

# Landscape and Ornamentals

Department of Entomology

## JAPANESE BEETLES IN THE URBAN LANDSCAPE

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Infestations of the Japanese beetle are found in rural and urban areas throughout Indiana and the Midwest region. This insect is most damaging to lawns, trees, flowers, fruits, and gardens in urban landscapes but may also cause economic injury to some agriculture crops.

### DESCRIPTION AND HABITS

Adult Japanese beetles are about 1/2 inch long, metallic green and bronze in color, with a row of white hairy tufts along each side of the body (Fig. 1). Immature forms of this pest are light colored-C-shaped grubs with a light brown head (Fig. 2) and can be found in the soil from mid-July through the following June.



Figure 1. Adult Japanese beetles are 1/2 inch long, metallic green and bronze in color, with a row of white hairy tufts along each side of the body.

Adult beetles are most active from mid-June through August (Fig. 3 and 4) and can feed on more than 400 different species of plants. They are especially fond of roses, grapes, smartweed, soybeans, corn silks, flowers of all kinds, flowering crabapple, plum and linden trees, as well as, overripe and decaying fruit. Adults can fly considerable distances (1-2 miles) to feed on leafy plants or to lay eggs. In areas of heavy infestation, the adults will attack and injure foliage and flowers.



Figure 2. Japanese beetle larvae (grubs) are soft bodied, light colored-C-shaped, soil-dwelling insects with a light brown head.

Grubs develop in lawns, turf, and cultivated land from eggs laid by the female during the summer. These grubs feed primarily on soil organic matter, thatch and the roots of grasses and other plants. They pass the winter in the grub stage, complete their growth the following spring and emerge as beetles beginning in June. The grubs may seriously damage lawns and cultivated crops by feeding on plant roots.

### PROTECTING ORNAMENTAL AND FOOD PLANTS

**Control on ornamentals with insecticides.** To protect ornamentals against the feeding of adult Japanese beetles, leaves should be coated with insecticide (Table 1) during the adult flight period. Typically, this may entail two treatments during the peak beetle flight. Homeowners should make their first application before damage becomes intolerable and beetles are still abundant. The need for repeated applications can be curtailed by inspecting plants for additional beetle damage prior to applying a second treatment. Neem products



Figure 3. Japanese beetles feeding on rose flowers.

containing Azadirachtin can be effective repellants that can reduce defoliation when applied regularly (but no more than weekly) during beetle flight. Apply before defoliation becomes intolerable. In years when beetle populations are very high, noticeable defoliation may occur because adults will consume a small amount of insecticide tainted leaves before they are killed. Soil applications of insecticides on flowering trees should be delayed until after petals have fallen. Concentrate control efforts on trees that are susceptible to beetles (Table 2). When possible, replant with species that are resistant to adult feeding (Table 3). Consult Table 4 to find crabapple varieties resistant to Japanese beetle.

**Control on food plants with foliar applications of insecticides.** *Bifenthrin, carbaryl, cyfluthrin, neem, and permethrin* are safe to use on fruit and vegetables if harvest restrictions on the label are followed. Sevin is also available as a 5% dust to be used at the rate of 1/2 pound per 1,000 square feet. (See also [Extension Publication E-21-W “Managing Insects in the Home Vegetable Garden”](#).)

