrin (0.2% granules)	Ortho Fire Ant Killer Granules	2.3 lb
fipronil (0.0103% granules)**	Gardentech Over 'n Out!	2 lb
lambda-cyhalothrin (0.04% granules)	Triazicide Soil & Turf Insect Killer Granules	2 lb
permethrin (0.5% granules)	Kill-A-Bug II Lawn Granules	2 – 3 lb

\* Most broadcast treatments will provide control for approximately 4 to 8 weeks.

\*\* The label of the fipronil treatment (Over 'n Out!) indicates that a single spring application will provide season-long fire ant control.

## Billbugs

Billbugs are small weevils that occasionally damage lawn grasses. They are most common in zoysia, but also occur in Bermuda, centipede, and St. Augustine. Several species of billbugs occur in Mississippi. Adults are shiny, dark-colored weevils, with an elongated body and a distinct snout. They are approximately one-fourth inch in length. The larvae are small, legless grubs normally found in the crown area.

Billbug damage initially appears as isolated, hand-sized patches of dying, discolored turf; however, these

patches may overlap when populations are heavy. This damage is often most obvious in the fall, but it can be difficult to detect when turf is also browning due to drought. Although the adults feed on the runners and stolens, most damage is caused by the larvae, which feed heavily in crowns and stolens. One can verify the presence of billbugs by checking in and around the damaged area to see if stems break easily when tugged, and, if so, noting whether or not they appear to have been chewed. Often, one can locate larvae or their frass by digging in the crown and root area.

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### Insecticides for billbug control

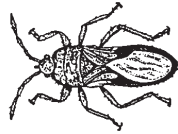
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Insecticide	Brand Name	Rate/1,000 sq ft	Comments
carbaryl (22.5% concentrate)	Sevin Concentrate Bug Killer	12 fl oz	Irrigate after treatment.
carbaryl (6.3% granules)	Ortho Bug-B-Gone Multipurpose Insect Killer	3 lb	Water thoroughly following application.
halofenozide (1.33% granules)	Hi-Yield Kill-A-Grub	0.75 lb	Under dry conditions, irrigate after application.
imidacloprid (0.2% granules)	Bayer Season-Long Grub Control	2.87 lb	Irrigate within 24 hours of treatment.
lambda-cyhalothrin (0.04% granules)	Triazicide Soil & Turf Insect Killer Granules	3 lb	Water thoroughly following application.

## Chinch Bugs

Chinch bugs are serious pests of St. Augustine lawns, but they rarely damage other types of grass. These pests like the more sunny areas of the lawn, so damage will probably occur in these areas first. Chinch bugs have piercing/sucking mouthparts, which they use to feed on root crowns and stolons. They inject a toxin while feeding, and it is this toxin that causes heavily infested areas to turn yellow, then brown, and eventually die. Because there are a number of other maladies that can cause damage to St. Augustine lawns, it is important to make sure your pest problem is chinch bugs before beginning treatment.

Adult chinch bugs are about one-fifth of an inch or less in length and are black with white wings folded in an "X" over their backs. Small nymphs are pink or red with a white line across their backs, while large



nymphs are black and also have a white line across the middle of their backs.

Scout turf on sunny days by parting stems and looking for the small, reddish nymphs and/or the black and white adults in the crown region or running across the exposed soil. Another method is to remove both ends of a gallon-size can, press one end of the can 2 to 3 inches into the turf, and then fill the can half-full with water. If chinch bugs are present, they will float to the top within a few minutes. When using this method it is important to check several sites, choosing areas where yellow and green grass meet. If chinch bugs are identified as the cause of the problem, they can be controlled with the insecticides listed below. If the infestation is heavy, apply a second application about 2 weeks after the first treatment. Although several granular insecticides are labeled for control of chinch bugs, treatments applied as sprays are usually more effective.

### Insecticides for chinch bug control

Insecticide	Brand Name	Rate/1,000 sq ft	Comments
TREATMENTS APPLIED AS SPRAYS			
carbaryl (22.5% liquid)	Sevin Concentrate Bug Killer	12 – 16 fl oz	Irrigate before application.
cyfluthrin (0.75% liquid)	Bayer PowerForce Multi-Insect Killer	6 fl oz	Irrigate before and after application.
lambda-cyhalothrin (0.5% concentrate)	Triazicide Soil & Turf Insect Killer Concentrate	4 fl oz	Water lightly following application.
permethrin (2.5% concentrate)	ProTech Sniper Yard & Garden Concentrate	6 fl oz	Water lightly following application.
permethrin (38% concentrate)	Hi-Yield 38 Plus Turf, Termite, & Ornamental Insect Concentrate	0.80 fl oz	Water lightly following application.
TREATMENTS APPLIED AS GRANULES			
bifenthrin (0.1% granules)	Ortho Lawn Insect Killer Granules	2.4 lb	Water thoroughly following application.
carbaryl (6.3% granules)	Ortho Bug-B-Gone Multipurpose Insect Killer	3 lb	Water lightly following application.
lambda-cyhalothrin (0.04% granules)	Triazicide Soil & Turf Insect Killer Granules	3 lb	Water thoroughly following application.
permethrin (0.50% granules)	Kill-A-Bug II Lawn Granules	2 – 3 lb	Water lightly following application.

## White Grubs

White grubs are the larvae of May beetles, June beetles, masked chafers, and several other species of scarab beetles.



They feed on grass roots about an inch below the soil surface. When fully grown, grubs are whitish or grayish in color, about 1 to 1½ inches long, have a brownish head, three pairs of legs, and usually rest in a C-shaped position. Most grubs spend about 10 months in the soil; however, some remain in the soil 2 to 3 years. Grub damage is often most noticeable in the spring, when severely grub-damaged areas fail to “green up.” However, grubs are easiest to control in middle to late summer when larvae are small.

Check for grubs in the spring or summer by cutting several 1- to 2-foot-square samples 2 to 3 inches deep, and lifting out, or rolling back, the turf square to look

for grubs. If you find an average of three to five grubs per square foot, your lawn probably needs treatment. Water grass before treatment if soil is dry (this causes grubs to move nearer to the surface of the soil), and thoroughly water again after treatment (this leaches the insecticide into the soil where the grubs are feeding). Large amounts of thatch can interfere with effective treatment of white grubs because the organic matter in the thatch tends to bind insecticides, keeping them from reaching the grubs. Limiting thatch can aid in control of white grubs.

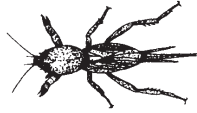
Controlling grubs and other soil-dwelling insects can help prevent moles. Because moles feed on insects and earthworms, they are less likely to occur in lawns where soil-inhabiting insects are controlled. Controlling soil-dwelling insects will also aid in preventing digging by armadillos, skunks, and other insect predators.

### Insecticides for white grub control

Insecticide	Brand Name	Rate/1,000 sq ft	Comments
TREATMENTS APPLIED AS SPRAYS			
carbaryl (22.5% concentrate)	Sevin Concentrate Bug Killer	12 fl oz	Irrigate after application.
imidacloprid (1.47% ready-to-spray)	Bayer Season-Long Grub Control	6.4 fl oz	Ready-to-spray product in a “hose-end” applicator; 32 fl oz cover 5,000 square feet. Apply according to label directions.
TREATMENTS APPLIED AS GRANULES			
carbaryl (6.3% granules)	Ortho Bug-B-Gone Multipurpose Insect Killer	3 lb	Water thoroughly following application.
halofenozide (1.33% granules)	Hi-Yield Kill-A-Grub	0.75 lb	Irrigate after application.
imidacloprid (0.2% granules)	Bayer Season-Long Grub Control	2.87 lb	Irrigate within 24 hours of treatment.
trichlorfon (6.2% granules)	Bayer 24-Hour Grub Control	3 lb	Irrigate within 24 hours of treatment.

