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Japanese Beetle

by W. Cranshaw* (5/13)

Quick Facts...

- Japanese beetle adults chew flower blossoms and leaves of many commonly grown plants.
- Japanese beetle larvae are a type of white grub that feeds on the roots of grasses.
- Adults are best controlled by handpicking or by use of certain insecticide sprays.
- Japanese beetle traps can capture many adults have never been shown to reduce damage to nearby plants.
- Japanese beetle larvae can be controlled with certain insecticides or by insect parasitic nematodes.

For close to a century, the Japanese beetle (*Popillia japonica*) has been one of the most seriously damaging insect pests of both turfgrass and landscape plants over a broad area of the eastern U.S. Recently, there have become a few permanent, reproducing populations of this insect in some communities along the Front Range of Colorado. At some of these sites high numbers of Japanese beetles regularly occur and adult beetles are causing significant damage to leaves and flowers of many susceptible landscape plants (Figure 1).

Figure 1. Rose blossoms are one of the most highly favored foods of Japanese beetles..

Description of the Japanese Beetle

The adult Japanese beetle has an oval form is about 7/16-inch in length. It is generally metallic green with coppery-brown wing covers, which do not quite cover the tip of the abdomen. Along the sides are five patches of whitish hairs. The antennae are clubbed at the end and may spread to a fan-like form (Figure 2).

Japanese beetle larvae are a type of white grub that feed on the roots of grasses. They have a creamy white body with a dark head and the legs on the thorax are well developed. Normally the body curves into a 'C-shape.' These features are also typical of other white grubs found in association with turfgrass in Colorado, such as masked chafers and May/ June beetles. (Extension fact sheet 5.516, *Billbugs and White Grubs*

discusses white grubs of turfgrass in more detail.) Japanese beetle larvae are slightly smaller than these other species (Figure 3) when full grown but they are best distinguished by closely examining the pattern of hairs on the hind end of the abdomen ('rastral pattern'), which forms a distinctive V-shape (Figure 4).

Figure 2. Japanese beetle adult. ***Photograph courtesy of David Cappaert/University of Michigan and IPMImages.org*****.**

Japanese Beetle Damage

Japanese beetle can be damaging to plants in both the adult and larval stages. However the type of injuries produced by adults and larvae are very different.

Figure 3. Larvae of 3 species of white grubs (left-right): Japanese beetle, European chafer, May/June beetle. ***Photograph courtesy of David Cappaert/University of Michigan and IPMImages.org*****.**

Injury by the adults is more obvious and is usually the primary concern in Colorado. Adults feed on leaves, buds and flowers of many common garden and landscape plants (Table 1). On leaves feeding is usually restricted to the softer tissues between the larger leaf veins, which results in a characteristic feeding pattern known and described as 'skeletonizing' (Figure 5). More generalized ragged feeding occurs on softer tissues, notably flower petals; rose flowers are particularly susceptible to Japanese beetle injury. Damage on individual plants may be patchy, concentrated where aggregations of feeding beetles occur.

Japanese beetle larvae feed on roots of grasses, in a manner similar to other turf damaging white grubs. These injuries produce root pruning that limit the plant's ability to acquire water. Damaged areas of turfgrass are more susceptible to water stresses and severely pruned roots can lead to plant death by drought. It is likely that there will be increasing turfgrass damage in areas where this species becomes established, adding to the damaging done by native white grubs present in Colorado turfgrass (e.g., masked chafers, May/June beetles).

Japanese Beetle Life History

Japanese beetle has a one year life cycle. Adults may begin to emerge from the soil in early June and are usually most abundant in early summer—from late June through early August. However, some adults may be found into September.

As adults, Japanese beetles can be found feeding and mating on foliage and flowers of their host plants. Periodically, mated females will move in late afternoon to areas of turfgrass to lay eggs. They seek areas where soil is suitably moist and then dig 2-3 inches where they will lay a small cluster of eggs among the plant roots. They subsequently emerge and will resume feeding on host plants, returning to turfgrass later to lay more eggs. A total of 40-60 eggs may be laid by each Japanese beetle female during the course of her 4-8 week life span.

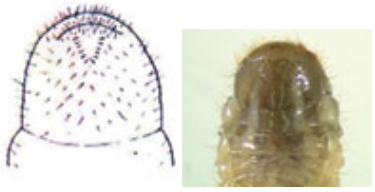

Figure 4. The rastral pattern that is distinctive for white grubs of the Japanese beetle. The rastral pattern is located on the underside of the tip of the abdomen. Photograph of the rastral pattern courtesy of Betsy Anderson and Mike Reding, USDA-ARS and IPMImages.org.

