E-211
6/04

TEXAS A&M AGRILIFE EXTENSION

White Grubs in Texas Turfgrass

Michael Merchant, Stephen Biles and Dale Mott*

White grubs are the larval stage of insects commonly known as May or June beetles (or Junebugs). Texas has almost 100 species of these beetles, most of which do not cause significant economic damage to crops or horticultural plantings. A few species, however, commonly damage turfgrass and other cultivated plants.

White grubs, sometimes referred to as grubworms, injure turf by feeding on roots and other underground plant parts. Damaged areas within lawns lose vigor and turn brown (Figure 1). Severely damaged turf can be lifted by hand or rolled up from the ground like a carpet.

Figure 1. Golf course fairway damaged by white grubs.

The most important turfgrass-infesting white grubs in Texas are the June beetle, *Phyllophaga crinita* (Figure 2), and the southern masked chafer, *Cyclocephala lurida*. Warm season grasses like bermudagrass, zoysiagrass, St. Augustinegrass and buffalograss are attacked readily by both types of white grubs, with most lawn damage occurring during summer and fall months.

Figure 2. Adult white grubs, often called May or June beetles, are commonly attracted to lights at night.

Cool season grasses such as the fescues, bluegrass and ryegrass are also susceptible to the June beetle and southern masked chafer, though such grasses tend to be attacked more frequently by a May beetle, *Phyllophaga congrua*. Damage from May beetles often appears in the spring and early summer, before injury from other white grubs becomes evident. Other white grub species occasionally recorded as pests in Texas turfgrass include *Cyclocephala pasadenae* and *Phyllophaga submucida*.

Another interesting kind of white grub is the green June beetle, *Cotinus nitida*. These rather large grubs feed primarily on decaying organic matter and normally do not injure turf; however, turf can be damaged by their burrowing activity. Larvae are especially common underneath fruit trees, in compost piles and in soils with high organic content, such as may be found in heavily mulched gardens and flower beds. Daytime resting places of green June beetle larvae can often be found near such sites and are marked by small mounds of soil on the lawn surface. The larvae have a curious habit of crawling on their backs across the soil surface to move from one site to another. Adults of the green June beetle are velvet-green on the top, metallic green below and approximately one inch long. Adults fly during the day and feed on over-ripe fruit.

*Extension Urban Entomologist and Extension Agents-IPM, respectively, for Texas Cooperative Extension, The Texas A&M University System.

Life Cycle

Most turfgrass-feeding white grubs in Texas, such as the June beetle and southern masked chafer, require 1 year to complete their life cycle (a 2-year cycle is suspected in a portion of the grub populations in north Texas). The May beetle, *Phyllophaga congrua*, requires 2 years to develop. For simplicity, the following discussion will be limited to species with 1-year life cycles.

Once a year, in late spring or summer, adult beetles emerge from the soil to mate. Mated females then return to the soil to lay eggs. Within about two weeks the eggs hatch into small white grubs that feed on grass roots. The pupa, or intermediate stage between the larva and the adult, occurs the following spring and is the last immature phase of the insect's development cycle. Adults subsequently emerge from the pupal stage when environmental conditions are favorable in early- to mid-summer. Most damage from white grubs occurs during mid-summer to early-fall when the larger larvae are actively feeding.

Adult. The adult stage of the various white grub species are heavy-bodied beetles, ½ to ⅝ inch long, brown, with long, spindly legs (Figure 2). The June beetle and southern masked chafer emerge from the soil and fly at night, usually after a significant rainfall or irrigation. Flight periods may last for several weeks, during which time mating and egg-laying occur. During flights, large numbers of adult beetles, primarily males, may be attracted to lighted windows or other lights at night. Females, being less active fliers, usually are less common around lighted areas than are males. For this reason, turning off outdoor lights during adult flight periods may not substantially reduce subsequent white grub damage. Heavy white grub infestations often can be found in areas with little or no outdoor lighting.