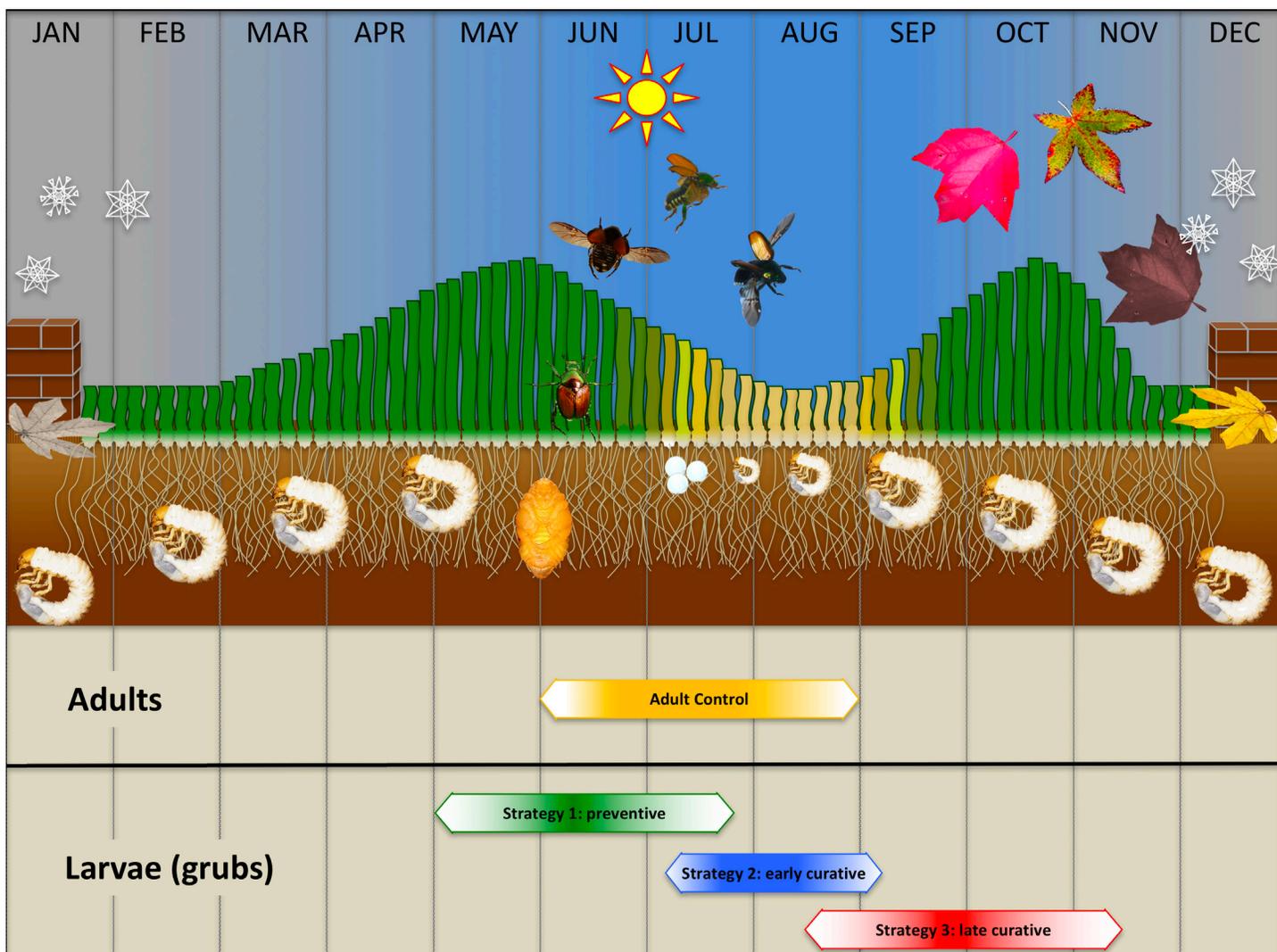


Figure 4. Life cycle of Japanese beetle and relative timing of different chemical or biological management strategies for adults and larvae. Adult control, larval preventive control (Strategy 1), early curative larval control (Strategy 2) and late curative larval control (Strategy 3).