Upon hatching from the eggs the larvae seek out nearby plant roots and feed. During this early period of development, during the egg and early larval stage, Japanese beetle is quite sensitive to drying and they may die if soils temporarily dry during this period. Later stage larvae are less sensitive to drying and Japanese beetle larvae become nearly full-size by early September. The rapid larval development during late summer results in severe root feeding injury combined with droughty conditions typical of late summer, most turfgrass damage is apparent at this time.

Larvae continue to feed until soil temperatures drop to about 60°F at which time the larvae move deeper in the soil where they remain through winter. All activity ceases when soil temperatures drop below 50°F. Activity resumes as soils warm in spring and, after a feeding period of about 4-6 weeks, the larvae form an earthen cell and pupate. A few weeks after pupation, adults emerge.

Figure 5. Leaf injury to Virginia creeper foliage by Japanese beetle adults.

Japanese Beetle Trapping

Traps are available that can capture Japanese beetle adults. These typically have a vane of yellow panels at the top with a funnel underneath into which the beetles fall after impacting the vane panels (Figure 6). A lure of floral-based compounds is used that is highly attractive to adults.

Large numbers of adult beetles can be captured in these traps and they are useful for detecting the presence of Japanese beetle for survey purposes. The traps also have some value in control where Japanese beetles are restricted to a very limited location; mass beetle trapping was a component of the Japanese beetle eradication in Palisade, CO.

Table 1. Some plants that are most commonly damaged by Japanese beetle adults.

Virginia Creeper	Grape
Rose	Crabapple, apple
American linden	American elm
American mountain-ash	Norway maple
Horsechestnut	Green beans
Raspberry	

Unfortunately, Japanese beetle traps are ineffective for control where Japanese beetle is well established over a large area, common now in many Front Range locations. Repeated trials have demonstrated that use of such traps does not reduce the number of beetles damaging nearby vegetation. Furthermore, the use of Japanese beetle traps often *increases* damage by Japanese beetles by drawing into the vicinity larger numbers of beetles than are captured in the traps. Because of this *Japanese beetle traps are not recommended for Japanese beetle control*.

Control of Adult Japanese Beetles

Hand picking beetles can sometimes be effectively employed in small plantings. The beetles are easily picked or dislodged; shaking infested plants over a collecting container in early morning can be particularly productive. The regular removal of beetles prevents the feeding damage by those beetles and also deters other beetles from aggregating on the plant. Beetle presence on plants and prior injury is attractive to other beetles.

Figure 6. Typical trap used to capture adults of the Japanese beetle.

Adult Japanese beetles can be effectively controlled by use of several sprayed insecticides which either kill and/or repel beetles. Various pyrethroid insecticides (e.g., cyfluthrin, permethrin, bifenthrin, deltamethrin, lambdacyhalothrin, esfenvalerate) are particularly good for this purpose and may provide protection of plants for 2-3 weeks following a single application. Carbaryl (*Sevin*) is also quite effective, although persistence of control is somewhat shorter. More recently acetamiprid has become an available option, which has the advantage of moving systemically in the plants. All of these insecticides do have a broad spectrum of activity against many insects and their use on flowering plants that are being visited by honey bees is illegal.

A few plant-based insecticides also can be useful for Japanese beetle control and these are particularly useful on flowering plants that are being visited by pollinators. Neem-based products that contain azadirachtin (e.g., BioNeem) can be used to deter beetles for 3-4 days. (Note: Neem oil products that have no azadirachtin are not effective for Japanese beetle control. Such products usually are sold as 'neem oil' and contain the active ingredient "clarified hydrophobic extracts of neem" but do not list the ingredient azadirachtin on the label.) Insecticides that contain pyrethrins and some oil (usually canola oil) also can control Japanese beetle on plants for a couple of days. However, many other plant-based insecticides sold for general insect control in gardens are ineffective Japanese beetle control products (e.g., garlic, citrus extracts/limonene, hot pepper wax) and are not recommended.

Soil applications of the systemic insecticide imidacloprid can also be used to protect plants that are at high risk of injury. Imidacloprid is applied as a soil drench to the roots and requires 2-4 weeks before it moves in sufficient concentration to leaves so that it can provide protection; applications need to be made prior to periods of expected adult feeding in early summer. Unless the formulation specifically allows the use, imidacloprid should not be applied to plants that are grown for

food. Its use is also discouraged on plants that later in the season will produce flowers that are visited by pollinating insects.

