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House and Landscape Pests

WHITE GRUBS IN TEXAS TURFGRASS

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White grubs are the larval stage of insects commonly known as May or June beetles (or Junebugs). Almost 100 species live in Texas, 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. The optimal time to treat grub-infested lawns is 5-6 weeks after the peak adult flights.

Cool season grasses such as the fescues, bluegrass, and ryegrass are also susceptible to the June beetle and southern masked chafer, though they 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 sites 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 are approximately 1 inch in length. Adults fly during the day and feed on over-ripe fruit.

Life Cycle

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

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limited to species with one-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 late-summer. Most damage from white grubs occurs during midsummer to early fall when the larger larvae are actively feeding.

Adult. The adult stage of the various white grub species produces heavy-bodied beetles, 1/2 to 5/8 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 three 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 (1/2 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 1/2 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 one-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 three weeks. Pupae can be found in small earthen cells 3 to 6 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 anytime 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 to white grub damage, dead spots caused by Take-all Patch may persist into the summer months.

Most Texas lawns probably do not experience damaging numbers of white grubs in any given year. For this reason, lawns should be inspected for grubs before a decision is made to treat. The best time to inspect for grubs is when they are small (1/2 inch or less). By detecting white grubs early, treatments can be applied before serious root damage occurs. Also, controls are more effective when applied to smaller larvae.

Several sites in the lawn should be examined to find out if treatment

is needed. Soil sections at least 3 to 4 inches across and 4 inches deep (deeper samples may be advisable in sandy soils) should be examined for grubs. A good rule of thumb is to examine several soil plugs (up to one square foot per 1,000 square feet of turf) from widely scattered parts of the lawn, being careful to include areas of suspected grub damage. Treatment is justified when more than five white grubs per square foot are found, although some lawns may be able to sustain higher numbers without noticeable damage.

When to treat. The best time to inspect for grubs and apply insecticides occurs approximately five to six weeks after the heaviest June beetle flights. Peak June beetle flights occur at different times of the year in different parts of the state. Within a given locale, flight periods may vary as much as two months from year to year, due to variations in rainfall.

In some areas, May or June beetle species that do not attack turf may become abundant at lights and cause confusion about when to treat. For this reason, it's best to consult with your local county Extension office to confirm the optimal treatment period for your area. Generalized guidelines for the best inspection and treatment times for major metropolitan areas in Texas are summarized in Figure 4.