## Mole Crickets

Mole crickets are common turf pests in the southern portion of the state, especially in the coastal region, but they are rarely a problem in north Mississippi. Mole crickets are most damaging in highly managed turf areas, such as golf greens, but they can occur in home lawns. These insects damage turf by burrowing in the soil and feeding on grass roots and stems. They are especially fond of light, sandy soils. Plants are damaged both directly, by the mole crickets feeding on the roots, and indirectly, by their extensive tunneling that destroys roots and disrupts root development. Feeding usually occurs at night with each cricket tunneling several feet per night.



There are two species of mole crickets that damage lawns in Mississippi: the southern mole cricket, which is primarily a predator on other animals living in the soil but also causes damage as a result of its tunneling, and the tawny mole cricket, which causes damage both by tunneling and feeding on roots. Although the biology of these two species differs in a number of ways, their general biology is similar.

Mole crickets overwinter as nymphs (immatures) in the soil, become active in early spring, and mature by mid to late spring. The most severe damage usually occurs during the spring as a result of the heavy tunneling and feeding of these large nymphs and adults. New adults emerge and begin mating flights from mid-March to mid-May (mating flights of tawny mole crickets are generally a bit earlier than those of southern mole crickets). Exact timing of mating flights can vary, depending on weather factors and location in the state (flights occur earlier on the Gulf Coast than in the central portion of the state). Eggs, which are deposited in clusters in the soil, hatch in 10 to 40 days, depending on temperature. At first the damage caused by the newly hatched nymphs is minimal and hard to see. However, this is the most vulnerable stage for control. There is only one generation per year. Because damage is usually greatest in the spring, due to the heavy feed-

ing and tunneling of large nymphs and adults, it is often necessary to treat at this time. But these large nymphs and adults are more difficult to control, so mole cricket treatments are most effective when targeted toward the young nymphs in June and July.

Because the grass has recovered from spring damage, and the damage caused by newly hatched nymphs is not obvious, it is sometimes difficult to understand the need to treat at this time. However, if a lawn was infested with mole crickets in the spring, they will be present in June and July. This is the best time to apply treatments on lawns with a history of mole cricket infestation. In areas where they occur on favorable soils, mole crickets are persistent, difficult pests to control and you may need to make several applications per season to achieve and maintain effective control. However, the treatment targeted to control young, newly hatched nymphs is the most important.

Check for mole crickets by mixing 1 to 2 fluid ounces of dishwashing liquid per gallon of water and pouring it over a small area of turf. This test works best early in the morning when crickets are most likely to be near the surface. Any crickets that come in contact with the soapy water will be flushed to the surface. This can provide information on the number and age of the mole crickets, as well as their depth in the soil. If they appear soon after the soap solution is applied, they are near the surface.

Before treating for mole crickets, be sure the turf is well watered. This is because mole crickets tend to burrow deeper in dry soil, where they are beyond the reach of insecticides. Making sure that the turf has been well watered in the several days before treatment assures that mole crickets will be close to the surface where the insecticide can reach them. With most mole cricket treatments it is also important to water immediately following treatment in order to leach the treatment into the soil where it can contact the mole crickets.

### Insecticides for mole cricket control

Insecticide	Brand Name	Rate/1,000 sq ft	Comments
TREATMENTS APPLIED AS SPRAYS			
lambda-cyhalothrin (0.5% concentrate)	Triazicide Soil & Turf Insect Killer Concentrate	4 fl oz	Irrigate after application.
cyfluthrin (0.75% concentrate)	Bayer Power Force Multi-Insect Killer	6 fl oz	Irrigate after application.
TREATMENTS APPLIED AS GRANULES			
bifenthrin (0.1% granules)	Ortho Lawn Insect Killer Granules	4.8 lb	Water thoroughly following application.
imidacloprid (0.2% granules)	Bayer Season-long Grub Control	3.8 lb	Irrigate within 24 hours of treatment. Imidacloprid is most effective against newly hatched nymphs in late May through June.
lambda-cyhalothrin (0.04% granules)	Triazicide Soil & Turf Insect Killer Granules	3 lb	Water 1/4 to 1/2 of an inch following application.
fipronil* (0.0103% granules)	Over 'n Out!	2 lb	Irrigate after application.
carbaryl (5% bait)	Mole Cricket Bait	0.75 – 0.90 lb	This is a bait. <b>Do not water following treatment.</b> Baits are more effective against large nymphs and adults.

\* Over 'n Out! is not specifically labeled for control of mole crickets. However, when used to control fire ants, this product will aid in the control of mole crickets.

## Caterpillars

There are several species of caterpillar pests that sometimes cause damage to home lawns. These include fall armyworms, cutworms, and sod webworms.



**Fall armyworms**, as their name implies, are most common in late summer and early fall. The moths often migrate in large numbers and lay their egg masses in turf and pasture grasses, as well as in certain field crops. They are very fond of Bermuda grass, especially when it has been well fertilized and watered. These caterpillars feed day and night and can cause severe defoliation. Like most caterpillars, they eat very little when small but consume very large amounts of leaf area during the last few days of their larval stage. This is why turf often appears to have been defoliated “overnight.” Fortunately, turf grasses can tolerate repeated foliage loss, such as mowing, without suffering serious long-term injury.

**Cutworms** feed on the stems and leaves of plants and often cut them off near the soil line. Their feeding

makes small, irregular areas in the turf, which creates more problems on highly managed golf greens than in home lawns. Although there are many species of cutworms, the black cutworm is most common in our area. They are nocturnal and hide in the daytime but may become active on cloudy days. Generally adult moths begin to appear in March and may produce four generations per year.

**Sod webworms** cut off grass blades above the thatch line and pull them into their tunnels to eat. Closely cropped grass may look like small brown patches. If infestation is heavy, patches may run together to form irregular brown patches. Adult moths are weak flyers and live only a few days. There may be two or three generations per year.

Lawn caterpillars are best controlled with broadcast foliar insecticide sprays. Some granular treatments are also labeled for control of caterpillar pests in home lawns. In general, these granular treatments work better against cutworms and sod webworms than against fall armyworms.

### Insecticides for lawn caterpillar control

Insecticide	Brand Name	Rate/1,000 sq ft	Comments
TREATMENTS APPLIED AS SPRAYS			
carbaryl (22.5% concentrate)	Sevin Concentrate Bug Killer	3 – 6 fl oz	Delay watering or mowing for 24 hours.
cyfluthrin (0.75% concentrate)	Bayer Power Force Multi-Insect Killer	6 fl oz	Delay watering or mowing for 24 hours.
lambda-cyhalothrin (0.50% concentrate)	Triazicide Soil & Turf Insect Killer Concentrate	2 fl oz	Delay watering or mowing for 24 hours.
permethrin (38% concentrate)	Hi-Yield 38 Plus Turf, Termite, & Ornamental Insect Concentrate	0.40 – 0.80 fl oz	Delay watering or mowing for 24 hours.
TREATMENTS APPLIED AS GRANULES			
bifenthrin (0.10% granules)	Ortho Lawn Insect Killer Granules	1.2 – 2.4 lb	Water thoroughly following application.
cyfluthrin (0.10% granules)	Bayer PowerForce Multi-Insect Killer Granules	2 – 3 lb	Water thoroughly following application.
trichlorfon (6.2% granules)	Bayer 24-Hour Grub Control	3 lb	Irrigate within 24 hours of treatment.
lambda-cyhalothrin (0.04% granules)	Triazicide Soil & Turf Insect Killer Granules	2 lb	Water lightly following application.