Control of Japanese Beetle Grubs in Lawns

Japanese beetle grubs can damage turfgrass in the same manner as other turfgrass white grubs. (See CSU Extension fact sheet 5.516, Billbugs and White Grubs). Some cultural practices can limit damage and applied chemical or biological controls may also be useful. However, *control of Japanese beetle larvae in a yard will have very little, if any, effect on the number of Japanese beetle adults feeding on trees, shrubs and garden plants*. The insect is highly mobile so that problems with adult beetles typically involve insects that have moved a considerable distance.

Where practical, limiting water during the period when eggs are being laid and early stage larvae are present (Late June-July) can be useful in Japanese beetle control. Egg laying will be concentrated in sites where soil moisture is highest and turf growth most lush. Such favorable conditions also favor subsequent survival of eggs and larvae. Intermittent periods of slight soil drying during the late June-July period can cause adults to seek other sites for egg laying and kill many developing eggs and larvae that are present. Such manipulation of soil moisture brings with it the risk of drought stress to plants, but deep and infrequent watering practices earlier in the season promote deep rooting that can provide turfgrass much greater tolerance to brief drying periods later in the season. (For more information see CSU Extension fact sheet 7.199, Watering Established Lawns.)

Conversely, in late summer when late stage larvae are present and most actively feeding watering can help turf areas better tolerate the effects of root injuries.

Several insecticides are presently available that can provide excellent control of Japanese beetle grubs in lawns. Most commonly available are imidacloprid (Merit, Zenith, myriad other products) and chlothianidin (Arena), which are used in preventive applications as beetles prior to egg hatch. More recently available as an option is chlorantraniprole (Acelypryn, Scott's Grub-Ex), a reduced risk insecticide that can provide excellent control of Japanese beetle larvae. These insecticides can provide control of Japanese beetle larvae over an extended period (several weeks-months) and are particularly effective against early stage larvae. Consequently applications are best made to coincide with the onset of Japanese beetle egg laying, typically in late June and early July. Rates of use are dependent on time of application with lower rates being adequate when applied against younger larvae in early summer. Higher rates are needed when late stage larvae are present. Control will diminish if applications are made later in the season, when grubs are large, and these products will often give disappointing results when used in "rescue" treatments for existing infestations in advanced stages.

(Both imidacloprid and chlothianidin are neonicotinoid insecticides that can move systemically in plants. Therefore, the use of these products is discouraged in turfgrass areas where white clover, dandelions and other flowering plants that are visited by pollinating insects are present. Spray applications of any insecticide applied to lawns should never be made so that they cover flowers and turfgrass with flowering weeds should be mowed to remove any flowers immediately prior to applications. Chlorantraniliprole [*Acelypryn, Scott's Grub-Ex*], a newly registered insecticide, has considerably lower potential hazard to pollinators than do other insecticides used for control of larval Japanese beetles.).

A biological control alternative for control of Japanese beetle larvae is the use of soil applications of certain insect parasitic nematodes. (These organisms are discussed in more detail in CSU Extension fact sheet 5.573, Insect Parasitic Nematodes.) Specifically effective are certain nematodes in the genus *Heterorhabditis* (e.g., *Heterorhabditis bacteriophora, H. megadis*) and several biological control suppliers will provide these organisms (Figure 7). (A list of biological control suppliers can be found on the Insect Information website at: http://bspm.agsci.colostate.edu/outreach-button/insect-information/.) Applications of *Heterorhabditis* nematodes are made as a soil drench, preferably during cool, overcast periods, and must be immediately watered into the turfgrass. They should be applied when Japanese beetle larvae are present and active.

Figure 7. A white grub (lower right) that has been infected and killed by the insect parasitic nematode Heterorhabitis sp. Insects infected by this nematode turn a reddish-brown color.

Another biological control that has received considerable past attention for Japanese beetle control is milky spore (*Bacillus popilliae*), a bacterium that produces 'milky disease' in Japanese beetle grubs. (The currently available formulation is sold under the trade name St. Gabriels' Organics Milky Spore Powder.) Milky spore powder is applied to turfgrass areas where Japanese beetle grubs are active and may infect some of the grubs, producing a chronic infection that reduces survival and

reproduction. Applications of milky spore powder will not produce immediate reductions in number of Japanese beetles; successful establishment of milky spore at a site, and its subsequent natural spread, may somewhat reduce overall numbers of Japanese beetles in future years.

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