White Grubs (Family Scarabaeidae): A Serious Lawn Pest

Order: Coleoptera (Beetles)

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Description. While there are many different types of beetles with a whitish soil-dwelling larval phase, the most common group are white grubs, which include several different beetle species that all feed on grass roots and cause damage directly or indirectly to lawns. At least 10 species of scarabs in five subfamilies are pests in lawns in the US. White grubs within the Scarabaeidae family are whitish, soft-bodied and "C"-shaped, with 3 pairs of legs and a hard brownish head (Fig. 1). They vary in size from less than 0.5 to 1.9 inches long depending on the species and age of the larva. For example, mature larvae of May and June beetles (*Phyllophaga*) are up to ~1.9 inches long, whereas those of Japanese beetle (*Popillia japonica*) and Asiatic garden beetle (*Maladera castanea*) are ~0.5 inches long. White grubs can be identified to species based on the shape of the anal slit and pattern of hairs at the base of the abdomen (rastral pattern). This requires the assistance of an entomologist and microscope.

Fig. 1. Different sizes of white grubs.

Fig. 2. Typical lawn damage linked with white grubs: Top: damage from grub feeding; Bottom: damage from rodent foraging for grubs.

Damage Symptoms and Pest Status. The common damage symptom caused by white grubs is irregular dead patches in the lawn, resulting from their feeding on the roots (Fig. 2). Feeding by grubs may go unnoticed until severe damage has occurred, esp. if the lawn is otherwise in good condition. Most of the damage from grubs occurs in September when the grubs have reached a later stage and are feeding aggressively in anticipation of hibernation. Just as serious is the damage caused by wildlife, such as, skunks, raccoons, squirrels and crows, etc.) foraging for grubs. The adult stage of several species of white grubs are also above ground pests on a wide variety of ornamentals, flowering garden plants, small fruits and tree fruits (Fig. 3). However, because the adults of these beetles can fly, managing grubs in the soil will have little impact on reducing their damage.

Biology. The life cycles of these beetles vary greatly in timing and duration underground. Most of the smaller species (Japanese beetle, Asiatic garden beetle and European chafer (*Amphimallon majale*)) have 1-2 year life cycles, depending on climatic conditions. They may emerge from the soil at different times over the summer. The larger species (May and June beetles) have 1-4 year life cycles. Adult beetles emerge from the soil in the spring or summer and mate. Females lay eggs in the soil or lawn, 1–5 inches deep. The eggs hatch into larvae within 2-3 weeks and begin to feed on plant roots. When soil temperatures begin to drop in late fall, larvae move down deeper into the soil below the frost line, where they overwinter, protected from freezing temperatures. As the soil warms in spring, larvae move up towards the soil surface to pupate, and after a few weeks emerge as adults. Knowing the pest life cycle is important for timing any management treatment.

Fig. 3. Adults with white grub larvae (left to right): European chafer, Japanese beetle, Asiatic garden beetle, Oriental beetle (*Anomala orientalis*), rose chafer (*Macrodactylus subspinous*), June/May beetle.

Cultural Practices to Minimize Grubs. The height of mowing appears to have some impact on the size of some grub species, with smaller ones found in association with high-mowed lawns. The population of some species is reduced when lawns are not mowed too short. In general, the most significant factor affecting grub populations is soil moisture. In summers with limited rainfall, grub populations are often less. The eggs and larvae of these beetles are killed during periods of drought. Adults also may lay less eggs when the soil is dry. In addition, larvae tend to move down when the soil is particularly dry, protecting the roots from feeding. However, grubs move back up closer to the surface within 24 hours when soil moisture returns. It is generally recommended not to overwater lawns. Instead, if watering is necessary, it is better to give the grass one deep watering every few days rather than a daily light, shallow watering.

Fig. 4. Sampling for white grubs in sod.

Monitoring. Monitoring is the first step when considering if a management action is required. There are many reasons why lawns develop brown patches, including disease, drought and poor fertility. That is why it is essential to check for grubs before spending time and money on management that isn't needed. In addition, grub populations vary from year to year and place to place. It is impossible to predict, based on past history, if there will be grubs in the lawn. Sampling should be done in late spring, August or early September before considering treatment. The least destructive sampling method is to cut three sides of a square piece of sod, each 6 inches long, to a depth of 3-4 inches (Fig. 4). Fold back the sod and count the number of grubs. Collect some grubs for identification and then fold the sod back in place. Tamp the flap down and water it. Repeat this in several locations to obtain a representative sample of the grub population. The number of samples depend on the size of the lawn. Sampling should be done after a heavy rain event or deep irrigation to get a clear idea of the population level. If the soil is too dry, the grubs may have moved deeper in the soil and will avoid detection. The threshold for damage to be observed depends on the health of the lawn. Lawn that is well maintained can tolerate 10 grubs per square foot, whereas an unhealthy lawn may show injury with only 4-5 per square foot. In general, an average of 5-10 grubs per square foot warrants action. However, even a small number of grubs can attract rodents that can do major damage by foraging.