## Two-Lined Spittlebugs

Two-lined spittlebugs are easily identified by the two bright red lines that cross each of the dark maroon wings. This explains the “two-lined” part of their name, but what does “spittlebug” refer to? This part of the name is due to a habit of the nymphs—they produce frothy masses of spittle on the stems or stolens of their host plants. These masses are sometimes called “frog spit.” They protect the nymphs from both predators and dehydration, and several nymphs may occur within a single spittle mass.

Adults use their piercing-sucking mouthparts to suck sap from stems and leaves. The nymphs feed similarly, but they form their spittle masses deeper in the turf on the stems and stolens near the crown of the plant. The adults produce toxic saliva that can cause significant injury to susceptible grasses. Initial symptoms include yellowing of the leaves, but heavy infestations can result in weak, unhealthy areas and even dead, brown patches. Centipede grass is most at risk for injury, but infestations can also occur in St. Augustine and Bermuda grasses.

Wet, rainy conditions and lush, vigorously growing grass are favorable to heavy infestations. Often the prettiest centipede lawn in the neighborhood has the heaviest infestations. Lawns that are well fertilized, frequently watered, mown relatively high, and suffer

from excessive thatch are especially vulnerable. This is because the nymphs, which have no known natural enemies, thrive in moist, humid conditions. Obviously cultural practices play an important role in managing this pest. Minimizing thatch buildup, keeping grass mown to the proper height, and avoiding excessive water and fertilization can reduce problems.

This insect produces two or three generations per year, and the adults of the second generations will emerge in August and September. It is normally the second generation that causes the greatest damage to home lawns. Homeowners with susceptible lawns can prevent this problem by checking for the presence of spittle masses and treating promptly if necessary.

Scout lawns by parting turf and looking for the white, frothy spittle masses. Turf that is heavily infested sometimes has a “squishy” feel when being walked on. If you find moderate to heavy infestations, treat using a liquid spray of a recommended insecticide. Sprays are usually more effective than granules for controlling spittlebugs because granules tend to fall below the target zone. Hose-end sprayers are a convenient method of applying spittlebug treatments, and many home lawn insecticides are available in ready-to-use hose-end spray containers. Mowing and watering before treatment will enhance control.

### Insecticides for Two-Lined Spittlebug Control

Insecticide	Brand Name	Rate/1,000 sq ft	Comments
carbaryl (22.5% liquid)	Sevin Concentrate Bug Killer	3 – 6 fl oz	Mow and water before treating.
lambda-cyhalothrin (0.5% concentrate)	Triazicide Soil & Turf Insect Killer Concentrate	2 fl oz	Mow and water before treating.
cyfluthrin (0.75% liquid)	Bayer Power Force Multi-Insect Killer	6 fl oz	Mow and water before treating.
permethrin (38% liquid)	Hi-Yield 38 Plus, Turf, Termite, and Ornamental Insect Spray	0.4 – 0.8 fl oz	Mow and water before treating.

## Slugs and Snails

Slugs and snails are common pests in and around home lawns. They can damage certain tender ornamental plants and vegetables. Slugs are nocturnal and often move onto patios and carports at night, leaving trails of clear dried mucus as evidence of their passage. Slugs are attracted to areas where pets



are fed and will often concentrate in such areas. These pests are best controlled with specially formulated baits. Because many of these baits are toxic to pets and wildlife, be sure to use them properly. Treatments containing iron phosphate are labeled for use around domestic animals.

### Bait treatments for slug and snail control

Active Ingredient	Brand Name	Rate/1,000 sq ft
metaldehyde (2% granules)	Ortho Bug-Geta Snail & Slug Killer	0.50 lb
metaldehyde (0.13% granules)	Bonide Slug & Snail Killer	1 lb
metaldehyde (2.75% pellets)	Hi-Yield Snail & Slug Killer Pellets	0.83 lb
carbaryl (4%) + metaldehyde (1% bait granules)	Fertilome Eliminate Snail, Slug, & Bug Bait	2.25 lb
carbaryl (5%) + metaldehyde (2% bait granules)	Ortho Bug-Geta Plus Snail, Slug, & Insect Killer	0.50 lb
iron phosphate (1% bait granules)	Monterey Sluggo	1 lb
iron phosphate (1% bait granules)	Escar-Go Slug & Snail Control	1 lb

## Pill Bugs

Pill bugs, also known as “roly-polies” or sowbugs, can be a problem around the home lawn when they occur in high numbers. These are not insects but are land-dwelling crustaceans related to shrimp and crayfish. Pill bugs prefer moist, protected environments with large amounts of decaying organic matter. Heavy pop-

ulations of pill bugs often occur in heavily mulched flower beds or areas with heavy accumulations of leaf litter. Like slugs, pill bugs can damage tender ornamental plants, such as hosta. Pill bugs can be controlled with baits containing the active ingredient carbaryl or with contact insecticides applied as sprays or granules.

### Treatments for pill bug control

Active Ingredient	Brand Name	Rate/1,000 sq ft
BAITS		
carbaryl (4%) + metaldehyde (1% bait granules)	Fertilome Eliminate Snail, Slug, & Bug Bait	2.25 lb
carbaryl (5%) + metaldehyde (2% bait granules)	Ortho Bug-Geta Plus Snail, Slug, & Insect Killer	0.50 lb
TREATMENTS APPLIED AS SPRAYS		
carbaryl (22.5% concentrate)	Sevin Concentrate Bug Killer	5 fl oz/gal
cyfluthrin (0.75% concentrate)	Bayer Power Force Multi-Insect Killer	0.50 fl oz
TREATMENTS APPLIED AS GRANULES		
cyfluthrin (0.1% granules)	Bayer PowerForce Multi-Insect Killer Granules	2 – 3 lb
lambda-cyhalothrin (0.04% granules)	Triazicide Soil & Turf Insect Killer Granules	2 lb
permethrin (0.5% granules)	Hi-Yield Kill-A-Bug II Lawn Granules	2 lb

## Millipedes

The millipede, another noninsect pest, also can become a pest when present in high numbers. Like pill bugs, millipedes prefer moist, protected, high organic-matter environments, such as mulch and leaf litter. Certain species of millipedes can occur in high numbers, especially following prolonged periods of unusually heavy rainfall. Under such conditions large numbers of migrating millipedes can accumulate on patios, carports, and other areas around the house. This situation most commonly occurs around homes built in or near wooded areas, where large numbers of millipedes develop in the leaf litter and then migrate into the lawn and home area.

Although millipedes do not feed on growing plants, they can cause problems due to their sheer numbers. Millipedes usually die once they reach the patio, carport, or inside the home because of the relatively dry, exposed conditions they encounter. When populations are low, these dead and dying millipedes can be easily handled with a vacuum or broom and dustpan, but when these pests occur in high numbers they are a much greater nuisance.

