



# FactSheet

Extension

## Ohio State University Extension Fact Sheet

### Entomology

1991 Kenny Road, Columbus, Ohio 43210-1090

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## Japanese Beetle

HYG-2504-91

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### Distribution

This imported pest is generally found east of a line running from Michigan, southern Wisconsin and Illinois, south to Alabama. Occasional introductions are made into western states such as California and Oregon when the adult beetles or larvae are shipped in commerce. 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, although only about 50 species are preferred. The 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 especially relish Kentucky bluegrass, perennial ryegrass, tall fescues and bentgrass.

### Damage Symptoms

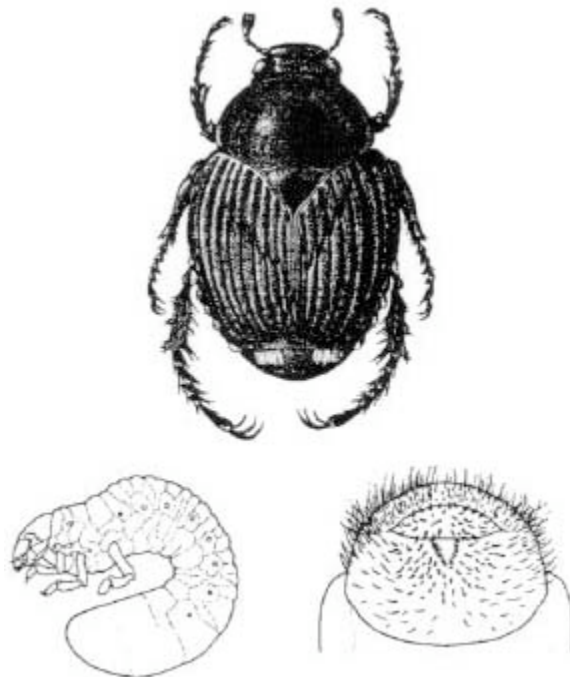
The adults are skeletonizers, that is, they eat the leaf tissue between the leaf veins but leave the veins behind. Attacked leaves look like lace that soon withers and dies. The adults will often attack flower buds and fruit. The grubs can kill small seedling plants but most commonly damage turf. The 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 roundish.
- **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 1-1/4 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.



**Adult Japanese beetle (top),  
grub (bottom left), raster pattern (bottom right)**

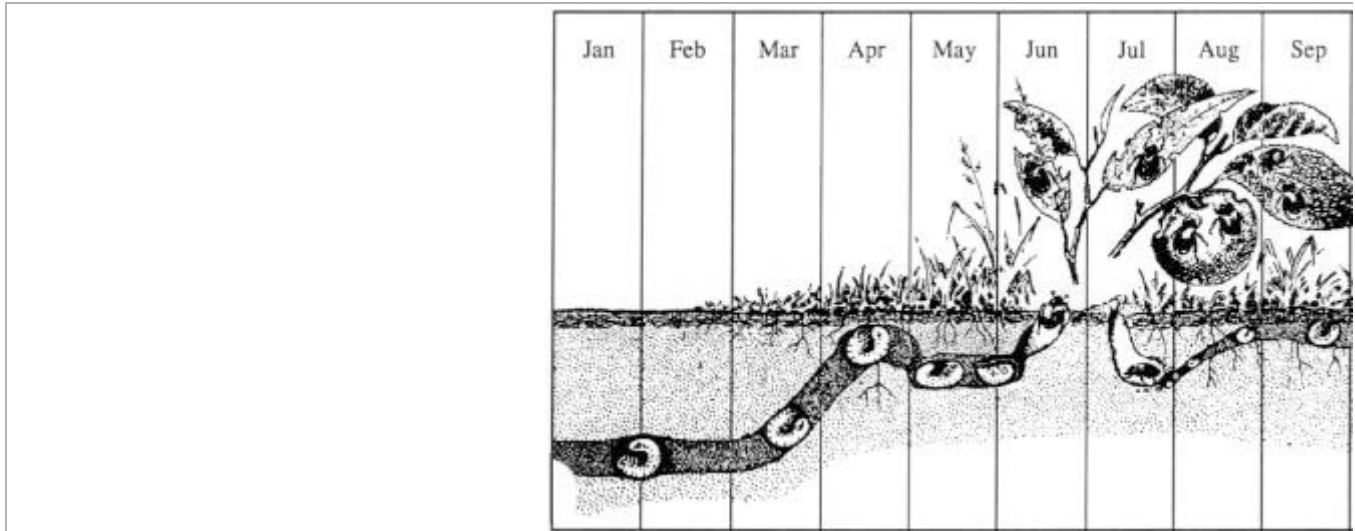
### Life Cycle and Habits

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 as soon as possible. These early arrivals begin to release a congregation pheromone (odor) which is attractive to adults that emerge later. These odors 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 an additional 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. These females will leave the following morning or a day or two later and will 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 are generally laid by mid-August, though adults may be found until the first frost of fall.

