White grubs
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What You Should Know

• White grubs are the larval stage of scarab beetles.
• Several different kinds of white grubs are found in Utah.
• White grubs prefer to feed on turfgrass roots.
• Healthy turfgrass can mask white grub feeding.

White grubs are the most widespread and destructive insect pest of turfgrass. White grubs are the immature form of scarab beetles. There are several established white grub species in Utah, including masked chafer, May/June beetles, and the black turfgrass Ataenius (Fig. 1). Most recently, Japanese beetles were detected in Orem, Utah, in 2006. These white grubs feed on turfgrass roots and are capable of causing significant economic damage. However, turfgrass can be successfully managed to prevent visible white grub damage with cultural control methods.

Damage Symptoms

White grubs chew off the turfgrass roots near the soil surface or just below the thatch layer. Early signs of white grub damage include grass wilting or yellowing; however, the initial feeding injury often goes unnoticed until brown patches of turf start to develop. White grub feeding damage can be most apparent in the late summer when grubs are nearly fully developed. Small patches of dying turf can quickly join together if grub density is extremely high.

Grub-damaged turfgrass becomes loosely attached to the soil as the roots are consumed. Heavily damaged turfgrass can feel spongy and easily pull away from the soil surface. Drought conditions can make turfgrass injury appear worse.

Description

Adult scarab beetles are identified by size and color pattern. Adults range in size from 3/16 - 1” and can be tan, brown or black (Fig. 1). Scarab beetles are stout, oval-shaped, and have clubbed antennae. Adults have a pair of hardened forewings called elytra and a pair of membranous hindwings for flight. The first pair of legs are modified to help burrow in the soil to lay eggs. Some adults are nocturnal and are only active at night.

Many of the white grub species established in Utah look similar to each other but vary in size. Mature grubs range in size from 3/8 - 2”. In general, grubs are C-shaped and have three pair of thoracic legs (Fig. 2). The head capsule is dark, but the body is usually creamy white in color. White grub species identification is often not necessary because the cultural control practices are similar. The arrangement of hairs and spines on the posterior end of the grub, called the raster, is a distinguishing feature between species (Fig. 3).

Fig. 1. White grubs are actually scarab beetles. Common scarab beetle adults are shown here (NOT TO SCALE).

Fig. 2. Common white grub body characters (NOT TO SCALE).
Sampling Protocol

Begin scouting after initial adult emergence to look for eggs or small instars to decide if treatment is warranted. Soil sampling should be done before turfgrass damage is obvious to minimize extensive root loss. White grubs are usually laid in clusters and will not be evenly distributed. Take at least four evenly spaced turfgrass samples for the area. Cut a 6" x 6" square on three sides with a hand trowel to examine the upper 2" of the root zone (Fig. 4). If the turf is dying and grubs are absent, examine the soil for other causes of injury, such as disease, excessive thatch, moisture stress, heat damage or other insect feeding. After looking through the soil sample, replace the soil and return the turf. During the summer, look for Japanese beetle adults on ornamental plants, trees and shrubs. Scout susceptible plants at least once per week, especially if adults were active the previous year. Masked chafer and May/June beetle adults are nocturnal and will be attracted to light.

Life Cycles

Japanese beetle. The Japanese beetle is an annual white grub, meaning they complete one generation per year. Adults have a metallic green head and bronze wing covers (Fig. 1). Adults emerge from turfgrass in late June and immediately begin to feed and mate on ornamental plants, sometimes causing significant damage. Mated females move back to turfgrass to lay small egg masses in soil cavities. Most eggs are laid between mid-July and early September. The eggs hatch into small grubs that feed on small turfgrass roots until the temperature cools. Small grubs are the overwintering stage until the next spring when they become active again. During the second summer, grubs continue to grow while feeding on larger turfgrass roots until they are almost fully-developed. The large grubs are the overwintering stage. During the third summer, grubs pupate in the soil and adults emerge in May and June.

May/June beetle: The May/June beetles require three years to complete one generation. Adults are usually larger in size compared to the masked chafer and Japanese beetle and range from tan to black in color (Fig. 1). Although adults do feed on a wide range of plants, they rarely cause significant damage like the Japanese beetle. Adults start emerging from turfgrass in May and June and are strongly attracted to lights like the masked chafer. During the first summer, mated females will deposit eggs in turfgrass. Eggs hatch into small white grubs that feed on small turfgrass roots until the temperature cools. Small grubs are the overwintering stage until the next spring when they become active again. During the second summer, grubs continue to grow while feeding on larger turfgrass roots until they are almost fully-developed. The large grubs are the overwintering stage. During the third summer, grubs pupate in the soil and adults emerge in May and June.