The first step in controlling millipedes is to identify where they are migrating from. Most often it is leaf litter in nearby wooded areas, but mulch in flowerbeds near the home and other areas with an accumulation

of organic matter on the ground surface are also potential sources. In locations where repeated heavy migrations of millipedes occur, reducing leaf litter, grass clippings, mulch, or other organic matter may help reduce populations.

Heavy millipede infestations are difficult to control effectively with insecticides because the millipedes that are killed are constantly being replaced by new arrivals. Unless they have access to moisture, millipedes on carports and in homes usually die quickly due to dehydration, and applying insecticides inside the home does not help kill more of them. In many cases the best way to deal with invading millipedes is with a vacuum or broom and dustpan. Insecticides are best used as perimeter treatments to kill millipedes before they enter the home.

Several insecticides are labeled for application as perimeter treatments to be applied in a narrow band around the edges of homes or other buildings. Perimeter treatments may help control millipedes, but during periods of heavy migration, they may not provide complete control. When millipedes are migrating from wooded areas and crossing the lawn, it may be beneficial to treat the lawn area as well. Obviously, this will be of little benefit if the millipedes are coming from mulched areas next to the home. In this case, perimeter treatments will be of greater benefit.

### Treatments for millipede control

Active Ingredient	Brand Name	Rate	Comments
carbaryl (22.5% concentrate)	Sevin Concentrate Bug Killer	5 fl oz/gal	Apply as a perimeter treatment according to label directions.
lambda-cyhalothrin (0.5% concentrate)	Triazicide Soil & Turf Insect Killer	0.50 fl oz/gal	Apply as a perimeter treatment according to label directions.
permethrin (38% concentrate)	Hi-Yield 38 Plus Turf, Termite, & Ornamental Insect Concentrate	1.6 fl oz/gal	Apply as a perimeter treatment according to label directions.
carbaryl (6.3% granules)	Ortho Bug-B-Gone Multipurpose Insect Killer	3 lb/1,000 sq ft	Apply as a perimeter treatment, and/or apply as a broadcast lawn treatment. Water lightly following application.
cyfluthrin (0.1% granules)	Bayer PowerForce Multi-Insect Killer Granules	2 – 3 lb/1,000 sq ft	Apply as a perimeter treatment, and/or apply as a broadcast lawn treatment.
lambda-cyhalothrin (0.04% granules)	Triazicide Soil & Turf Insect Killer Granules	2 lb/1,000 sq ft	Apply as a perimeter treatment, and/or apply as a broadcast lawn treatment.

## Bees and Wasps

There are several different types of stinging insects that nest in and around the home lawn. These can be divided into two groups: paper wasps and hornets, which build their nests above the ground; and bumblebees and yellow jackets, which build their nests in the ground. Although these insects are rarely aggressive when foraging individually away from the nest site, they are much more defensive of their nests, and homeowners are often stung when they accidentally disturb a nest. Reduce your chances of being stung by being aware of possible nest sites and taking time to check for nests before beginning work in an area.

All of these stinging insects are actually very beneficial. Wasps, hornets, and yellow jackets collect caterpillar larvae and other insects to feed to their developing larvae, and bumblebees provide pollination as they collect pollen and nectar for their brood. Therefore, only attempt to control these insects when they pose a direct stinging threat or when the location of the nest interferes with work or other activities.

When necessary, you can control stinging insects with specially designed aerosol sprays. The insecticides used in these aerosols are chosen for their “quick knock-down,” and many of these sprays can shoot a stream of spray several feet. It is a good idea to keep a can of aerosol wasp spray on hand during the summer months. It is best to apply such treatments at dusk when most insects will be on the nests. Most species are also less likely to give pursuit in low sunlight. Sprays that produce foam will help prevent insects from taking flight and are especially useful when treating aggressive species, such as hornets and bumblebees. There is always the potential of being stung when trying to control stinging insects, so take care to minimize this risk. Wasp and bee stings can produce serious and even life-threatening reactions in some individuals.

One of the best ways to control ground-nesting insects, such as yellow jackets and bumblebees, is to apply an insecticide dust over the nest entrance. Then the insects are controlled as they crawl back and forth through the dust. However, it may take a day or two to gain full control, so you may need to repeat applications. This is best done at night when these insects are less likely to fly—note, however, that they will fly towards light. Several companies market dusts containing the active ingredient deltamethrin that are labeled for bee and wasp control.

Several species of **paper wasps** occur in Mississippi, but two are most common. *Polistes annularis* is a large, dark-red wasp with black wings. These are commonly referred to as “red wasps.” *Polistes exclamans* is a somewhat smaller species often referred to as “Guinea wasps.” Their abdomens have alternating bands of yellow and dark red. Because they are similar in appearance, people often mistake them for yellow jackets.



Paper wasp nests are made of a single tier of papery cells. They build their nests in areas that are protected from rainfall, such as under house eaves, in thick shrubbery, in thick grass or weeds, in equipment that is stored for long periods, or in other protected locations. It is a good idea to check for wasp nests before beginning work such as pruning shrubs or moving equipment that may harbor wasp nests. Give the shrubs a vigorous shake with a rake or other long-handled tool and promptly step back to observe whether or not any wasps fly out. Use a similar approach before moving equipment or other items that may harbor wasp nests. If you see wasps, determine the location of the nest and treat as described above.

**Bald-faced hornets** are large, black and white wasp-like insects that nest in big aboveground nests. Unlike paper wasp nests, hornet nests are completely enclosed in a protective paper-like substance, and the interior nest is composed of several tiers. Because their nests are more protected, hornets will nest in more exposed areas than paper wasps. They often build their nests high in tree limbs and branches, but nests are sometimes found within a couple of yards of the ground. Hornets will also occasionally nest under the eaves of houses, in thick shrubs and vines, and in other similar sites. By late summer or fall a hornet nest may be larger than a basketball and may house several hundred insects.

Hornets are much more aggressive than paper wasps, and once disturbed they will give pursuit much farther away from their nests. Because of their aggressive nature, use extra caution when attempting to treat a hornet nest. In situations where a large nest is discovered in late summer or fall, the best course of action may be to avoid the area until freezing temperatures cause the hornets to leave the nests in search of overwintering sites. Be advised, however, that some live hornets may persist inside the nest even in cold temperatures, and these may become active if the nest is brought indoors.

Technically the bald-faced hornet is not a true hornet; it is an aerial yellow jacket. The only true hornet in the U.S. is the European hornet. These insects are orange-brown in color and are about 1½ inches long, much larger than bald-faced hornets. They build their big, paper-covered nests in wall voids, attics, hollow trees, and other large cavities. Unlike many other bees and wasps, European hornets often fly at night.

**Yellow jackets** are similar to bald-faced hornets in many ways. They build a multi-tiered nest encased in a protective paper-like substance. A mature nest can be larger than a basketball, housing several hundred individuals, and yellow jackets can be very aggressive when disturbed. Unlike bald-faced hornets, yellow jackets usually nest in the ground. The paper-lined, funnel-shaped entrance is often hidden behind vegetation and can be difficult to spot. Nests are often built at the base of a tree or stump, under a fallen log, or near

some other type of structure, but they may also occur in other locations. Homeowners usually encounter yellow jackets when performing lawn maintenance, such as mowing, weeding, or trimming. Yellow jackets will respond aggressively when they sense vibrations in the ground around their nests, and attacks often result in multiple stings. Before working in an area where yellow jackets might nest, observe the area for workers flying back and forth to a specific ground-level location. If a nest is located, control it as described above and be sure to take appropriate precautions. Yellow jackets will occasionally nest in wall voids, stacked hay, and other protected, aboveground areas.

