UNIVERSITY OF VERMONT EXTENSION

CULTIVATING HEALTHY COMMUNITIES

Identification & Management of White Grubs in Vermont's Greenscapes

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The Grubby Facts: White grubs are the immature (larval) stage of several species of beetles in the family Scarabaeidae, order Coleoptera. They are typically found within the first few inches of the soil. Grubs feed on the roots of grasses, weeds, ornamentals and vegetables causing significant damage. As adults, many of these species of scarab beetle can also damage foliage of various landscape and garden plants during the summer. Damage in turf and lawns from white grubs usually shows up later in the summer and early fall. It tends to be localized in irregular spots and distribution can be highly variable from year to year, making it difficult to predict where high populations will be. In addition, predators such as skunks and raccoons can cause more damage than the pest itself in their search for grubs. Sometimes management is required to minimize this secondary cause of turf damage, rather than to reduce grub feeding itself.

Identification & Life Cycle: White grubs are soft-bodied, C-shaped, pale yellowish-white with a brownish head and have six legs (Fig. 1). They range in size from ½ to over 2 inches long depending on species. This group of beetles has four life stages: egg, several larval instars (stage), pupa and adult. Most species complete their life cycle in 1 year (e.g., Japanese beetles), but some take 2-3 years to reach adulthood (e.g., May or June beetles). The size and color of the adults vary greatly among the species. They range from ½ -1 inch long, have stout oval bodies, and vary in color from brown or green, to bronze or greenish metallic. They have broad front legs adapted for digging. Adults lay eggs in the top 3-4 inches of the soil in early to mid-summer, which hatch within 1-2 weeks into young grub larvae that feed on roots until late summer-early fall. In the fall, the grubs move deeper in the soil (2-6 inches) where they overwinter. In the spring, grubs begin to feed again and turn into a non-feeding pupa and then emerge in early summer the following year as adult beetles (for species with a 1-year life cycle).

Fig. 1. Three species of "white grubs": L to R, Japanese beetle, European chafer, June bug. D. Cappaert, Michigan State Univ., www.images.bugwood.org

Accurate identification of white grub is critical because some management options are specific to a particular species. The best time to identify grubs is in May-June when most are in their last larval stage and are large enough to observe the raster patterns. Raster patterns are located on the tail end (rear) of the abdomen (Fig. 2). Grubs have a slit near their tail end. These can be curved following the contour of the body, or Y-shaped (Fig. 3). There are also spines or hairs near the slit that form a pattern and several spines or hairs just in front of the slit. The combination of these features is used to distinguish the species of a grub. However, when in doubt, it is best to send specimens to a diagnostic laboratory to obtain a definitive identification.

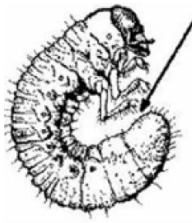
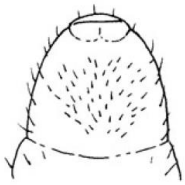


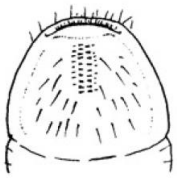
Fig. 2. Location of raster patterns at the end of the white grub. (USDA/Cornell)

In the Northeast, there are several native and exotic/introduced species of white grubs (Fig. 3). Native species include the black turfgrass Ataenius (*Ataenius spretulus*), green June beetle (*Cotinis nitida*), May or June beetles (*Phyllophaga* spp.) and northern masked chafers (*Cyclocephala borealis*). Exotic species include the Asiatic garden beetle (*Maladera castanea*), European chafer (*Amphimallon majalis*), Japanese beetle (*Popillia japonica*) and oriental beetle (*Anomala orientalis*). Japanese beetles are one of the most devastating greenscape pests in the eastern U.S., attacking flowers, turf, vegetables and fruit.

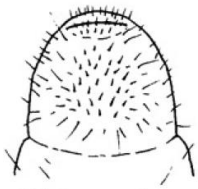
Native Species



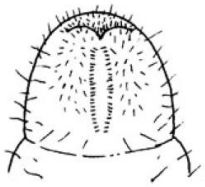
Black Turfgrass Ataenius (*Ataenius spretulus*). Adult: 0.25 in.; larva: 0.1-0.2 in. W. Cranshaw, Colorado State Univ.



Green June Beetle (*Cotinis nitida*). Adult: 0.8 in.; larva: 1.6 in. S. Ellis.

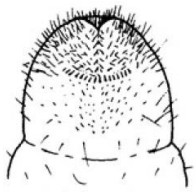


Northern Masked Chafer (*Cyclocephala borealis*). Adult: 0.43 in.; larva: 0.9 in. M. Reding & B.Anderson, USDA ARS.

