The Japanese Beetle

An Invasive Pest

Japanese beetles arrived in St. Louis in 1934. They migrated from the East Coast and continue to move westward. Their life cycle makes them a major pest for agriculture and landscaping because they eat over 300 types of plants.

Japanese Beetle Larvae

Description

Adult Japanese beetles are one-half-inch long and metallic green with bronze wing covers *(photo on right)*. They have a row of white hair-like tufts just below their wing covers. Juvenile Japanese beetles (larvae) *(photo below, left)* are white grubs that range in size from one-sixteenth to 1 ¼ inches. They differ from other white grubs by the obvious V-shape of the hairs on the tip of their abdomen.

History in Missouri

Japanese beetles were accidentally introduced to the East Coast in 1916 in a shipment of Iris bulbs. Since then, they have slowly and steadily made their way westward. They arrived in Missouri in 1934. For several years, populations were mainly in the St. Louis area before spreading further west. Japanese beetle numbers continue to increase in some parts of the state.

Adult beetles are usually mated within a few minutes of emerging from the soil.

Life Cycle

Japanese beetles have a life cycle that makes them a major pest for agriculture and landscaping. As larvae (juveniles), they prefer cool season turf grasses, such as fescue and ryegrass. However, they eat the roots and underground stems of grasses and weeds. Turf that is heavily infested will feel spongy when stepped on; it can be pulled back like a carpet. Heavy feeding will eventually cause browning and death of the turf. This is especially true when the grass is also stressed by drought. The Japanese beetle's appetite for turfgrass has created a thriving market for its control among golf course managers and homeowners.

LINCOLN University

Cooperative Extension

by
Jacob Wilson, Extension Technician I
Integrated Pest Management (IPM)
Dr. Jaime Piñero, State Extension Specialist – (IPM)
Austen Dudenhoeffer, photos of larvae and mating beetles.

900 Chestnut Street, Allen Hall
Jefferson City, MO 65101

LUCE FS#18-D-2014
07/28/2014

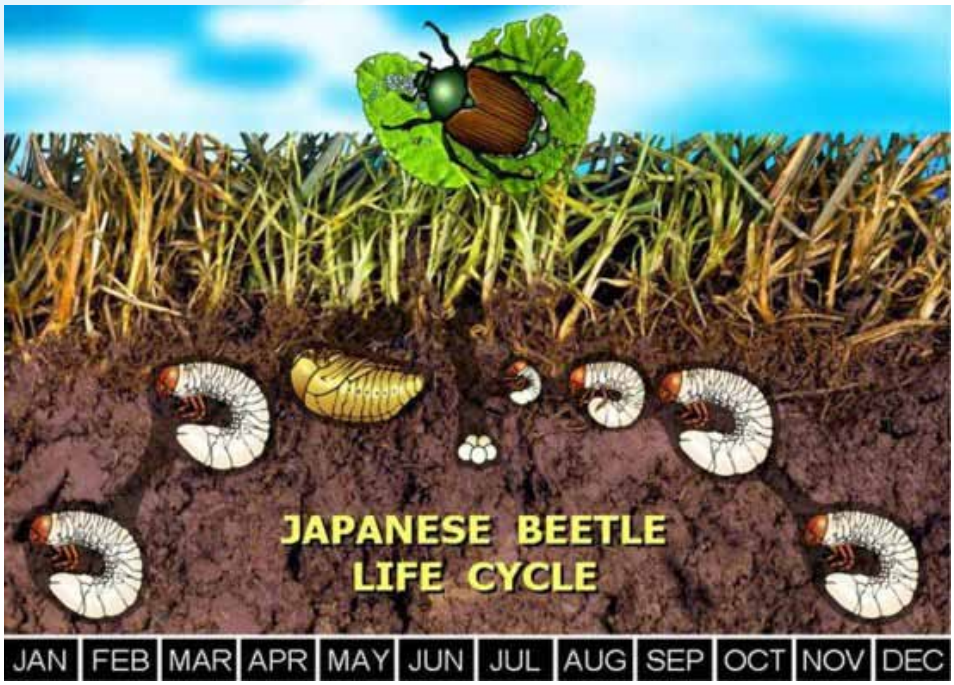

Illustration courtesy of the University of Kentucky; http://www2ca.uky.edu/entomology/enfacts/ef451.asp

Japanese beetles overwinter as a partially grown grub in the soil below the frost line. After pupating (in the stage between larva and adult) in the soil, adult Japanese beetles emerge in midsummer. In central Missouri, this typically occurs in mid to late June. Virgin females immediately release a strong pheromone (sexual attractant). They are usually mated within a few minutes of emerging from the soil. Both males and females then find a suitable food source and begin feeding and mating for the rest of their short lives. Japanese beetle activity normally lasts four to six weeks in Missouri. It peaks in late June or early July. Eggs are laid in the soil where they incubate and hatch in mid to late summer. The larvae actively feed until the soil cools in the fall, then they move deeper (8”-10”) until the soil warms in the spring. At that point, they begin feeding again. Japanese beetles can only complete one generation per year in Missouri.