**Bumblebees** are large, hairy, and either black and yellow or black and white. There are several species, but all usually build their nests in the ground. Occasionally bumblebees will nest slightly above-

ground in stacked hay, wood, or other protected areas. Carpenter bees are similar in appearance to bumblebees, but carpenter bees are solitary and nest in galleries they bore in wooden structures. Bumblebees often begin their nests in an abandoned mouse nest or some other pre-existing cavity in the soil. A mature nest may contain dozens of bees.

Like yellow jackets, bumblebees respond aggressively when they sense vibration or disturbance of the area surrounding their nest site, and stinging incidents most often occur when someone accidentally disturbs a nest while weeding, mowing, or doing other lawn maintenance. As with yellow jackets, bees flying back and forth from a particular location on the ground often indicate the location of a nest.

## Fleas

As parasites of dogs, cats, and other mammals, adult fleas spend the majority of their time on their host. Eggs, which are normally laid when the host is at rest, fall from the host and accumulate in the bedding area. The flea larvae that hatch from these eggs develop by feeding on dander, dried blood droplets, and other organic matter that accumulates in such bedding areas. After feeding in this location for several weeks, flea larvae enter a nonfeeding pupal stage, and then emerge as adult fleas. These adult fleas hop onto a host in order to obtain the blood meals they require.



Occasionally, high numbers of fleas will be present in a home lawn. This usually occurs when a flea-infested pet or stray or wild animals visit the lawn often. Successful flea control requires a three-pronged approach.

1. Adult fleas must be controlled on the pet through the use of topical, spot-on type treatments, flea collars, dips, sprays, etc.
2. Immature and adult fleas must be controlled in any indoor areas frequented by the infested pet, with special attention given to pet bedding areas.

3. Fleas must be controlled in any infested lawn areas frequented by the pet.

Other publications address control of fleas on the pet and indoors. Fleas can be controlled in the yard by applying a spray or granular insecticide labeled for use against fleas in home lawns. When attempting to control fleas in a home lawn situation, keep in mind you will not have lasting success unless fleas are also controlled on all animals that visit the area often. When treating the animal itself is not an option, it may be possible to take steps to prevent or discourage the animal from using the area.

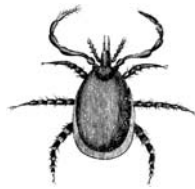
When lawns become infested with fleas, broadcast insecticide treatments applied either as sprays or granules can reduce the incidence of bites on people who use the area. Keep in mind that the animal's resting areas, which are the primary source of the fleas, may not be in the lawn itself. Instead they may be in some nearby, more protected site where the animal rests. Such areas include: under porches, under shrubs, under crawl spaces of homes, in garages, in utility sheds, etc. Successful flea control will not occur in the lawn unless these areas are treated as well. In many cases, insecticides that are labeled for use against fleas in a lawn are not necessarily labeled for use in these situations. Be sure to check the product label before making applications.

### Treatments for flea control

Active Ingredient	Brand Name	Rate/1,000 sq ft	Comments
carbaryl (22.5% concentrate)	Sevin Concentrate Bug Killer	12 fl oz	Apply as a broadcast spray using a hose-end sprayer or other appropriate sprayer.
lambda-cyhalothrin (0.50% concentrate)	Triazicide Soil & Turf Insect Killer	2 – 3 fl oz	Thoroughly wet grass before applying. Apply as a broadcast spray using a hose-end sprayer or other appropriate sprayer.
permethrin (38% concentrate)	Hi-Yield 38 Plus Turf, Termite, & Ornamental Insect Concentrate	0.40 – 0.80 fl oz	Apply as a broadcast spray using a hose-end sprayer or other appropriate sprayer.
cyfluthrin (0.75% liquid)	Bayer PowerForce Multi-Insect Killer	6 fl oz	Apply as a broadcast spray using a hose-end sprayer or other appropriate sprayer.
carbaryl (6.3% granules)	Ortho Bug-B-Gone Multipurpose Insect Killer	3 lb	Water following application.
cyfluthrin (0.1% granules)	Bayer PowerForce Multi-Insect Killer Granules	2 – 3 lb	Water following application.
lambda-cyhalothrin (0.04% granules)	Triazicide Soil & Turf Insect Killer Granules	2 lb	Water lightly following application.
permethrin (0.50% granules)	Hi-Yield Kill-A-Bug II Lawn Granules	2 – 3 lb	Water following application.

## Ticks

Several species of ticks may inhabit home lawns, some of which have the potential to transmit serious diseases. Although ticks are not insects, they belong to a closely related group known as arachnids, which also includes mites and spiders. Depending on the species, ticks may require one to three different hosts to complete their life cycle, and the time required to complete a life cycle may range from several months to several years. The general life cycle of a three-host tick is described in the following paragraph. The life cycle of one-host ticks is similar except that they remain on the same host throughout their development.



Once a female tick becomes engorged with blood and mates, she releases from the host and drops to the ground to lay eggs. She lays the eggs on the ground in a mass that may contain several hundred to more than a thousand eggs. These eggs hatch into six-legged larvae, sometimes referred to as seed ticks, which must find a suitable host in order to obtain their first blood meal. They do this by crawling to the end of a grass blade and waiting for a suitable host to brush against them. Often the host is a small mammal such as a mouse, but many ticks will also feed on other animals such as lizards or ground-dwelling birds. Once it has become fully engorged, the tick drops from the host and molts into an eight-legged nymph. Then the tick repeats the process. The nymph crawls up to a suitable location and waits for a host to come close enough that it can crawl aboard. The host of choice may now be a larger mammal such as a rabbit or raccoon. Once it finds a suitable host, the nymph takes a blood meal and again drops from the host to molt to the adult stage. After finding a suitable host, adult ticks will mate and take their final blood meal. Then the female ticks will drop to the ground to lay eggs.

Ticks are very hardy and can survive many months while waiting for a suitable host. In the case of three-host ticks, the tick chooses larger hosts as it matures. In the case of one-host ticks, larger mammals are usually the preferred hosts, but smaller animals are also readily attacked. Deer are favored hosts for some species of ticks, and tick populations can be particularly high in areas with many deer. Obviously, because of

the manner in which they live, ticks will be much more numerous along game trails and in other areas where hosts live.

Ticks are usually brought into the home lawn aboard pets or other animals, including strays and wild animals that frequent the area. Unfortunately, ticks in the home lawn are likely to seek their next blood meal from any person who happens to brush against them. Therefore, the first step in controlling ticks in the home lawn is to control ticks on any pets that use the area. Currently, there are a number of highly effective treatments that can be used on dogs and cats to control ticks. Consult your local veterinarian about these products, which can be especially helpful in reducing ticks in unfenced rural yards visited often by roaming pets.

