Japanese Beetle

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Distribution

The Japanese beetle, *Popillia japonica*, is generally found east of a line running from Michigan, southern Wisconsin and Illinois, south to Alabama. Occasional introductions are made into more western states such as Nebraska, Missouri, Kansas, Colorado and Arkansas. The original population was detected in New Jersey in 1916, having been introduced from Japan. In Ohio, the most damaging populations are east of a line running from Cleveland to Cincinnati. Isolated, damaging populations of grubs are occasionally found west of this line, usually in high-quality urban turf.

Hosts

The adult beetles are general herbivores and are known to feed on over 400 species of broad-leaved plants, including roses, flowering cherry, zinnias and others, although only about 50 species are preferred. Their larvae, called white grubs, will also feed on a wide variety of plant roots including ornamental trees and shrubs, garden and truck crops, and turfgrasses. They seem to prefer Kentucky bluegrass, perennial ryegrass, tall fescues and bentgrass.

Damage Symptoms

The adult beetles are skeletonizers, meaning they eat the leaf tissue between the leaf veins but leave the veins behind. Attacked leaves look like lace that soon withers and dies. The adults will often attack flower buds and fruit. The grubs can kill small seedling plants but most commonly damage turf. The turf first appears off-color as if under water stress. Irrigating causes a short-lasting response or no response at all. The turf feels spongy under foot and can be easily pulled back like old carpet to reveal the grubs. Large populations of grubs kill the turf in irregular patches.

Description of Stages

The life stages of the Japanese beetle are typical of white grubs.

- **Eggs**: The white oval eggs are usually about 1/16 inch (1.5 mm) long and 3/64 inch (1.0 mm) wide. They are placed in the soil where they absorb moisture and become more spherical.

- **Larvae**: The larvae are typical white grubs that can be separated from other soil-dwelling white grubs by the presence of a V-shaped series of bristles on the raster. First instar larvae are about 1/16 inch (1.5 mm) long while the mature third instars are about 1¼ inch (32 mm) long.

- **Pupae**: The pupae are first cream colored and become light reddish-brown with age. The average pupa is about 1/2 inch (14 mm) long and 1/4 inch (7 mm) wide.

- **Adults**: The adults are a brilliant, metallic green color, generally oval in outline, 3/8 inch (10 mm) long and 1/4...
inch (7 mm) wide. The wing covers are copper-brown and the abdomen has a row of five tufts of white hairs on each side. These white tufts are diagnostic. The males have a sharp tip on the foreleg tibia while the female has a long rounded tip.

**Life Cycle and Habits**

Larvae that have matured by June pupate and the adult beetles emerge from the last week of June through July. On warm sunny days the new beetles crawl onto low growing plants and warm for a while before taking flight. The first beetles out of the ground seek out suitable food plants and begin to feed immediately. Odors that are released by the damaged leaves attract additional adults to gather in masses on the unfortunate plants first selected. In cool weather, the adults may feign death by dropping from the plants, but normally, they will take flight. Newly emerged females release a sex pheromone which attracts males. The first mating usually takes place on turf with several male suitors awaiting the emergence of a new female. Mating also is common on the food plants and several matings by both males and females is common.

After feeding for a day or two, the females leave feeding sites in the afternoon and burrow into the soil to lay eggs at a depth of 2 to 4 inches. Females may lay 1 to 5 eggs scattered in an area before leaving the soil. Upon oviposition the females depart, but soon return to feed and mate. This cycle of feeding, mating and egg laying continues until the female has laid 40 to 60 eggs. About 95% of a population is generally laid by mid-August, though adults may be found until the first frost of fall.

If the soil contains adequate moisture, eggs will fully swell in 2 to 3 days. Egg development takes approximately 8 to 9 days at 80 to 90 degrees F° but may take as long as 30 days at lower temperatures. The first instar larvae dig to the soil surface where they feed on roots and organic material. If sufficient food and moisture are available, the first instars can complete development in 17 days at 78°F or as long as 30 days at 68°F. The second instars take 18 days to mature at 78°F and 56 days at 68°F.

While this development is occurring, grubs may tunnel laterally in search of organic matter and fresh roots to feed upon. This feeding creates a very spongy feel to the soil and turf. Generally most of the grubs are in the third instar by early fall and are ready to dig into the soil to hibernate. The grubs burrow 4 to 8 inches into the soil as cold temperatures arrive. At this depth, the soil rarely gets below 25°F and the grubs survive with no difficulty. If the soil begins to cool further, the grubs may dig deeper. As spring and warmer temperatures approach, the grubs begin to move toward the surface to commence feeding. In general, grubs are actively feeding at the surface when the surface soil temperatures reach 65°F, usually in mid-April. The grubs continue their development in the spring and the few second instars seem to mature in time to pupate along with the third instars. The mature grubs form a pre-pupa in early June. The pre-pupa voids its gut contents creating a translucent appearance. The pupa is formed in the split skin of the pre-pupa in an earthen cell 1 to 3 inches below the surface.

**Control Strategies**

**Option 1: Cultural Control—Quarantine**

Japanese beetle quarantines are currently operated by the USDA-APHIS in states involved with shipping materials out of an infested area into uninfested areas. Though this has not stopped the slow progression of Japanese beetles westward, it seems to have slowed the process. Nurserymen and sod producers shipping plant material with soil out of Japanese beetle infested areas must obtain an inspection and certification. Often, airports and rail yards are under quarantine and transporters must treat their containers before shipping.
Option 2: Cultural Control—Habitat Modification
Since the eggs and young grubs are very susceptible to desiccation, refrain from irrigating during the time the eggs and first instar larvae are developing. However, if natural rainfall occurs, this tactic will not work. Do not plant trees and shrubs that are highly attractive to adult Japanese beetles near turf. This is especially true along golf course fairways. Trees and shrubs most attractive to adults include: Japanese and Norway maple, birch, pin oak, horse chestnut, Rose of Sharon, sycamore, ornamental apple, plum, cherry, rose, mountain ash, willows, lindens, elms and Virginia creeper. Trees and shrubs rarely attacked include: red and silver maple, holly, boxwood, euonymus, flowering dogwood, cedar, juniper, arborvitae, red oak, tulip tree, magnolias, red mulberry, forsythia, ashes, privet, lilac, spruces, hydrangeas and taxus (yew).

Option 3: Biological Controls—Insect Parasites
Several parasitic wasps, especially *Tiphia popillia* and *T. vernalis*, and the winsome fly, *Hyperecteina aldrichii* have been imported and are now known to be established in several eastern states. Unfortunately, these parasites do not seem to be reliable in reducing Japanese beetle populations below damaging levels. However, the *Tiphia* appear to be more efficient in southern states.

Option 4: Biological Control—Bacterial Milky Disease and *Bacillus thuriengensis*
The bacterial milky diseases, *Paenibacillus popilliae* Dutky and *B. lentimorbus* Dutky, have infected white grubs in certain areas of the eastern United States. The spore count must build up for 2 to 3 years to achieve maximum levels. In Ohio and Kentucky, test trials have shown that these bacteria only cause 20–25% infection rates. *Bacillus thuriengensis* (Bt) strains that are active against beetles have been shown to provide effective grub suppression against Japanese beetles and masked chafers when applied during the summer months. These strains are rarely available in commercial quantities. Keep in mind that microbial insecticides require immediate irrigation upon application to move product into the soil-thatch interface and that these products may succumb to UV degradation. They have a substantially shorter shelf life than standard grub control products.

This fact sheet is a revision of HYG-2504-91, “Japanese Beetle,” by David J. Shetlar.