**Table 1. Recommended Insecticides to Kill Adult Japanese Beetles on Ornamental Plants**

Insecticide	Formulation	Amount per 100 gallons	Amount per gallon	General Use Restriction (check label) H = Homeowner C = Commercial
Acephate (Orthene)	75% S 15.6% EC	1/3 lb. 1 1/5 cup	1/3 tsp. 1 1/2 Tbsp.	H, C
Azadirachtin (Various products)	Varies	See label	See label	Works as repellent
<i>Bacillus thuringiensis galleriae</i> (beetle-GONE)	76.5%	-	1.5 lbs.	H, C, bee safe
Bifenthrin (Talstar L&T and other site specific products)	0.7 F	5.5 - 10.9 oz.	1/3 - 2/3 tsp.	H, C
Carbaryl (Sevin and others)	4 F 2 F	1 qt. 2 qt.	2 tsp. 4 tsp.	H, C
Chlorantraniliprole (Acelepryn)	18.4% EC	2 - 4 oz.	1/8 - 1/4 tsp.	H, C, bee safe
Cyantraniliprole (Mainspring GNL)	18.7% SC	2 - 8 oz.	1/8 - 1/2 tsp.	H, C
Cyfluthrin (Tempo, Decathalon) (Bayer Lawn & Garden)	20 WP 0.75 EC	1.3 oz. -	- 1 Tbsp.	H, C H (Bayer)
Deltamethrin (Deltaguard (T&O))	4.75% EC	4 - 8 oz.	1/4 - 1/2 tsp.	H, C
Fluvalinate (Mavrik)	2 F	5 - 10 oz.	1/4 - 1/2 tsp.	H, C
Imidacloprid (Bayer Tree and Shrub)	2.9% C	See label	See label	Soil application H
Lambda-cyhalothrin (Scimitar CS)	9.7% EC	1.5 - 5 oz.	-	C
Permethrin (Astro EC) Spectracide Bug Stop (Eight)	36.8% EC 2.5% EC	4 - 8 oz. -	1/4 - 1/2 tsp. 2 Tbsp.	H, C

**Traps.** Pheromone traps have long been used to monitor the activity of the Japanese beetle. The “Bag-A-Bug” trap utilizes both a pheromone and a floral scent to catch both sexes of the beetle. However, these traps are not recommended for beetle management because they attract more beetles than they can control, often resulting in increased plant damage. Do not put traps in or near plants that are susceptible to Japanese beetle.

## PROTECTING LAWNS

**Control with Insecticides.** Several insecticides will protect turfgrass lawns from Japanese beetle grubs and other soil insects if applied at the proper time and according to label directions (see also *Extension Publication E-271-W “Managing White Grubs in Turfgrass”*). As a general rule of thumb, smaller grubs are easier to control using insecticides. Irrigating turf after insecticide application increases efficacy by facilitating movement of the product into the soil where the grubs are feeding. Insecticide applications are generally not required if soil sampling reveals 5 or fewer grubs per square foot, but sites with a history of grub damage may benefit from preventive applications.

There are three basic strategies for using insecticides against Japanese beetle grubs. Table 4 provides a list of insecticides recommended for each of these strategies.

### Strategy 1: Preventive

This strategy relies on the use of insecticide formulations that remain active in the soil for an extended period of time. Areas that have a history of white grub infestation and highly manicured playing surfaces, such as golf course fairways, are the most common candidates for this type of approach.

### Strategy 2: Early Curative

This strategy targets early or late instar grubs in areas where densities are high enough to be a concern, but before damage is visible. Any registered white grub insecticide is appropriate for this approach. Monitoring white grub populations in the soil is a cornerstone of this strategy since the goal is to prevent damage while avoiding unnecessary applications. Again, population densities of less than 5 grubs/ft<sup>2</sup> rarely require treatment

### Strategy 3: Late Curative (Rescue)

This strategy is often referred to as a rescue strategy because it targets white grubs after damage has been noticed. Damage may either be a direct result of grub feeding (primary damage) or a result of animals destroying the turf while foraging for the grubs (secondary damage). Chemical options for this strategy are somewhat more limited because they must kill or cause the grubs to stop feeding relatively quickly in order to provide an opportunity for the turf to recover and resume growth before winter.