The second step to control ticks in the home lawn is to limit access of wild animals and stray pets to the lawn area. Fenced lawns tend to have fewer tick problems than unfenced lawns. Obviously, keeping pets penned so that they are unable to roam the woods and collect ticks will help prevent ticks from being brought into the yard. Keeping vegetation cut low, so that one can walk through an area without brushing against tall weeds and grass blades, also reduces the risk of tick infestation.

When lawns do become infested with ticks, there are several effective spray treatments available. Because ticks waiting for a host normally rest above ground level, granular products are generally less effective than sprays. Concentrate treatments on areas where pets rest, along game trails and areas where wildlife visit, around building perimeters, and on any tall, weedy vegetation in the area. However, because engorged ticks may fall from their host anywhere in the lawn, you usually need to treat the entire lawn area when attempting to control a heavy tick infestation.

Reduce the chances of being bitten when working in tick-infested areas by taking precautions. Tuck pant legs into the tops of boots or socks, tuck in shirttails, and use an effective tick repellent. Repellents containing the active ingredient permethrin are especially effective against ticks, but read labels carefully. Repellents containing permethrin may not be applied directly to the skin, but may be applied to clothing only. Repellents containing the active ingredient DEET are also useful against ticks.

### Treatments for tick control

Active Ingredient	Brand Name	Rate/1,000 sq ft	Comments
carbaryl (22.5% concentrate)	Sevin Concentrate Bug Killer	3 fl oz	Apply as a broadcast spray using a hose-end sprayer or other appropriate sprayer.
cyfluthrin (0.75% liquid)	Bayer PowerForce Multi-Insect Killer	6 fl oz	Apply as a broadcast spray using a hose-end sprayer or other appropriate sprayer.
permethrin (38% concentrate)	Hi-Yield 38 Plus Turf, Termite, & Ornamental Insect Concentrate	0.40 – 0.80 fl oz	Apply as a broadcast spray using a hose-end sprayer or other appropriate sprayer.

## Chiggers

Chiggers are better known as redbugs in much of the South. Actually, they are mites, not bugs, and several species exist. Adult chiggers do not cause bites; they prey on insect eggs and other mites and also feed on microbes and organic matter. Only chiggers in the newly hatched larval stage will bite. These tiny, immature mites normally feed on ground-dwelling rodents, birds, reptiles, and amphibians, but they will also attack humans when given the opportunity.

Chiggers normally feed at a hair follicle by secreting an enzyme that dissolves skin cells and other tissue and then ingesting this dissolved cell mixture. It is the body's reaction to this foreign enzyme that causes the intense itching many people experience with chigger bites. After feeding for several days the larval chigger will detach, fall to the ground, and enter a brief resting stage. This is followed by the nymph stage, in which the nymph feeds on microbes and small insects much like an adult.

Chiggers are rarely found in well-maintained lawns, but they can be very common in overgrown brushy or weedy areas. This is because the moisture in such areas is favorable to the development of spring-tails and other small insects that adult and nymphal chiggers eat. These areas also harbor large numbers of the small animals that serve as hosts for larval chiggers. Therefore, regular mowing and brush removal is one of the best methods of controlling chiggers in the home lawn. Maintaining mown trails through "natural" areas, so that one can walk through without brushing against overgrown vegetation, will also aid greatly in reducing chigger bites, as will the use of insect repellents when entering such areas. It is usually not necessary or effective to treat well-maintained lawn areas for chiggers. However, insecticides can be used to control chiggers in weedy or overgrown areas of the home landscape. In general, the insecticides that are effective against ticks will control chiggers as well.

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### Treatments for chigger control

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Active Ingredient	Brand Name	Rate/1,000 sq ft	Comments
carbaryl (22.5% concentrate)	Sevin Concentrate Bug Killer	3 fl oz	Apply as a broadcast spray using a hose-end sprayer or other appropriate sprayer.
cyfluthrin (0.75% liquid)	Bayer PowerForce Multi-Insect Killer	6 fl oz	Apply as a broadcast spray using a hose-end sprayer or other appropriate sprayer.
lambda-cyhalothrin (0.50% concentrate)	Triazicide Soil & Turf Insect Killer	2 – 3 fl oz	Apply as a broadcast spray using a hose-end sprayer or other appropriate sprayer.
permethrin (38% concentrate)	Hi-Yield 38 Plus Turf, Termite, & Ornamental Insect Concentrate	0.40 – 0.80 fl oz/gal	Apply as a broadcast spray using a hose-end sprayer or other appropriate sprayer.

## Mosquitoes

Mosquitoes are common visitors to home lawns, and their presence often interferes with enjoyment of the lawns that we work so hard to establish and maintain. In addition to the nuisance and irritation caused by their bites, mosquitoes also have the potential to spread a number of different diseases. The number of mosquitoes present in the lawn can vary greatly, depending on location, time of year, and weather. In lawns located near favorable breeding sites mosquitoes can become so numerous they keep us from using the lawn during certain times of the year.



There are many different species of mosquitoes that occur in and around the home lawn, all with differing biological characteristics. Some species lay their eggs in standing water, while others lay their eggs on dry ground in areas prone to seasonal flooding. Some species are strong fliers that may travel 3 to 5 miles or more in order to find a blood meal, while other species are relatively weak fliers and do not travel far from the area where they developed.

Although there are differences in the biology of the different species of mosquitoes, their general life cycle is similar. Mosquitoes lay their eggs either on the surface of standing water, or on the surface of the soil in areas that are prone to periodic flooding. In the case of “floodwater” mosquitoes, the eggs do not hatch until the area becomes flooded. The eggs hatch into mosquito larvae, known as wigglers, and live as aquatic insects feeding on particles of organic matter that float in the water. Mosquito larvae breathe air through a tube located at the end of the abdomen. Because these larvae must make frequent trips to the surface to get air, shallow water is better for mosquito development. Shallow water also tends to have higher concentrations of the organic matter on which mosquito larvae feed and lower numbers of fish, dragonflies, and other predators.

Upon completing their larval stage, mosquito wigglers enter a nonfeeding pupal stage, which, in most species, floats freely at or near the surface of the water. Adult mosquitoes emerge from this pupal stage by crawling onto the surface film of the water and flying away to seek a mate. Male mosquitoes feed on flower nectar, but in most species, female mosquitoes must obtain a blood meal before they are able to produce and mature their eggs. The time required for mosquitoes to complete a single generation can vary from as little as 1 week to a month or more, depending on temperature and species.

There are several steps that can help reduce mosquito populations in the home lawn. However, these steps will be more effective against some species of mosquitoes than others. If the lawn is located near a large rice-growing area, swamp, salt marsh, or other large-scale mosquito source, there is little that the

homeowner can do to decrease overall mosquito populations significantly. However, many of the container-breeding species are relatively weak fliers and local management efforts can reduce their populations. This is important because these container-breeding species are most likely to transmit serious human diseases.

**Controlling Mosquito Larvae:** Where possible, the most effective method of managing mosquitoes is to control them in the immature stage, either by eliminating breeding sites or by applying larvicides to those sites. Any container, low area, or other area where standing water can accumulate for more than a few days can serve as a mosquito breeding site. Eliminating such breeding sites can aid greatly in reducing mosquito populations around the home lawn. Some of the steps that can eliminate mosquito breeding sites are listed below.