After mating, female beetles dig 2 to 5 inches into the soil to lay eggs. Each female can lay up to 30 to 40 eggs, which hatch in approximately two weeks.

Larva. White grub larvae are creamy white and C-shaped, with three pairs of legs (Figure 3). After hatching, the white grub passes through three larval life-stages, or instars. These instars are similar in appearance, except for their size. First- and second-instars each require about 3 weeks to develop to the next life-stage. The third-instar actively feeds until cool weather arrives. Third-instar larvae are responsible for most turfgrass damage due to their large size (½ to 1 inch-long) and voracious appetites. Feeding by large numbers of third-instar white grubs can quickly destroy turfgrass root systems, preventing efficient uptake of food and water. Damaged turf does not grow vigorously and is extremely susceptible to drying out, especially in hot weather.

Figure 3. Turfgrass-infesting white grub larvae feeding on grass roots. Grubs are most damaging when they reach a length of ½- to 1-inch.

When cool weather arrives, white grubs become dormant until the following spring. During this dormant period white grubs do little or no feeding and cause little damage. Occasionally white grubs will be found in turfgrass areas that fail to green up in the spring; however, the damage is primarily the result of feeding that occurred the previous fall. Spring and winter treatments for white grubs with 1-year life cycles generally are ineffective in preventing turf damage.

Pupa. The pupal stage follows the third-instar and is the life stage during which the white grub transforms, or metamorphoses, into an adult beetle. The pupal stage does not consume food and does not move through the soil. This life stage occurs during the spring and lasts approximately 3 weeks. Pupae can be found in small earthen cells three to six inches below the soil surface. White grub treatments applied during the pupal life stage are both ineffective and unnecessary.

Managing White Grubs

Knowing when you have a problem. White grub damage can be detected by the presence of irregular-shaped areas of weakened or dying grass in the lawn. Less-severely damaged turf lacks vigor and is more vulnerable to invasion by weeds. Depending on location within the state, damage may appear any time between the months of June and October. Turfgrass damaged by white grubs has a reduced root system and is easily pulled from the soil. Grubs should be readily found in the top few inches of soil, in the turfgrass root zone. Turfgrass usually recovers from white grub damage by fall or the following spring.

At least one turfgrass disease, Take-all Patch, can sometimes be mistaken for white grub damage. Take-all Patch occurs most frequently in spring and early summer and can be distinguished by the rotted appearance of the roots. In contrast with white grub damage, dead spots caused by Take-all Patch may persist into the summer months.

Some Texas lawns never suffer white grub damage, while others are damaged year after year. If your lawn consistently dies out in patches during late summer and if you can verify that white grubs are the culprits, you may benefit from a preventative treatment. On the other hand, if you want to minimize your use of insecticides and don't mind sampling for white grubs, follow the quick decision guide on page 6. By confirming that you have white grubs before treating your yard, you can avoid spending money on grub control and reduce pesticide use.

To confirm whether you need to treat for grubs, examine several soil sections at least 3 to 4 inches across and 4 inches deep (sample sandy soils to greater depths). A good rule of thumb is to examine several soil plugs (up to one square foot per 1000 square feet of turf) from widely scattered parts of the lawn. Take care to include areas at the edges of suspected grub damage. Finding more than five white grubs per square foot justifies treatment, although some lawns with even higher numbers of grubs may show no damage.

Non-chemical controls. Several non-chemical treatments are available for controlling white grubs. Beneficial nematodes within the genera *Steinernema* and *Heterorhabditis* are tiny worms that attack white grubs and other soil inhabiting insects. These microscopic worms can be purchased in stores or through garden supply catalogs. Commercial nematode products are usually designed to be mixed with water and applied to lawns using a hose-end or hand-held sprayer. Recent research shows that under good conditions commercially-available nematodes can reduce white grub populations by 50% or more.