Adult Japanese beetles have been known to feed on over 300 types of agricultural, landscape and wild plants; some studies show them eating as many as 400 types. Although it seems they will eat almost anything, Japanese beetles have clear-cut preferences for certain plants, such as grapes and roses.

Control

Japanese beetle control methods can take many forms. There are many conventional pesticides that work well to control both the grubs in the soil and the adults on foliage. There are fewer pesticides that are approved by the Organic Materials Review Institute® (OMRI) for organic use; however, there are some that can be used to control adults. Other than chemical control, there are several other ways to manage these pests. These include biological control using natural enemies, mass trapping, resistant plant varieties, cultural controls and irrigation management:

1. Natural Enemies

Japanese beetles are not native to Missouri. This means that there are few natural enemies to keep them in check. However, there are some pathogens (organisms that cause diseases) that attack the grubs in the soil. One naturally occurring bacterium that is commercially available is called milky spore (*Bacillus popilliae*). When Japanese beetle grubs eat milky spore, they die and release billions of new spores into the nearby soil. There are also several species of nematodes (tiny roundworms) that attack Japanese beetles and other soil-dwelling grubs. Birds, small mammals and a few larger insect predators, such as wheel bugs, also eat adult Japanese beetles. *(photo below)*

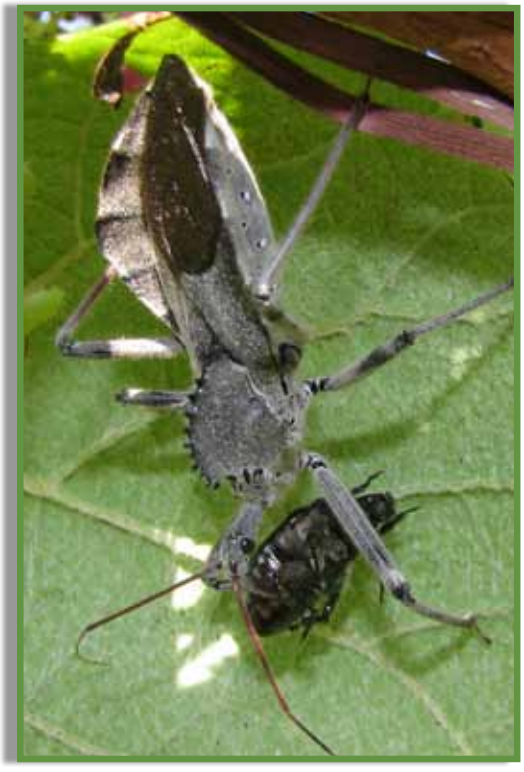

Photo by Patrick Byers, Regional Horticulture Specialist, University of Missouri

Mass trapping device used by the LUCE IPM program for organic management of Japanese beetles. A powerful 2-component lure is attached to the yellow top; the net sock was constructed using charcoal fiberglass screen. Each full sock can hold up to 20,000 Japanese beetles.

2. Mass Trapping

Mass trapping is a controversial topic. Research has shown that in certain situations, the powerful lures used in Japanese beetle traps can actually attract many more beetles than are caught. This can increase plant damage in nearby areas (Gordon and Potter, 1985; Switzer et al., 2009). Other studies have found that a few successive years of mass trapping can significantly reduce the local population (Hamilton et al., 1971; Wawrzynski and Ascerno, 1998). Dr. Jaime Piñero and the Lincoln University Cooperative Extension (LUCE) Integrated Pest Management program (IPM) conducted as yet unpublished research over three years in central Missouri. It shows that elderberry, blueberry and blackberry plantings can be protected from Japanese beetles by using a mass trapping system. This system involves a powerful lure and a modified catching device deployed outside the cropped area.

3. Careful Selection of Plant Varieties

There are a number of plant varieties that Japanese beetles do not favor. These plants are unlikely to suffer significant feeding damage *(table at right)*.

4. Cultural Controls

In agricultural settings, Japanese beetle numbers can be reduced by carefully selecting tillage, groundcovers and irrigation regimes. For example, researchers at Michigan State University found that planting buckwheat between rows of blueberry drastically increased the chances of finding Japanese beetles when compared to planting clover or ryegrass, or leaving the ground bare (Szendrei and Isaacs, 2006). Another study found that female Japanese beetles choose to lay their eggs more often and in higher numbers in fescue versus warm season turf grasses (Wood et al., 2009). Females also choose to lay their eggs in moist soil; that means that withholding irrigation during the peak egg-laying season can help reduce grub numbers (Potter et al., 1996).