- Discard old cans, bottles, tires, and other unused items that can hold standing water.
- Where possible, install drain holes in items that tend to catch and hold water.
- Repair leaks in outdoor plumbing, sewage lines, livestock waters, etc.
- Clean and repair gutters to prevent them from holding water.
- Empty and refill birdbaths, pet water bowls, and other such containers at least weekly.
- Avoid excessive lawn irrigation that may result in standing water.
- Where possible, drain or fill small, low areas to prevent them from forming puddles.
- Where drainage is not possible, deepen seasonal pools into permanent ponds.
- Control aquatic vegetation in ditches and permanent ponds.
- Stock ornamental ponds and livestock ponds with fish, especially mosquito fish.
- Treat standing water with appropriate mosquito larvicides.

A number of products can control developing mosquito larvae in permanent or temporary pools or containers of standing water that cannot be filled or drained. The products most commonly available to the homeowner contain one of two active ingredients.

*Bacillus thuringiensis israelensis* is a bacteria that produces a toxin that only affects fly larvae. (Do not confuse *Bt israelensis* with other *Bt* products that control caterpillars or beetles but do not affect mosquitoes.) Methoprene is an insect growth regulator that disrupts the development of mosquito larvae.

Both of these products are labeled for use in areas such as abandoned swimming pools, ornamental fountains or ponds, rain barrels, storm drains, ditches, fishponds, cesspools, seasonal pools, and other small bodies of water where mosquitoes may breed. Read the label carefully to be sure that the product you are plan-

ning to use is approved for the specific site you plan to treat. Successful use of these products requires that they be reapplied at frequent intervals throughout the mosquito breeding season. Re-treatment may also be necessary following heavy rainfall, which washes out or dilutes the treatment. These products are formulated as granules or briquettes, allowing for easy application. The briquettes are often designed to provide slow release of the product in order to provide control over an extended period of time. While these treatments can be somewhat costly when purchased in small quantities, they are also available in bulk quantities.

**Controlling Adult Mosquitoes:** Although there are some day-biting species, most species of mosquitoes fly mainly at twilight and at night. During the day they rest in nearby protected areas. Heavy vegetation is one favored resting area for adult mosquitoes. Therefore, keeping shrubs trimmed can help reduce the number of adult mosquitoes present in an area. Likewise, occasional mowing or bush-hogging of any nearby pasture areas to prevent heavy stands of tall, weedy vegetation can also reduce resting sites for adult mosquitoes. Adult mosquitoes may also rest in buildings and other structures during the day. Examples of such structural harbors include carports, tool sheds, outbuildings, areas under porches and decks, and crawlspaces. When adult mosquitoes are observed gathering in such areas, they can be controlled with sprays containing resmethrin, permethrin, or other active ingredients labeled for use in such sites. Some products containing active ingredients such as permethrin or other pyrethroid insecticides are labeled for application to shrubs to control adult mosquitoes. Although such treatments can help control mosquitoes, be aware that spraying shrubs with these insecticides can trigger outbreaks of plant pests such as scale insects and spider mites.

In cases where large numbers of adult mosquitoes are migrating into the lawn from areas outside the homeowner's control, fogging can be an effective method of providing limited short-term control. Many of the foggers available for use by homeowners use the active ingredient resmethrin. This product will usually provide knockdown and control of any mosquitoes in the area when the treatment is applied, but newly arriving adult mosquitoes can quickly reinfest treated areas.

Commercial area repellents containing citronella or other active ingredients can also provide some degree of relief. These products are intended to repel mosquitoes from a limited outdoor area, such as around a deck or patio. Such products work best on evenings with little wind. When using repellents formulated as burnable coils, sticks, or candles, keep in mind that persons using the area will be inhaling the resulting smoke. Read product labels carefully.

During recent years a number of different types of mosquito traps have been marketed for use by homeowners. These work by using UV light, carbon dioxide, or other attractants. While such traps do attract and catch adult mosquitoes, carefully research their outdoor effectiveness prior to purchase.

The use of protective clothing and/or personal repellents is one of the most effective methods of reducing mosquito bites in outdoor areas. When used properly, repellents containing the active ingredients DEET or picaridin are quite effective in repelling mosquitoes. Be sure to read the product labels of personal repellents carefully before using. Some are not approved for use on small children; others are approved for use on clothing but may not be applied directly to the skin.

### Treatments for control of mosquito larvae in standing water

Active Ingredient	Brand Name	Rate	Comments
<i>Bacillus thuringiensis israelensis</i>	Mosquito Dunks	1 dunk/100 sq ft	Slow-acting and provides control for approximately 30 days.
<i>Bacillus thuringiensis israelensis</i>	Mosquito Bits	1 tsp/25 sq ft 0.50 lb/2,178 sq ft	Provides fast-acting, short-term control.
methoprene	Zodiac Pre-Strike Mosquito Larvicide granules	1 tsp/211 sq ft 1 c/7,154 sq ft	Provides control of mosquito larvae for up to 21 days.
methoprene	Altosid Briquettes	1 briquette/100 sq ft (if less than 2 ft deep)	Provides control of mosquito larvae for up to 30 days.

## Choosing and Purchasing Insecticides

There are several important factors to consider when purchasing an insecticide to use in the home lawn. Take the time to think about these factors and read insecticide labels before making any purchase!

Purchasing the wrong product can lead to many undesirable consequences, including poor control, plant injury, application difficulties, and time spent returning the product. Some key points to consider when purchasing insecticides are listed below.

### 1. What is the active ingredient in the product?

When purchasing insecticides it is important to think in terms of the active ingredient, rather than the brand name. Granted, the names of these active ingredients sound somewhat technical in nature (e.g. permethrin, carbaryl, imidacloprid), but in the long run they are much shorter, less confusing, and easier to remember than brand names (e.g., Hi-Yield Kill-A-Bug II, Garden Tech Sevin Concentrate Bug Killer, Bayer Advanced Season-Long Grub Control). Quite often, the same active ingredient may be sold under dozens of different brand names. Knowing the active ingredient makes it easier to find an alternative product if a particular brand-name product is not available. It is also important to be aware that the active ingredient contained in a product with a given brand name may change over time. Do not assume that Mo-Betta Bug Bopper 33 contains the same active ingredient now as it did when you last used it 5 years ago. Check the active ingredients.

### 2. Is the product labeled for the intended site and use?

If you need a product to control chinch bugs in St. Augustine grass, be sure to read the label and verify that the insecticide you are purchasing is labeled for use in home lawns, that it is safe to use on St. Augustine grass, and that it is effective against chinch bugs. All of this information should be available on the product label, and it

should also indicate how much product to use and how to mix and apply the product. If you do not find this information on the label, don't buy the product! Look for products with labels that are easy to read and understand.

### 3. How is the product formulated?

In many cases the same active ingredient is available in products that are formulated as granules, wettable powders, liquid concentrates, and dilute ready-to-spray products. It is important to be sure that you are purchasing the formulation that is best suited for your intended use. If you purchase a wettable powder formulation, which is mixed with water and applied as a liquid spray, but you do not have the necessary spray equipment, you will be unable to apply the product. Also, be sure to consider what type of formulation is best for the intended use and be sure you have the necessary equipment to apply that formulation before purchasing the product. Granular products are relatively easy to apply on the home lawn, but they are not as effective as liquid sprays against some types of pests.

### 4. What is the percentage of active ingredient in the product; how much is in the container; what is the use rate; and how much product do you need to do the job?