**Table 2. Landscape Plants Nearly Always Severely Attacked by Adult Japanese Beetle<sup>1</sup>**

Scientific Name	Common Name
<i>Acer palmatum</i>	Japanese maple
<i>Acer platanoides</i>	Norway maple
<i>Aesculus hipposastanum</i>	Horsechestnut
<i>Atlbaca rosea</i>	Hollyhock
<i>Betula populifolia</i>	Gray birch
<i>Castanea dentuta</i>	American chestnut
<i>Hibiscus syriacus</i>	Rose-of-Sharon
	Shrub Althea
<i>Juglans nigra</i>	Black walnut
<i>Malus species</i>	Flowering crabapple, apple
<i>Plananus acerifolia</i>	London planetree
<i>Populus nigra italica</i>	Lombardy poplar
<i>Prunus species</i>	Cherry, black cherry, plum, peach, etc.
<i>Rosa species</i>	Roses
<i>Sassafras albidum</i>	Sassafras
<i>Sorbus americana</i>	American mountain-ash
<i>Tilia americana</i>	American linden
<i>Ulmus americana</i>	American elm
<i>Ulmus protera</i>	English elm
<i>Vitis species</i>	Grape

<sup>1</sup>Courtesy of Sheiner, Townsend and Potter, University of Kentucky

**Cultural Tools**

Sound cultural practices that include, 1) selection of turf-grass species and cultivars that are well adapted for a specific site and use and 2) proper mowing, fertilization, irrigation, thatch management and cultivation to promote healthy, vigorous turf. Well maintained turfgrass is capable of tolerating or quickly recovering from most grub feeding.

**Biological Controls**

Although a host of pathogens, predators and parasites attack and kill white grubs, commercially available, effective biological controls are limited. Nonetheless, these products can provide reasonable levels of control and are generally safer than chemical insecticides. Biological insecticides tend to be more expensive than chemical insecticides, more variable in the level and speed of control provided, and sometimes require special handling and application procedures. As with chemical insecticides, post-application irrigation is always recommended.

Insect-Parasitic Nematodes

Heterorhabditis bacteriophora is a parasitic nematode that attacks and kills white grubs by vectoring a bacterial pathogen. It should be refrigerated upon arrival and used as soon as possible. Nematode viability should be checked prior to application by examining a small amount of the spray solutions with a magnifying glass to ensure the nematodes are active and moving about. After mixing, nematodes should be applied immediately. Ideally, applications should be made in

the early morning or evening to limit exposure to UV radiation, and irrigation should immediately follow application in order to wash the nematodes off of the turf canopy and into the soil. Larger larvae are the best targets for nematode applications so they can be used most effectively in early and late curative strategies targeting all but the smallest grubs.

Insect-Pathogenic Bacteria

*Bacillus thuringiensis galleriae* is a strain of naturally occurring soil bacteria that produces toxins capable of killing grubs. It can be mixed and applied using methods similar to those employed for chemical insecticides. This product appears to work equally well against small and large grubs making it useful in both early and late curative strategies.

**Table 3. Landscape Plants Relatively Free of Feeding by Adult Japanese Beetle<sup>1</sup>**

Scientific Name	Common Name
<i>Acer negundo</i>	Boxelder*
<i>Acer rubrum</i>	Red maple
<i>Acer saccharinum</i>	Silver maple
<i>Buxus sempervirens</i>	Boxwood
<i>Carya ovata</i>	Shagbark hickory
<i>Cornus florida</i>	Flowering dogwood
<i>Diospyros virginiana</i>	Persimmon
<i>Euonymus species</i>	Euonymus (all species)
<i>Fraxinus americana</i>	White ash
<i>Fraxinus pennsylvanica</i>	Green ash
<i>Ilex species</i>	Holly (all species)
<i>Jaglans cinerea</i>	Butternut
<i>Liriodendron tulipifera</i>	Tuliptree
<i>Liquidamar styraciflua</i>	American sweetgum
<i>Magnolia species</i>	Magnolia (all species)
<i>Morus rubra</i>	Red mulberry
<i>Popuus alba</i>	White poplar
<i>Pyrus communis</i>	Common pear
<i>Quercus alba</i>	White oak
<i>Quercus coccinea</i>	Scarlet oak
<i>Quercus rubra</i>	Red oak
<i>Quercus velutina</i>	Black oak*
<i>Sambucus canadensis</i>	American elder*
<i>Syringa vulgaris</i>	Common lilac

Most evergreen ornamentals, including Abies (fir), Juniperus, Taxus, Thuja (arborvitae), Rhododendron, Picea (spruce), Pinus (pine) and Tsuga (hemlock) are not attacked.