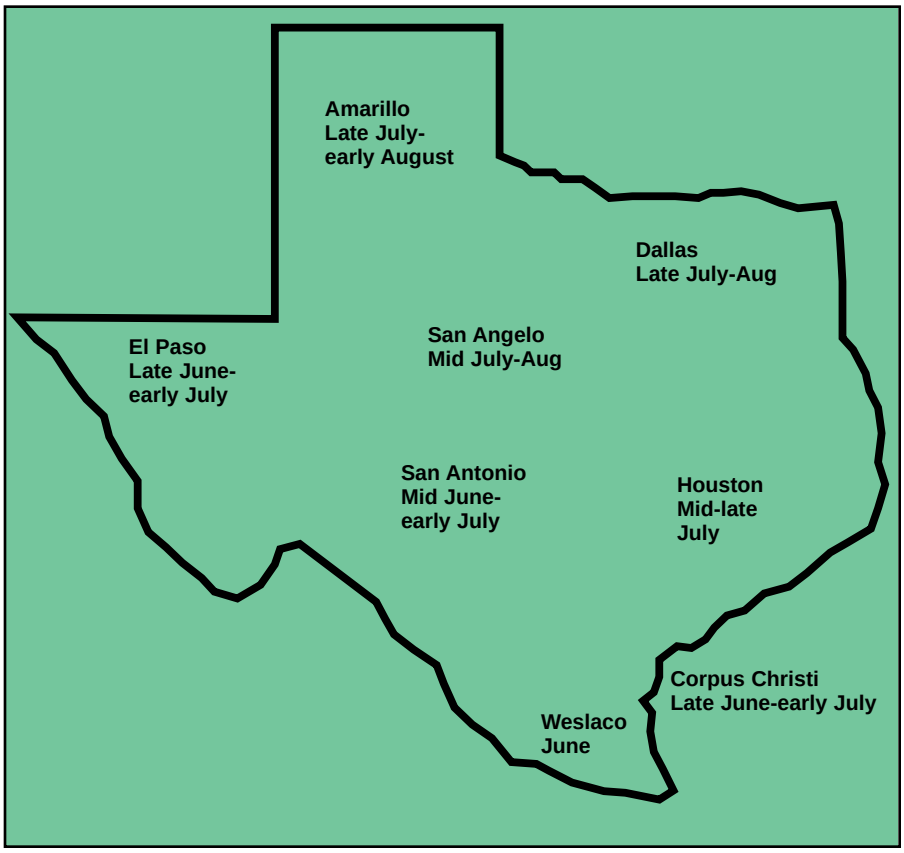


Figure 4. Optimal treatment times for white grubs in Texas.

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 up to 50 percent.

Nematodes must be supplied with adequate soil moisture to help them move down into the soils where grubs are feeding. At least 1/4 inch of water should be applied before, and another 1/4 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 percent. These sandals are available through several garden supply catalogs.

Chemical control. Proper timing of insecticide treatments is one of the most critical elements for successful suppression of white grubs. Both chemical and biological control measures are most effective when applied against smaller (less than 1/2 inch long) larvae, and less effective against eggs, larger larvae, and pupae. The residual effectiveness of most insecticides is greatly reduced one to two weeks after application; thus, insecticides applied too early may not remain effective in the soil through the egg hatch period. Insecticides applied after the optimal treatment period are often less effective because white grubs have become large and difficult to kill.

If grubs are restricted to certain areas of a yard, treat the infested areas only.

Effective white grub insecticides for use by consumers include chlorpyrifos (Dursban®), diazinon, imidacloprid (Merit®) and isofenphos (Oftanol®). A decline in white grub numbers should be observed within 2 to 3 weeks after treatment. Properly timed and applied chemical treatments should be effective with only one application. When using imidacloprid, applications should be made before damage becomes evident, as this product is most effective against first- and second-instar larvae.

Irrigating the soil prior to insecticide application, particularly when the soils are dry, can improve the effectiveness of insecticides. For dry soils, apply 1/4 to 1/2 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.

Post-treatment irrigation is essential. Liquid insecticide formulations must be watered-in with 1/2 to 1 inch of water immediately after application to ensure that insecticides reach the root zone. Granular formulations should be irrigated within 24 hours to wash the insecticide into the soil and reduce the chance for the insecticide to be picked up by birds or other wildlife. A rain gauge or straight-sided can should be used to verify that sufficient irrigation water has been applied. Two or more waterings may be needed to apply sufficient water if the soil is wet or difficult to penetrate. If water is applied too quickly, runoff and loss of pesticide may occur.

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 1/2 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, unecessary 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 the target site than are rotary-type spreaders (Figure 5). Pesticide runoff from improper pesticide applications reduces the effectiveness of a treatment and can pollute above-ground and underground water supplies.

Figure 5. Drop-type spreaders allow precise placement of insecticide granules.

One should be aware that certain insecticides can be highly 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. Diazinon is especially toxic to birds and has been a problem contaminant in many community wastewater and stormwater effluents. Particular care should be taken when using this product where songbirds or other birds are abundant or where contamination of surface water may occur. Never dispose of leftover diazinon or any other pesticide down sewer or stormwater drains. Such actions can cause toxicity to fish and other aquatic organisms.

For more information on pests, pest control and pesticide products, please see Extension publication B-1373, *House and Landscape Pests*.

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 to 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 6). 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 6-inch squares or 10 4-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 bermuda-grasses in the southeastern regions of the U.S., but rarely damages turfgrass in Texas.
- Additional chemical treatments available to commercial pesticide applicators include bendiocarb, carbaryl, fonophos, ethoprop, isofenphos, imidacloprid and trichlorfon. Trichlorfon is subject to rapid breakdown in high pH soils or waters. Imidacloprid should only be used before grub damage becomes evident. Chlorpyrifos treatments may be less effective than other treatments in soils with high organic matter content or thatch buildup.
- Use of surfactants in the spray solution may improve control, especially in turf with heavy thatch.