Nematodes must be supplied with adequate moisture to help them move down into the soil where grubs are feeding. At least ¼ inch of water should be applied before, and another ¼ inch of water applied just after, nematodes are sprayed on the lawn. These worms pose no threat to humans or landscape plants and are an environmentally sound alternative for those who prefer not to use pesticides on their lawn.

One microbial pesticide, *Bacillus popilliae*, or milky spore disease, often is recommended for white grub (Japanese beetle) control in other regions of the U.S.; however, it has ***not*** been shown to be effective against Texas turf-infesting white grubs.

Spiked sandals sold for aerating turf have been tried with some success for controlling damaging grub populations. According to one study, repeatedly walking over heavily infested turf with the spiked sandals may reduce grub populations up to 50%. These sandals are available through several garden supply catalogs.

Chemical control. Proper timing and chemical application are critical to suppressing white grubs. New white grub insecticides are more persistent and less toxic to beneficial arthropods and earthworms. However, these treatments must be applied early enough to kill the smaller (less than ½-inch-long) larvae. Once white grubs reach the third-instar life stage, they are more difficult to control with the new products.

The insecticides imidacloprid and halofenozide are used most today for white grub control. Imidacloprid is most effective against small- and medium-sized grubs but may kill some grubs larger than ½ inch long. Imidacloprid trade names include Merit®, Bayer Advanced Lawn™ Season Long Grub Control and Scott's® Grub-Ex®. The lethal effects of the insect growth regulator halofenozide are limited to early white grub life stages. Halofenozide is ineffective if applied too late, after grubs have reached the third-instar life stage. Halofenozide trade names include Mach 2, Spectracide® Grub Stop™ and Hi-Yield® Kill-a-Grub™.

Fortunately, both halofenozide and imidacloprid can be applied early and persist in the soil. Ideally, both products should be applied within six weeks of egg-laying. In south Texas, apply insecticides for white grubs in early- to mid-June. In central and north Texas, the optimal treatment time is early- to mid-July.

Where grub damage is already evident in lawns and larger grubs are present, use products containing trichlorfon or carbaryl. Because they bind to soil particles and remain close to the surface even after irrigation, pyrethroid insecticides (such as permethrin, esfenvalerate, cyfluthrin and bifenthrin) are less effective against white grubs, especially in clay soils.

Post-treatment irrigation is essential for all grub-control products. To ensure that insecticides reach the root zone, water-in liquid for-

mulations with ½ to one inch of water immediately after application. Irrigate granular formulations within 24 hours to wash the insecticide into the soil and minimize the chance for exposure to people, pets and wildlife. Use a rain gauge or straight-sided can to verify application of sufficient irrigation water. Two or more irrigation applications may be needed if the soil is wet or difficult to penetrate. Water applied too quickly may cause run-off and pesticide loss. Irrigating the soil prior to insecticide application, particularly when the soils are dry, can improve the effectiveness of insecticides. For dry soils, apply ¼ to ½ inch of water the day before a treatment to improve spray penetration of the soil and to encourage white grubs to move closer to the soil surface. This makes grubs easier to contact with the insecticide treatment.

Heavy thatch buildup can reduce the effectiveness of insecticide sprays. Thatch is the accumulation of dead plant material, such as dead grass stems, between the soil surface and the turfgrass foliage. Thatch layers greater than ½ inch can result in greater susceptibility of the turf to plant diseases and can lead to other problems. Recent research has shown that many pesticides bind to thatch, preventing them from reaching the soil and reducing their effectiveness. Dethatching machines or soil aerifiers that remove small plugs of soil can be rented to help remove thatch and enhance penetration of the turf by pesticides. Excessive thatch buildup is more likely to occur with hybrid bermudagrasses, St. Augustinegrass and some zoysiagrasses. Use of mulching mowers to recycle grass clippings should not cause thatch buildup in regularly mowed lawns.