If you purchase a quart of ready-to-spray formulation containing 0.002% active ingredient when you really need a quart of 25% liquid concentrate, you will not have nearly enough product. If you know that you need to treat 6,000 square feet at a rate of 4 fluid ounces of product per 1,000 square feet, then you need 24 fluid ounces of total formulated product. Based on this, you know you need to buy the quart size (32 fluid ounces) rather than the pint size (16 fluid ounces). You also know that you do not need to buy the gallon size, as this would result in a lot of leftover product.

## Applying Insecticides to the Home Lawn

There are several different methods of applying insecticides to the home lawn. In many cases the homeowner has a choice of two or more different methods of applying a particular active ingredient to control a particular pest. However, in some cases you will need to choose a method of application that is suitable for the intended use and target pest. Regardless of the application method, you must calibrate the application equipment to apply the proper rate of insecticide. Although detailed discussion of calibration is beyond the scope of this publication, the following discussion will provide some general information on choosing and using insecticide application equipment.

- **Be safe!** Before using any insecticide, always read the label carefully and follow all label directions regarding personal protection equipment and instructions for mixing and applying the product. The label is the law, and the use directions it specifies are designed for the safety of the applicator, the environment, and those using the area. Insecticides are poisons and excessive exposure can result in acute and/or chronic health problems, so handle them with care and respect.
- **Define the area to be treated.** The first step in making an insecticide application to a home lawn is to define the area to be treated and determine the number of square feet involved. Only by knowing how much area needs to be treated can you know how much insecticide you need. For example, if you have 6,000 square feet of lawn to treat, and the rate for the granular insecticide you plan to use is 2 pounds per 1,000 square feet, then you need to apply a total of 12 pounds of insecticide.
- **Choose the correct application tool.** The following descriptions provide information about the best times to use each tool, as well as the proper way to use them.

**Granular Spreaders:** Granular insecticides are inert granules containing a known amount of insecticide, and they are applied using granular spreaders. This is a convenient and effective way to apply many insecticides, fertilizers, and other pesticides to the home lawn. The rate for granular insecticides depends on product and target pests, but it is normally given as "apply \_\_\_ pounds (or ounces) of granules per 1,000 square feet." The challenge for the homeowner is to calibrate the granular applicator to achieve this rate. This can be difficult and requires much trial and error. Fortunately, many granular insecticide products provide information on the label indicating the appropriate setting for spreaders of various brands. These settings will differ depending on the specific granular insecticide and spreader being used.

By purchasing a good quality spreader that has easy-to-use, well-defined adjustments and using the setting recommended on the insecticide label, you can usually be very close to the appropriate rate. However, it is a good idea to check the spreader calibration by pouring a known amount of product into the spreader, measuring the area treated with that known amount of product, and calculating the amount of product applied per 1,000 square feet. Before purchasing a granular spreader, give some thought to the brands of insecticides and other pesticides that you will apply most often, and choose a spreader listed on the labels of those products.

As with applying fertilizers and granular herbicides, you need to obtain thorough, even coverage when applying granular insecticides. To do this, set the spreader to apply only half the desired rate in the first pass over the lawn, and then make a second pass at right angles to the direction of the first pass in order to apply the remainder of the desired rate.

**Hose-end Sprayers:** Hose-end sprayers are another common, convenient method of applying insecticides to the home lawn. While the large droplets produced by these types of sprayers are not best for treating the foliage of ornamental plants, they are well suited for treating turf. These sprayers are designed to apply liquid insecticides. As the name implies, they are attached to a garden hose and powered by the force of the flowing water. The insecticide concentrate is placed into the mix chamber attached to the hose, and a small amount of the concentrate is sucked into the spray stream as the main stream of water flows past the mix chamber. Thus the insecticide concentrate is mixed into the main stream of water just before it leaves the spray nozzle.

There are two basic types of hose-end sprayers. Dial-adjustable hose-end sprayers have a dial that allows adjustment of the final application rate. On non-dial hose-end sprayers, you adjust the final rate by diluting the spray concentrate with a small amount of water in the mix chamber. Generally, the dial-adjustable type of hose-end sprayer is easier to use. Closely follow the manufacturer's directions for mixing and calibration.

**It is important to install a backflow prevention device between the hose and faucet when using hose-end sprayers.** This prevents the insecticide from being sucked into the water system in the event of a sudden loss of pressure in the water system. When using hose-end sprayers, begin spraying the area farthest away from the faucet and apply the spray in a pattern that prevents you from having to walk over recently treated areas.

A number of insecticides are now being marketed in ready-to-use hose-end applicators. These can be convenient because the insecticide comes in the hose-end applicator, which is screwed directly on to the garden hose. However, because they are not adjustable,

do not reuse these containers to apply other brands of pesticides.

**Broadcast Sprayers:** Broadcast sprayers use a spray boom containing multiple spray nozzles. These can be mounted on power equipment or on backpack units and can apply insecticides formulated as liquid concentrates as well as insecticides formulated as wettable powders or wettable granules. You mix the insecticide with a known amount of water in the spray tank to achieve the desired application rate. These sprayers are very effective at applying insecticides to large areas of lawn or turf and are the application method of choice for professional turf managers. However, because they can be somewhat challenging to calibrate, homeowners use them less often. Proper calibration of broadcast sprayers involves determining the amount of water applied to a given surface area when traveling at a specified speed. After you determine the volume of spray applied per given unit of area, it is simple to add the appropriate amount of insecticide. For example, if the spray volume is 2 gallons per 1,000 square feet and the use rate is 3 fluid ounces per 1,000 square feet, one would add 3 fluid ounces of insecticide for every 2 gallons of water in the spray tank.

**Single Nozzle Hand Sprayers:** Single nozzle hand sprayers are not well suited for treating large areas of lawn or turf, but they are useful for making spot treatments or treatments to individual plants. These sprayers are designed for applying liquid concentrate, wettable powder, and wettable granule-type

insecticides. The tank capacities of these types of sprayers usually range from one quart to several gallons. Typical label directions will indicate: "Mix \_\_\_ fluid ounces per gallon of water and spray to run off," or "Mix \_\_\_ fluid ounces per gallon of water and apply at the rate of 1 gallon per \_\_\_ square feet." Hand sprayers can be used to spot-treat very small areas of lawn or to apply perimeter treatments, provided one follows label directions.

**Use adequate spray volume.** When applying liquid insecticides it is important to use enough finished spray to ensure proper coverage of the treatment area. Failure to use adequate spray volume will often result in poor control. In most cases the insecticide label will indicate an appropriate spray volume in addition to giving the rate of insecticide to use. For example: "Mix 4 fluid ounces in 8 gallons of water to treat 1,000 square feet." This recommended volume of spray often varies depending on the target pest. For example, higher spray volumes are normally required to properly treat belowground pests, such as white grubs, than for aboveground pests, such as armyworms.

Also, many insecticide labels will have additional requirements for watering turf either before or after the insecticide application. Again, these instructions will vary depending on the target pest. In some cases the label may indicate: "Irrigate immediately after application with a minimum of ¼ inch of water"; in other cases the label may recommend avoiding watering for 24 hours following treatment.

*Before purchasing and using any insecticide, always carefully read the label to make sure that product is labeled for the intended use.*

*Carefully follow all instructions and restrictions specified on the product label.*

*The information given here is for educational purposes only. References to commercial products, trade names, or suppliers are made with the understanding that no endorsement is implied and that no discrimination is intended against other products or suppliers.*



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