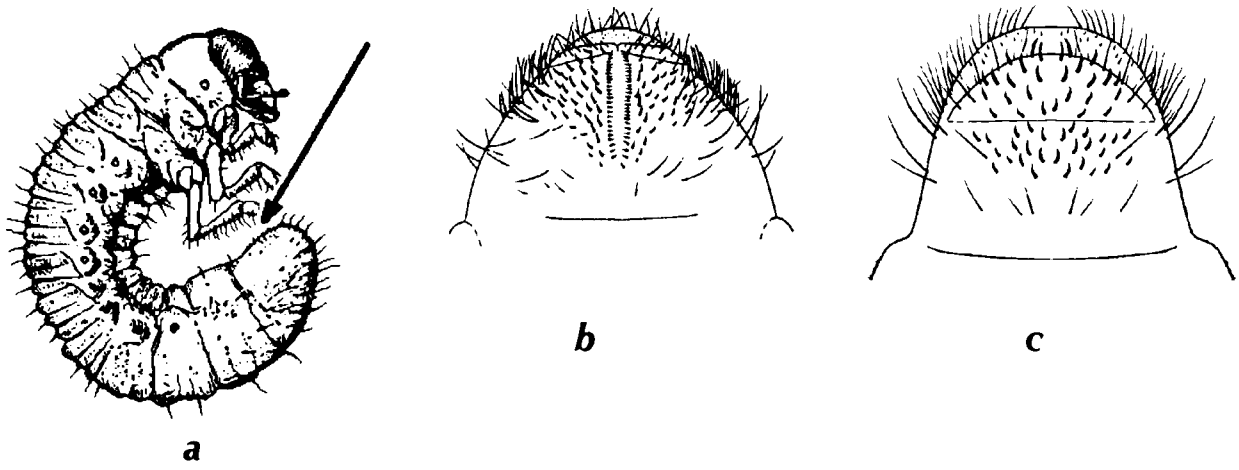
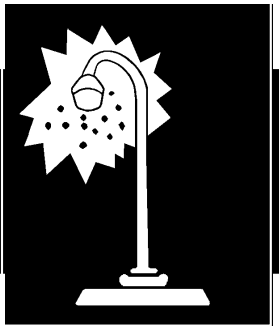


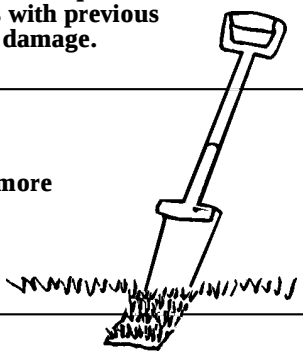
Figure 6. White grub rastral patterns used in species identification are located at the anus (a) and can be observed with a 10X hand lens. June bug larvae, Phyllophaga spp., can be recognized by their seagull-shaped anal slit (⌣) and by the two parallel rows of spines running longitudinally under the 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



Have you seen numerous adult beetles attracted to lighted windows or outdoor lights?

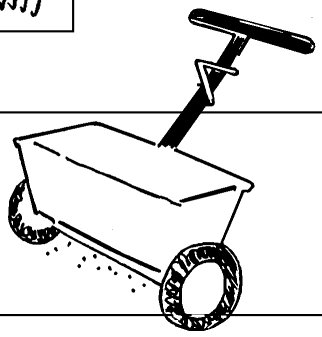
Wait 4 to 5 weeks, then sample sites. Be sure to check sites with previous history of white grub damage.



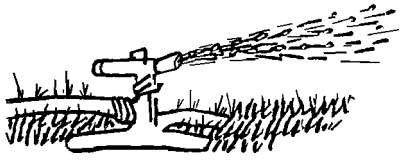
Did you find 5 grubs or more per square foot?

If you found fewer than 5, no treatment is needed.

If yes, treatment is needed.



If you found 5 or more grubs per square foot, apply appropriate treatment according to label directions.



Water treatment thoroughly (1/2 to 1 inch of irrigation) to move pesticide down to root zone where grubs feed.

Properly dispose of any pesticide containers according to label directions. NEVER pour leftover pesticide down drains or storm sewers.

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