Management. It is important to know what stage of the pest you are targeting. Targeting the adults will not necessarily eliminate the grubs. Conversely, targeting the grubs won't prevent adults from feeding on the plants above ground. Japanese beetle traps are commonly used by homeowners in the hope of preventing damage from adults and perhaps reducing egg laying and grub populations. However, eliminating adults by trapping is rarely effective, and in fact traps may lure beetles to them, resulting in more grubs in the soil. Therefore, trapping is not recommended in most cases, except to detect the presence of adult beetles. In general, preventative insecticide treatments should be made to the soil from late May to early August, and watered in by irrigation or with rainfall. This is the time when grubs are closest to the surface, and most likely to come in contact with the compound. Fast-acting chemical pesticides can also be applied in August and September to reduce the number of grubs. It is not recommended to apply pesticides against grubs after early October, however. Before applying any chemical or biological pesticide, read the label to make sure it is registered for use against white grubs in the soil. In addition, make sure to follow instructions regarding the protective clothing that should be worn when making an application. Remember that any insecticide, whether a chemical or biological product, organic or non-organic, may present hazards to humans, pets, wild animals, pollinators and other non-target organisms. The label will explain the risks involved with using a product, and how to avoid problems.

Organic Options: Most of the materials described below use live microscopic organisms to kill the grubs. As with most natural enemies, it takes time for them to spread throughout the pest population, and often they are not 100% effective.

Bacillus thuringiensis var *galleriae* (Btg): This is a bacterial pathogen that has been found to be effective against several species of white grubs, and is sold as "grubGONE!". Remember Bt products are somewhat specific, and the one used against pests in the vegetable garden won't be effective against white grubs.

Beneficial nematodes: Nematodes are microscopic worm-like soil organisms, some of which attack insects and others that infect plants. Several species of "beneficial" nematodes are produced commercially and have been shown to be effective at reducing white grubs. *Steinernema glaseri, S. feltiae* and *Heterorhabditis bacteriophora* are three common species available on the market. To be effective, care must be taken to apply nematodes correctly. They are living organisms and will be killed quickly when exposed to sunlight, allowed to dry out or get too hot. Therefore, it is best to apply them in the late afternoon or on a cloudy day. Adequate water should be applied to the soil/lawn surface before and after application. They need water to move through the soil and search for grubs.

Milky spore disease, Bacillus popilliae. This is a well-known insect-killing bacteria that has been sold for use against white grubs for many years. The effectiveness of this product has not been definitively confirmed. It works on the premise that a few grubs become infected and when other grubs come in contact with infected ones, they also are killed. Over time the bacterial inoculum spreads throughout the yard serving as a sustained line of defense that remains alive in the soil for several years. Some theorize that, in Vermont, summers are too short, and there isn't sufficient time for the inoculum to build up in the soil.

Chemical Options: Several chemical pesticides are registered for use against white grubs in lawns. The advantage of these products is that they are usually fast acting. However, because grubs can continue to develop over a long period over the summer and early fall, repeat applications may be required. In addition, many of these are broad spectrum products that kill both beneficial insects in the environment as well as the grubs. It is generally recommended to mow the lawn before making a chemical insecticide treatment to minimize exposure of pollinators. Some products also have a long residual activity, meaning they remain active in the soil killing insects over an extended time period. This is good in that it eliminates the need for multiple reapplications, but it also means that the toxic chemical remains in the lawn, which is not ideal for non-target organisms, like pets and humans. To minimize the impact of a chemical pesticide, spot applications can be made in areas where grub populations are high. In general, irrigation (at least 0.5 inches) of the lawn after an insecticide treatment is essential to ensure the compound reaches the depth where the grubs occur.

For additional information, check these websites:

https://extension.umn.edu/news/white-grub-control-lawns

https://extensionentomology.tamu.edu/insect/may-beetle/

https://web.extension.illinois.edu/lawntalk/weeds/dealing_with_white_grubs_in_lawns.cfm

https://extension.colostate.edu/topic-areas/insects/billbugs-and-white-grubs-5-516/

https://extension.psu.edu/white-grubs-in-home-lawns

https://www.arbico-organics.com/category/beneficial-nematodes-faqs

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Images used in this factsheet were obtained from several different websites, too many to mention. We appreciate those who contributed to promoting Integrated Pest Management through their images. This information is provided with support from the Univ. of VT College of Agriculture & Life Sciences and Extension System; and the IPM Extension Program from the USDA National Institute of Food and Agriculture.