Plant Varieties Least Favored By Japanese Beetles	Plant Varieties Most Favored by Japanese Beetles
Arbovitae	American and English elm
Box elder	Birch
Boxwood	Black walnut
Clematis	Elm
Dogwood	Grape
***Euonymus* sp. (burning bush, etc.)**	Hawthorn
Forsythia	Hollyhock
Hemlock	Horse chestnut
Hickory	Japanese and Norway maple
Holly	Larch
Juniper	Linden
Lilac	London planetree
Magnolia	*Malus* spp. (crabapple, apple etc.)
Mulberry	Mountain ash
Northern red oak	Pin oak
Pine	*Prunus* spp. (flowering cherry, etc.)
Red and silver maples	Pussy willow
Redbud	Rose
Spruce	Raspberry
Sweet gum	Virginia creeper
Tulip poplar (tuliptree)	Willow
Yew	

Table reproduced with permission from Dr. Laura Jesse, Iowa State University.

5. Chemical Control

Application of insecticides to control pests including Japanese beetles should be considered the last resort. When exploring chemical control options, select the lowest risk and most effective products. The key is to use pesticides in a way that complements rather than hinders other elements in an IPM strategy and which also limits negative environmental effects. The table below was taken from the 2014 Midwest Small Fruit and Grape Spray Guide. It lists several insecticides that have been proven through research to be effective at controlling Japanese beetles in blueberries. Always thoroughly read the label and make sure to use the proper personal protective equipment before applying any pesticide.

References

Gordon, F. C. and Potter, D. A. "Efficiency of Japanese Beetle (Coleoptera: Scarabaeidae) Traps in Reducing Defoliation of Plants in the Urban Landscape and Effect on Larval Density in Turf." J. Econ. Entomol. 78 (1985): 1381-1384.

Hamilton, D. W., Schwartz, P. H., Townshend, B. G., and Jester, C. W. "Traps Reduce an Isolated Infestation of Japanese Beetle." J. Econ. Entomol. 64 (1971): 150-153.

Potter, D. A., Powell, A. J., Spicer, P. G., and Williams, D. W. "Cultural Practices Affect Root-Feeding White Grubs (Coleoptera: Scarabaeidae) in Turfgrass." J. Econ. Entomol. 89 (1996): 156-164.

Switzer, P. V., Enstrom, P. C., and Schoenick C. A. "Behavioral Explanations Underlying the Lack of Trap Effectiveness for Small-scale Management of Japanese Beetles (Coleoptera : Scarabaeidae)." J. Econ. Entomol. 102 (2009): 934-990.

Szendrei, Z., and Isaacs, R. "Ground Covers Influence the Abundance and Behavior of Japanese Beetles." Environ. Entomol. 35 (2006): 789-796.

Wawrzynski, R. P., and Ascerno, M. E. "Mass Trapping for Japanese Beetle (Coleoptera: Scarabaeidae) Suppression in Isolated Areas." J. Arboric. 24 (1998): 303-307.

Wood, T. N., Richardson, M., Potter, D. A., Johnson, D. T., Wiedenmann, R. N., and Steinkraus, D. C. "Ovipositional Preferences of the Japanese Beetle (Coleoptera : Scarabaeidae) among Warm- and Cool-Season Turfgrass Species." J. Econ. Entomol. 102 (2009): 2192-2197.

Japanese beetle	Actara 25WG	4 oz	
	Admire Pro (4.6F)	2.1-2.8 fl oz	
	Asana XL (0.66 EC)	4.8-9.6 fl oz	
	Assail 30SG	4.5-5.3 oz	
	Aza-Direct	1-2 pt	Aza-Direct acts as a repellent.
	Danitol 2.4EC	10.67-16 fl oz	
	Imidan 70WP	1.3 lb	Imidan is moderately effective and may be used until 3 days before harvest.
	Malathion 5EC	1.5-2 pt	
	Neemix 4.5	7-16 fl oz	Neem acts as a repellent.
	Pyganic 1.4%EC	16-64 fl oz	Pyganic and Neemix provide some short-term control and may be applied until the day of harvest.
	Pyganic 5%EC	4.5-18 fl oz	
	Sevin XLR Plus (4F)	1-2 qt	For control of Japanese beetles on fruit, Sevin is labeled and effective, but may not be used within 7 days of harvest. Other formulations may be available.
	Surround 95WP	12.5-50 lb	Surround may leave noticeable residues on berries.

The guide is available as a free PDF at https://ag.purdue.edu/hla/Hort/Documents/ID-169.pdf

No endorsement of products mentioned is intended nor is criticism implied of products not mentioned.