<sup>1</sup>Courtesy of Sheiner, Townsend and Potter, University of Kentucky

\*Unmarked species undergo little or no feeding. Species marked with an asterisk may suffer occasional light feeding.

*Paenibacillus popilliae* (Milky Spore), is a bacterial pathogen of Japanese beetle grubs. Although strains of this bacterium that infect and kill other white grub species are known, commercially available formulations are only active against Japanese beetle grubs. It is usually applied as a granule or dry formulation, but commercially available products have not proven to be very effective.

#### Entomophagous Fungi

*Metarhizium brunneum* (formerly *Metarhizium anisopliae*) is a soil-born fungal pathogen of many insect species including white grubs. It is commercially available in liquid and granule formulations. Efficacy can vary widely, but the most consistent levels of control are obtained with fall applications targeting later instar grubs. For this reason, *Metarhizium brunneum* is most compatible with curative control strategies targeting larger grubs.

#### Detering Foraging Animals

Animals foraging for grubs can be a serious concern because of the damage caused as they dig for the grubs. Animals such as raccoons, skunks, armadillos and turkeys routinely forage for and consume white grubs that infest turfgrass even when primary damage from the grubs themselves is not apparent. Although trapping and hunting these foraging animals may provide a long-term solution for turf managers, such activities can be time consuming and are not always feasible. One recent study suggests the use of Milorganite organic fertilizer can deter foraging animals, substantially reducing secondary damage to turf. The application of Milorganite to areas damaged by foraging animals at a rate of 0.02 lbs/ft<sup>2</sup> can reduce further damage by 75% or more over the short-term. The long-term residual effectiveness of Milorganite remains unclear, but reactive use appears to be effective at reducing further damage over the short-term.

**Table 4. Active ingredients of chemical and biological insecticide products recommended for use against Japanese beetle grubs in turfgrass and their relative suitability for use in different management strategies.**

Insecticide * (Trade Names)	Insecticide Class	Management Strategy		
		Preventive	Early Curative	Late Curative
<b>SYNTHETIC INSECTICIDES</b>				
<b>Carbaryl</b> (Sevin)	Carbamate		X	X
<b>Chlorantraniliprole</b> (Acelepryn)	Diamide	X	X	
<b>Cyantraniliprole</b> (Ference)	Diamide	X	X	
<b>Clothianidin</b> (Arena, Aloft, Others)	Neonicotinoid	X	X	X
<b>Imidacloprid</b> (Merit, Triple Crown, Others)	Neonicotinoid	X	X	X
<b>Thiamethoxam</b> (Meridian)	Neonicotinoid	X	X	X
<b>Trichlorfon</b> (Dylox)	Organophosphate		X	X
<b>BIOLOGICAL/BIORATIONAL INSECTICIDES</b>				
<b><i>Bacillus thuringiensis galleriae</i></b> (GrubGONE G)	Microbial		X	X
<b><i>Metarhizium brunneum</i></b> (Met 52)	Microbial			X
<b><i>Paenibacillus popilliae</i></b> (Milky Spore)	Microbial	X		
<b><i>Heterorhabditis bacteriophora</i></b> (Nemasys G, NemaSeek)	Parasitic Nematode		X	X
* Always consult label directions for specific timing and application recommendations.				

READ AND FOLLOW ALL LABEL INSTRUCTIONS. THIS INCLUDES DIRECTIONS FOR USE, PRECAUTIONARY STATEMENTS (HAZARDS TO HUMANS, DOMESTIC ANIMALS, AND ENDANGERED SPECIES), ENVIRONMENTAL HAZARDS, RATES OF APPLICATION, NUMBER OF APPLICATIONS, REENTRY INTERVALS, HARVEST RESTRICTIONS, STORAGE AND DISPOSAL, AND ANY SPECIFIC WARNINGS AND/OR PRECAUTIONS FOR SAFE HANDLING OF THE PESTICIDE.

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