AGRICULTURAL

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White Grubs in the Lawn

Bruce A. Barrett and Erik H. Ervin
Departments of Entomology and Horticulture

White grubs are the larval or immature stage of several species of soil-inhabiting beetles (Scarabaeidae) that are similar in general appearance and habits. The larvae or grubs pass through three stages (instars), are crescent-shaped (Figure 1), and live in the soil, where they feed on the roots of many important ornamental and agricultural plants.

The earliest symptom of white grubs feeding on turfgrass roots is a gradual thinning and weakening of the stand. Damage may progress from thinning to small patches of dead grass to the sudden wilting of the grass even with adequate soil moisture. Aside from turf damage the grubs cause directly, their presence in high numbers can attract birds (e.g., starlings, grackles, crows) and mammals (e.g., moles, shrews, chipmunks, skunks, raccoons) that can cause further damage as they tear at the turf in search of the grubs for food.

This guide discusses the life history and control of two species of white grubs found infesting turfgrass in Missouri-the southern masked chafer and May or June beetles.

Southern masked chafer *(Cyclocephala immaculata)*

Adult southern masked chafers (SMCs) are yellow-brown in color and about 0.5 inch long and 0.25 inch wide. They are robust and stout-bodied. The adults do not feed and are not a pest of foliage.

The SMC has a 1-year life cycle and is thus correctly referred to as the "annual" white grub. By late March, overwintering third-instar grubs begin migrating upward near the soil surface to feed. They continue feeding on grass roots and organic matter until May, then move back deeper into the soil to pupate.

Adults emerge from the soil June through early August. The adults emerge at about dusk and swarms of males fly low over the turf in search of females. Eggs usually are laid in the top 2 inches of soil. The developing grubs will reach the final instar (third) in late summer and early fall. Most damage to turf is done in September and early October when the grubs are full-sized (about an inch long) and feeding vigorously. Feeding continues until temperatures force the grubs to migrate 5 to 10 inches deep in the soil to hibernate.

Figure 1. Third-instar (mature) grub.

May or June beetles *(Phyllophaga* spp.)

Numerous species of May or June beetles (M-JB) are turfgrass pests. Ten major species have been found in Missouri. Unlike SMC adults, adults feed on and can be serious pests of, shade trees and ornamental shrubs. Adults look much like SMC adults (heavy-looking, stout-bodied) but are usually larger. The smallest M-JB species is about 0.5 inch long, and the largest can be about 1 inch long. The adult body is light to dark brown, and the head is dark brown.

Depending on the species, it takes 1 to 4 years to complete one generation. The most common M-JB species have a 3-year life cycle. Below is a generalized M-JB life cycle based on observations in the Midwest:

Year 1. In early May, overwintering adults begin emerging from the soil to feed and mate. Adult emergence continues through June, sometimes into July depending on the species. The adults are nocturnal in their activities, and as such, most people see the adults only when they are attracted to porch or window lights at night. During the day the adults can be found buried

in the soil or sod. A female will lay on average about 50 eggs over a 1- to 3-week period. Eggs are deposited 3 to 4 inches in the soil. Newly hatched larvae (first instar) first feed on the organic material found in the soil, but soon will turn to feeding on roots. By August the grubs have developed into the second instar. In late fall they burrow deep into the soil to hibernate. Minor turf damage can occur late in the summer of the first year.

Year 2. By late March and April, the overwintering second-instar grubs have moved back to the soil surface and resumed feeding. By June they develop into third-instar larvae. This is the time of the grubs' life cycle when they feed most actively on roots and cause the most turf damage. Most species feed 4 to 6 months during this time of their life cycle. In late September and October they migrate into the soil to hibernate. Depths of soil penetration for hibernation vary with the species.

Year 3. In late March overwintering third-instar grubs become active and move toward the soil surface for a brief feeding period. Minor turf damage can occur early in the summer as the mature larvae complete their feeding before pupation in late July. By September they develop into adults. These young adults remain underground until the following spring, when they emerge to feed and mate, completing their life cycle.

Identification

On the larval white grub, the ventral area of the last abdominal segment just below the anus is called the raster. The raster has spines, hairs and bare spots that are arranged in certain patterns among different species. These patterns can be used to identify grub species in the field. A hand lens, 10× or stronger, is the only piece of equipment needed. The rastral patterns of the SMC and M-JB are seen in Figure 2.

A reliable characteristic in separating adult SMC and M-JB grubs is the color of the clypeus (structure or area above the mouth parts). Adults of both species have a dark brown/black head. But in adult SMC, the dark colored head shades to a lighter brown clypeus, which makes the beetle appear to be wearing a mask. Conversely, the clypeus in most M-JB species is the same dark color as the rest of the head.

Control

The major factor influencing white grub density in turfgrass appears to be **soil moisture**; that is, in years with normal or above normal precipitation, grub populations tend to increase. This is because all white grub species require moist soil for their eggs to hatch. Young grubs are very susceptible to desiccation. Turf next to regularly watered ornamental plants is favored by the adults as oviposition sites.