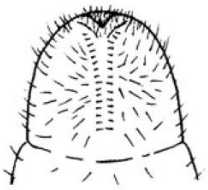


May or June Beetles (*Phyllophaga* spp.). Adult: 0.41-0.93 in.; larva: 0.93-1.5 in. Kansas Dept. of Agriculture.

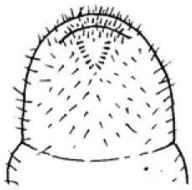
Introduced Species



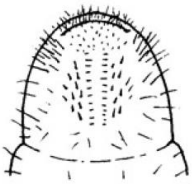
Asiatic Garden Beetle (*Maladera castanea*). Adult: 0.39 in.; larva: 0.75 in. M. Reding & B.Anderson, USDA ARS



European Chafer (*Amphimallon majalis*). Adult: 0.55 in.; larva: 0.24 in. M. Reding & B.Anderson, USDA ARS.



Japanese Beetle (*Popillia japonica*). Adult: 0.31-0.43 in.; larva: 0.40 in. C. Frank Sullivan, Univ. of VT, Entomology Res. Lab



Oriental Beetle (*Exomala orientalis*). Adult: 0.35 in.; larva: 0.79 in. Y. Alexander, Atco, NJ.

Fig. 3. Native and introduced species of turf feeding scarab beetles; adults (left) and raster pattern on white grub (right). All numbered images were downloaded from Bugwood Image Database System, www.images.bugwood.org

Integrated Pest Management

Managing white grubs that feed on turf is particularly difficult because the immature stages live underground and the adults can fly long distances. Without an area-wide effort, management can be challenging. An IPM approach must be selected based on the life stage targeted. For example, reducing adult beetle populations on the foliage of plants will not prevent damage caused by skunks and raccoons searching for grubs in the lawn. Similarly, reducing the number of grubs in the lawn may not eliminate the adult population because they can migrate from other untreated areas. This factsheet focuses on managing white grubs to minimize root feeding and damage from animals foraging for them in the fall, rather than reducing adult feeding on foliage, flowers or fruit.

Cultural Control: The first line of defense is to provide favorable conditions for growth of the lawn while discouraging adult egg laying and immature survival. Lawns should be mowed to a height of 1–2 in. to encourage good shoot and root growth is critical. While white grubs may occur in lawns at this height, their damage is generally less, but it will not protect the grass from animal foraging. It is also best to change the pattern of mowing regularly to avoid soil compaction. Lawns should be irrigated to supplement natural rainfall, especially in times of drought. Watering the lawn when adult activity is at its peak in summer may attract more adults. However, in late summer and fall, lawns that are irrigated properly are more tolerant to grub feeding. Lawns should be watered in the morning when it is cool, and evaporation is relatively slow. They should not be watered after 6 pm because this promotes conditions that favor disease. Lawns should be watered enough to moisten the soil to around 6 inches. A deep watering once or twice a week is better than watering for a short time several times weekly.

Adult Suppression: Because the adult stage of white grubs can fly, managing adults on individual properties is not effective for reducing lawn damage, though it may be suitable for protecting the vegetation, flowers or fruit on which they feed. Hand-picking of adult beetles and drowning them in soapy water can reduce their damage. Although controversial, for Japanese beetles, pheromone/bait traps set at least 50 feet away from susceptible plants may reduce damage causing adults, but they may also attract more adults to the area. Laying down protective barriers (fabric-based material) on the soil and growing plants that are unattractive or resistant plants to adult beetles can be effective, but not always realistic.

Scouting: Sampling for white grubs in the lawn should be done to determine if treatment is needed. This provides information about how many are present, where they are located and what species they are, and ensures treatments are applied where the grubs are feeding. The lawn should be sampled in mid-July or early August, before damage is observed. A sample is taken by cutting three sides of a square (6 or 12 in.) to a depth of 3-4 in. with a shovel or spade, and flipping back the sod. White grubs will be visible at the soil/sod interface. After sampling, the sod should be replaced, tamped down and watered to avoid injury. At least three samples should be taken in different locations of the lawn, and the numbers averaged to estimate the population. Action thresholds have been developed, but are dependent on site conditions and the treatment approach that will be used. Lawns having an average of less than 5 grubs/ft^2 are likely to show minimal damage, whereas those with 8-15 grubs/ft^2 may warrant treatment to avoid damage. Lower thresholds should be used on stressed sites prone to drought. Even if grubs are maintained below levels that injure the turf directly, damage from small mammals may still occur. In addition, the adults may still pose a problem on ornamentals, given their mobility.