Masked chafer. The masked chafer is also an annual white grub and has a similar life cycle pattern to the Japanese beetle, except adults rarely cause plant damage. Adults are tan and have dark markings over the eyes (Fig. 1). Adults are normally present during late June through July and are highly attracted to lights at night. Females deposit eggs in the soil by making small cavities in turfgrass. Eggs hatch into small white grubs that feed on small turfgrass roots. The most common turfgrass damage from masked chafer occurs in late summer or early fall when grubs are nearly full grown and are feeding on larger turfgrass roots. Grubs overwinter well below the soil surface until temperatures begin to warm up in the spring. Third-instar grubs pupate in the soil and adults emerge in late June.

Black turfgrass Ataenius: The black turfgrass Ataenius beetle can have up to two generations per year. They are black in color and relatively small (1/4") compared to other common white grub adults. Adults overwinter in leaf litter and loose soil and begin depositing eggs in turfgrass in April. Grubs feed for about 3 - 5 weeks before pupating and starting the second generation in July. As temperatures cool, adults move back to overwintering habitat by late September.

Fig. 3. Illustration of white grub raster differences

Fig. 4. Core soil sample and turfgrass root zone

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### Cultural Control

Parasitic wasps, flies, and birds are effective biological control agents for white grubs. Using broad spectrum insecticides for low densities of white grubs is unnecessary and will reduce biological control. Using natural enemies and other integrated pest management (IPM) strategies can reduce adults and grubs to tolerable levels in most cases. Implement the following cultural control methods to reduce white grub damage:

- Consider insect-resistant cultivars blended with turfgrass that is well adapted to Utah’s climate.
- Encourage natural enemies by planting a variety of flowering plants that produce pollen and nectar.
- Overly maintained turfgrass can be an attractive place to lay eggs for adult females; keep plants healthy but be careful not to exceed recommended fertilization and irrigation schedules.
- Start monitoring for grubs in the early spring by taking a few soil samples, and scout for adults in the summer by inspecting ornamental plants.
- If adult feeding damage on ornamental plants becomes noticeable, simply remove the beetles by hand and drop into a jar of soapy water.

### Threshold Guidelines

The treatment thresholds for turfgrass are based on grub size and feeding duration on roots. Treatment is not recommended unless obvious feeding damage is visible on the soil surface. Healthy lawns can support grubs without showing leaf browning or significant root damage.

- The threshold for masked chafers and Japanese beetle grubs is 8-10 per ft² or 2-3 per 6” x 6” square.
- The threshold for May/June beetle grubs is 3-5 per ft² or 1 per ft² per 6” x 6” square.
- The threshold for black turfgrass Ataenius beetle grubs is 30-50 per ft² or 8-13 per 6” x 6” square.

### Chemical Control

In certain turfgrass situations where grubs are persistent over multiple years, a more aggressive control program can be initiated. White grub control should start before they are fully developed to prevent serious damage. Apply a long-lasting systemic insecticide before eggs hatch so that plants have enough time to uptake the product. Newly-hatched grubs are the optimal stage to control because they are typically found feeding closer to the soil surface and are more likely to make contact with the insecticide. Small grubs are also easier to control purely because of their size.

Chemical control should be considered when cultural methods are not effective. Consider using “reduced risk” insecticides as an alternative to broad spectrum products because they preserve natural enemies and are less toxic to other animals. In mid to late June, apply a long-lasting reduced risk insecticide, such as imidacloprid (Merit®), before eggs hatch into grubs. Other reduced risk pesticides are available (Concern®, Pyganic®, and Surround®) but have a relatively short residual. Highly infested turfgrass may need an additional treatment of trichlorfon (Dylox®) in July to control grubs. Here are some guidelines for effective chemical control in turfgrass:

- If the thatch layer exceeds ½”, use a light aeration to enhance soil penetration.
- Apply ½” of water 48 hours before chemical application to bring feeding grubs closer to the soil surface.
- Immediately apply ½ - ¾” of water after application to push the chemical down to the root zone.
- Mow the lawn to about 1½” to improve penetration.
- Repeat irrigation every four or five days to continue chemical movement in the soil.

Adults are above ground for a relatively short time and are very mobile insects. Applying foliar insecticides to trees, shrubs and other ornamentals is not recommended because the chemicals are expensive and generally not effective. In extreme situations, traditional insecticides, including carbaryl (Sevin®), malathion®, and permethrin (Merit®, Pounce®) can be used.

1. Image courtesy of Matthew Roth [http://bugguide.net/node/view/40314/bgimage].
3. Image courtesy of Laura C. Jesse, Iowa State University Extension [https://www.extension.iastate.edu/yardgarden/].
4. Image courtesy of Marin Rice, Department of Entomology Iowa State University [http://www.ent.iastate.edu/].
5. Images courtesy of Erin Hodgson, Department of Biology Utah State University [http://www.utahpests.usu.edu/photogallery].
6. Image courtesy of the University of Minnesota Extension [http://www.extension.umn.edu/distribution/horticulture/OG7644.html].