This dependence on soil moisture by white grubs can be exploited as a type of **cultural control** option. In areas where turf can stand some moisture stress, do not water as much in the hot summer months, particularly

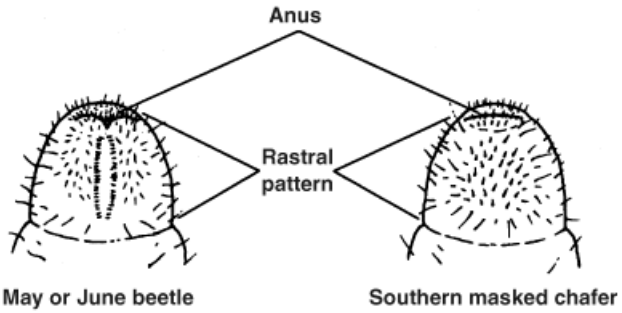

Figure 2. Rastral patterns found on the larval stage (grub) of May or June beetles and the southern masked chafer.

July and August when adults are laying eggs and young grubs are present.

Because damaging white grub populations tend to be sporadic from year to year, **preventative chemical control** applications are not really justifiable. But in areas where moderate to damaging levels of grubs have been perennial, preventative applications made in late May or June may be warranted. Some products that seem to have extended activity are isofenphos[1] (e.g., Oftanol), imidacloprid (e.g., Merit), and halofenozide (e.g., Mach 2).

Insecticides that have shorter residual periods (3 weeks or less) or must be ingested (preferably by small grubs) to be most effective are best used in a **curative chemical control** program. The successful use of these materials depends to a large degree on the proper timing of the applications (reapplication often necessary). These products must be applied shortly after egg hatch when the grubs are small and actively feeding. Remember, the smaller (younger) the grub, the easier it is to control. As a general rule, the recommended time to treat for grubs is about 4 weeks after the adult beetles start to emerge, the time when the eggs begin to hatch. For the SMC, this period is around late July to early August. Because emergence of M-JB adults can last for several weeks, chemical treatment for M-JB grubs is also recommended during late July and early August. Insecticides that appear to be effective as curative treatments include diazinon[2], ethoprop[3] (e.g., Chipco Mocap), trichlorfon[4] (e.g., Dylox), bendiocarb[5] (Turcam), halofenozide (e.g., Mach 2), and carbaryl (e.g., Sevin).

Notes

[1] For use by commercial applicators only.
[2] Not for use on golf courses or sod farms.
[3] Not for home lawn use.
[4] Some formulations for use by commercial applicators only.
[5] Restricted use pesticide, for use by commercial applicators only.

All chemical information is presented with the understanding that no endorsement of named products is intended, nor criticism implied of similar products that are not mentioned.

In recent years, several strains of insect parasitic nematodes in the genera *Steinernema* and *Heterorhabtitis* have offered somewhat effective **biological control** of white grubs. For these beneficial organisms to be most effective in managing white grub populations, it is critical that the labeled application instructions are followed exactly (e.g., time of day, soil moisture, size of grub, rates).

Chemical applications can be rendered useless if the material has not been thoroughly watered-in (0.5-inch), especially with liquid applications. The water not only moves the chemical down to the **thatch layer** (the final destination for most of the chemical), but it will often stimulate the grubs to move upward in the soil, closer to the thatch and toxicant. However, if the thatch layer is 0.75 inch to 1 inch thick, the grubs probably will not come into contact with lethal doses of the insecticide. It may be necessary to remove some of the thatch before a chemical application.

To determine if a chemical treatment is necessary, a **sampling** of the grub population is necessary. To do this, cut a 1 ft^2 piece of sod in each of several areas of the lawn, pull it back, count the number of grubs, and inspect their rastral patterns to determine species. Replace the sod squares back on the soil. If you have on average more than **10 SMC** grubs or more than **5 M-JB** grubs per square foot, then a chemical treatment is recommended. Remember, it is not unusual to have more than one species of white grub infesting the same lawn.

For further information

Brandenburg, R. L., and M. G. Villani. 1995. *Handbook of Turfgrass Insect Pests.* Lanham, Md.: Entomological Society of America.

Leslie, A. R. 1994. *Handbook of Integrated Pest Management for Turf and Ornamentals.* Boca Raton, Fla.: Lewis Publishers.

Tashiro, H. 1987. *Turfgrass Insects of the United States and Canada.* Ithaca, N.Y.: Comstock Publishing.

Watschke, T. L., P. H. Dernoeden, and D. J. Shetlar. 1995. *Managing Turfgrass Pests.* Boca Raton, Fla.: Lewis Publishers.

Before using any chemical please read the label carefully for directions on application procedures, appropriate rate, first aid, and storage and disposal. Make sure that the chemical is properly registered for the intended use.

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