Biological Control: Several natural-occurring biocontrol agents can reduce white grub populations, including birds, skunks, raccoons, parasitic wasps and flies, nematodes and insect killing microbial organisms (fungi and bacteria), though their impact is often not sufficient to keep pest populations below damaging levels. If it is determined, based on sampling, that action is needed, treatments should be made in late summer when white grubs are young and most susceptible. At this time they tend to be closer to the soil surface, which enhances treatment effectiveness. A few biocontrol agents are commercially available. Milky spore disease (a commercial product containing the bacterium, *Bacillus popilliae*) is sold for use against Japanese beetle grubs, but is not generally recommended in this region because soil temperatures are too cool. Beneficial nematodes, *Steinernema* spp. and *Heterorhabditis* spp., are also available. Nematodes enter the bodies of the grubs and infect them with a bacterium that kills them. Nematodes are species-specific so it is essential to identify the grub species present in the lawn, and selecting the nematode product accordingly. Consult with the supplier to determine the best product to use. When making an application, the area must be kept moist before and after treatment to allow the nematodes to enter the soil in search of prey. If the soil dries out soon after treatment, the nematodes will die on the soil surface before they enter the soil.

Chemical Control: Use of chemical pesticides should be considered a last resort when other options are not enough to maintain a pest population below damaging levels. Chemical control of white grubs can be challenging because they live in the soil, making contact difficult. Preventative insecticides are applied in June or July to reduce newly hatched grub populations the following year. They do not work well on larger grubs that are found in the soil in late summer or fall.

There are a few "curative" pesticides that can be applied in the summer or fall to target these large grubs. Some active ingredients bind with organic matter in the soil, preventing them from moving to where grubs are actively feeding. For best results when using chemicals, mow the turf, rake out dead grass and thatch before treatment. This reduces the binding potential of the active ingredients to organic matter. It is essential to water the lawn immediately after an application to make sure the active ingredient contacts the grubs. Read the label instructions carefully each time a treatment is made because each type of pesticide type may need to be applied at different times during the growing season to be effective. Many pesticides should be applied in the late summer after the first egg hatch is complete. Treating the lawn with a pesticide may reduce white grubs, but will not reduce adults that are feeding above ground. In the spring, the grubs are large and are more resistant to insecticides. Several of the pesticides used for white grubs may be harmful to bees and natural enemies, and precautions to minimize their impact on these non-target organisms should be taken. Michigan State Univ. provides useful information best practices to follow for white grubs. http://msue.anr.msu.edu/news/how_to_choose_and_when_to_apply_grub_control_products_for_your_lawn

Always read the label and follow the instructions for all pest management products.

Information in this factsheet was developed for conditions in Vermont, and may not apply to other geographical areas.

For more information on identification and management of white grubs, check these resources:

- An Integrated Approach to Insect Management in Turfgrass: White Grubs. A. Koppenhofer, Rutgers: https://njaes.rutgers.edu/pubs/fs1009/
- Common White Grubs of Northeast Ohio Nurseries (Identification Key): https://www1.maine.gov/dacf/php/gotpests/bugs/documents/Ohio-State-grub-ID.pdf
- How to De-Grub Your Lawn Organically: http://frwa.org/publications/grubs.pdf
- How to choose and when to apply grub control products for your lawn. T. Davis, Michigan State Univ., 2016: http://msue.anr.msu.edu/news/how_to_choose_and_when_to_apply_grub_control_products_for_your_lawn
- Identifying and Managing White Grubs in Turf, S. Bosworth, Univ. of VT, 2011: https://www.uvm.edu/mastergardener/documents/ManagmentOptionsforGrubsinVermont_000.pdf
- Identifying White Grubs. Michigan State & Purdue University: http://www.msuent.com/assets/pdf/03GrubID.pdf
- Managing the Japanese Beetle: A Homeowner's Handbook, USDA: https://www.aphis.usda.gov/publications/plant_health/2015/japanese-beetle-handbook.pdf
- NOFA Organic Lawn Care Guide: http://ctnofa.org/Documents/book_FINAL_OPT.pdf
- Using Beneficial Nematodes for Grub Control, State of Maine: https://www1.maine.gov/dacf/php/gotpests/bugs/documents/nematodes-for-grub-control-maine.pdf
- White Grub Identification. 2011 UMASS Extension: https://ag.umass.edu/sites/ag.umass.edu/files/fact-sheets/pdf/white_grub_ID.pdf

If you have additional questions, contact:

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