Environmental Considerations. Unnecessary insecticide applications sometimes create more problems than they solve. Pesticides can have detrimental effects on beneficial organisms, like earthworms, that help decompose thatch. Most insecticides do not discriminate between "good" and "bad" bugs and may kill beneficial insects that help control other pests. Also, unnecessary pesticide applications can increase the risk of insecticide resistance developing among white grub and other pest populations. For these reasons, routine, "preventative" insecticide applications to lawns for white grub control are not recommended.

Heavy rainfall can wash recently applied pesticides out of lawns, especially if the ground is saturated with water when the treatment is applied. Avoid treating lawns just before a heavy rain is expected. Also try to avoid application of pesticides to street gutters and sidewalks. Drop-type spreaders are less likely to scatter pesticide granules off of the target site than are rotary-type spreaders (Figure 4). Pesticide runoff from improper pesticide applications reduces the effectiveness of a treatment and can pollute above-ground and underground water supplies.

Figure 4. Drop-type spreaders allow precise placement of insecticide granules.

One should be aware that some insecticides can be toxic to birds and other wildlife. Always read and follow label directions, including the precautionary statements pertaining to potential environmental hazards. Apply only the labeled rates, avoid pesticide use near streams and ponds, and irrigate treatments promptly to help reduce the risk to non-target organisms, like birds. ***Never*** dispose of leftover pesticides down sewer or storm water drains. Such actions can cause toxicity to fish and other aquatic organisms.

Tips for Professionals

- Grubs of the southern masked chafer, *Cyclocephala lurida*, appear to be less destructive than *Phyllophaga crinita* grubs. An approximate economic threshold for masked chafers is 8-10 grubs per square foot. The two species can be distinguished by observing the raster (hair patterns) on the underside tip of the abdomen (see Figure 5). A 10X hand lens is sufficient to see these patterns on mature white grubs.

- Sampling for white grubs can be done using a spade or knife to cut 6-inch square sections of turf, or by using a golf course cup cutter. Four, six-inch squares or ten, four-inch cup cutter core samples are equivalent to one square foot of turf.

- An insect that is occasionally mistaken for a white grub is the billbug. Immature stages of billbugs are small, white, legless larvae commonly found within the top few inches of soil. One species, *Sphenophorus venatus*, is the most common billbug collected from turf in Texas. This species can damage turfgrass, especially zoysiagrasses and hybrid bermudagrasses in the southeastern regions of the U.S., but rarely damages turfgrass in Texas.

- Merit® and Mach 2® are trade names for professional formulations of imidacloprid and halofenozide, respectively. Merit® may provide some late season grub control, but both products are best used early in the season, when grubs are less than ½-inch long.