If the soil is sufficiently moist, eggs will swell in a few days. Egg development takes only 8 to 9 days at 80 to 90 degrees F or as long as 30 days at 65 degrees F. 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 degrees F or as long as 30 days at 68 degrees F. The second instars take 18 days to mature at 78 degrees F and 56 days at 68 degrees F.

While this development is occurring, grubs may tunnel laterally in search of organic matter and fresh roots. This 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 degrees F and the grubs survive with no difficulty. If the soil begins to cool further, the grubs may dig deeper. The grubs return to the surface in the spring as the soil temperature warms. Generally the grubs can be expected to be active at the surface when the surface soil temperatures are about 60 degrees 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 prepupa voids its gut contents and has a translucent appearance. The pupa is formed in the split skin of the pre-pupa in an earthen cell 1-to-3 inches in the soil.



**Japanese beetle life cycle**

## **Control Strategies**

See: White Grubs in Turfgrass (HYG-2500). Since this pest is important in agriculture and commerce, considerable effort has been placed on developing control options.

**Option 1: Cultural Control - Quarantine** - Japanese beetle quarantines are currently operated by the USDA-APHIS and states involved with shipping materials out of infested areas to 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 dry soils, do not irrigate 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 popilliavora* and *T. vernalis*, and the winsome fly, *Hyperecteina aldrichi* 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** - The bacterial milky diseases, *Bacillus popilliae* Dutky and *B. lentimorbus* Dutky, have been quite effective at controlling grubs in certain areas of the eastern United States. The spore count must build up for 2 to 3 years to be very effective. During this time you should not use an insecticide against grubs that are needed to complete the bacterium cycle. There is some recent data that suggests that these bacterial diseases may not be performing well in certain areas. This may be due to reduced virulence, soil conditions or grub resistance. More commonly, different white grub species have displaced the Japanese beetle grubs. In Ohio and Kentucky, test trials have not produced satisfactory results. Additional experiments are needed to determine the lack of efficacy of milky disease in these soils.

**Option 5: Biological Control - Entomophagous Nematodes** - The insect parasitic nematode, *Steinernema* (= *Neoapectana*) *glaseri* Steiner, was used before 1940 and had considerable promise but this agent was not developed further because of problems of rearing and expense. This nematode may be economically available in the future. Commercially available products containing strains of *S. carpocapsae* have been marginally effective. Preparations containing *Heterorhabditis* spp. seem to be the most effective of the currently available nematodes. Apply the nematodes when the white grubs are in the second instars. Irrigation before and after nematode application with 1/4 inch of water minimum greatly increases the efficacy of the nematodes.

**Option 6: Mechanical Control - Trapping** - Several traps have been developed to capture the adults. These traps generally use a mixture of the aggregation and sex pheromones. Recent data indicate that these traps do not significantly reduce grub populations and in some cases may actually contribute to increased foliar plant damage. There has been no correlation between trap captures and reductions in white grub populations in surrounding turfgrass areas.

**Option 7: Chemical Controls - Insecticides** - Consult, HYG-- 2500, White Grubs in Turfgrass for insecticide use recommendations. Bulletin L-187 lists the pesticides currently registered. When using trapping to monitor adult activity, keep in mind that the females lay the majority of their eggs within the first 7 to 10 days of their existence. They may live considerably longer than this and could be trapped into September and October. Usually, in Ohio the majority of Japanese beetle eggs have been laid by the end of the first week of August.

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This publication contains pesticide recommendations that are subject to change at any time. These recommendations are provided only as a guide. It is always the pesticide applicator's responsibility, by law, to read and follow all current label directions for the specific pesticide being used. Due to constantly changing labels and product registration, some of the recommendations given in this writing may no longer be legal by the time you read them. If any information in these recommendations disagrees with the label, the recommendation must be disregarded. No endorsement is intended for products mentioned, nor is criticism meant for products not mentioned. The author, The Ohio State University and the Ohio Cooperative Extension Service assume no liability resulting from the use of these recommendations.

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