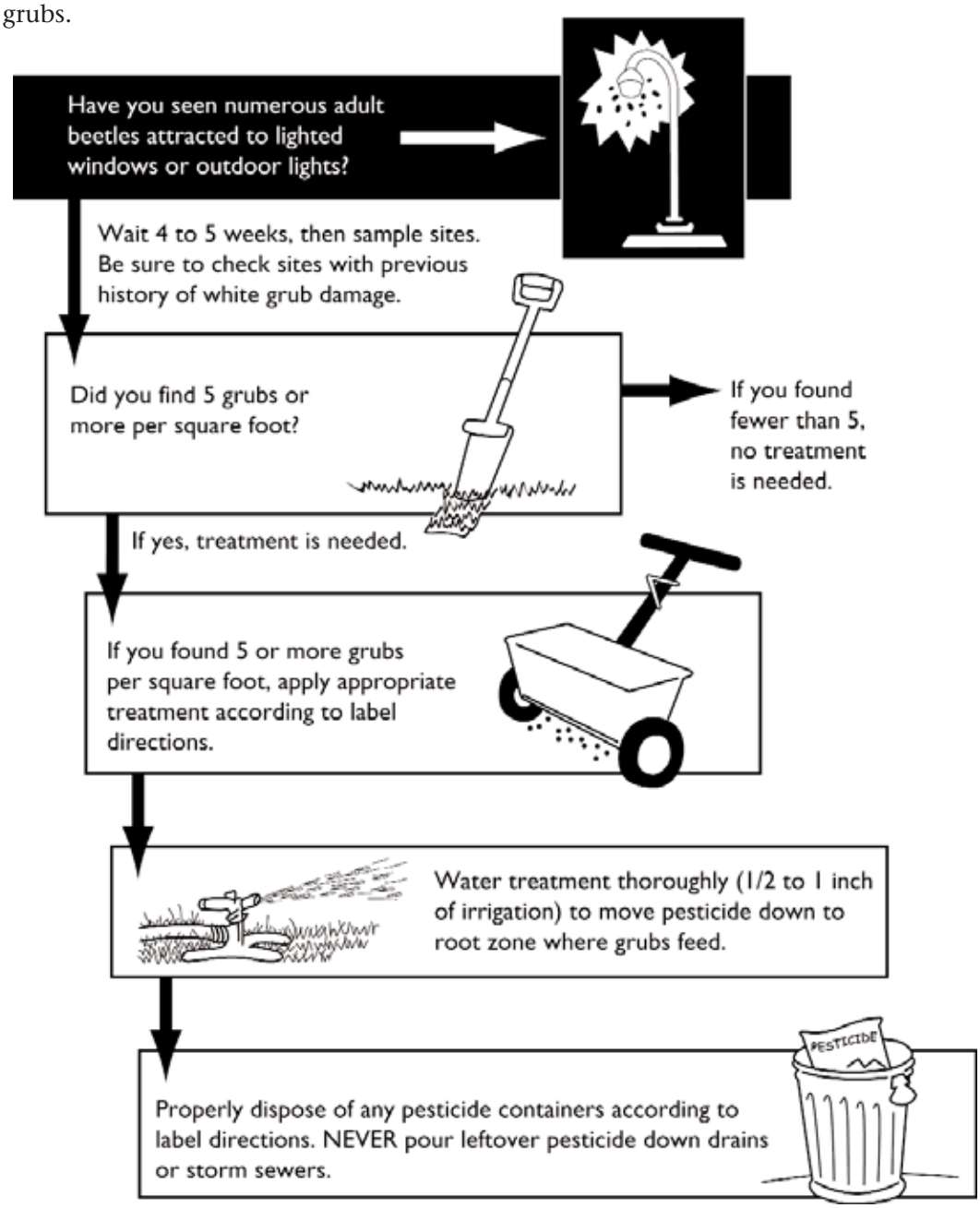
- Using surfactants in the spray solution may improve control, especially in turf with heavy thatch. Trichlorfon (Dylox®) is short-lived in high pH (greater than 7) soils and spray solutions. Add buffering agents to spray solutions to increase stability of trichlorfon sprays.

a ***b*** ***c***

Figure 5. White grub rastral patterns used in species identification are located in the anus (***a***) and can be observed with a 10X hand lens. June bug larvae, *Phyllophaga* spp., can be recognized by their seagull-shaped anal slit (⋒) and by the two parallel rows of spines running longitudinally under the anus (***b***). Masked chafer larvae, *Cyclocephala* sp., can be recognized by their straight anal slit (–) and the random placement of spines beneath the anus (***c***). Scanned images courtesy Dr. Dave Shetlar, Ohio State University.

Quick Decision Guide for Grub Treatment

Not sure you need to treat for grubs? Want to minimize your use of pesticides for economic or environmental reasons? Follow this quick decision guide. Remember that some treatments are effective only on small (less than ½ inch-long) grubs.



Texas A&M AgriLife Extension Service

AgriLifeExtension.tamu.edu

More Extension publications can be found at *AgriLifeBookstore.org*

Produced by Texas A&M AgriLife Communications