Colorado Dept. of Agriculture
Division of Plant Industry
Nursery Program
305 Interlocken Pkwy
Broomfield, CO 80021
303-869-9070

Photo credit David Cappaert, Michigan State University, Bugwood.org

INVASIVE—MODERATE RISK PEST

Japanese Beetle (*Popillia japonica*)

BEST MANAGEMENT PRACTICES FOR THE COLORADO LANDSCAPE

Japanese beetle is a scarab beetle, approximately one-half inch long with a metallic green body and copper-colored covers on its wings. Close examination with a hand lens will reveal 12 tufts of white hairs bordering the margin of the wing covers. Larvae, or grubs, reside in the soil. They are about an inch long when fully grown and lie in a curled or "C" shaped position. Close examination of the grubs will reveal a v-shaped series of bristles n the tip of the abdomen.

The insect feeds on roots, leaves and flowers of many landscape ornamental and agricultural plants with a host range of over 300 species of plants including:

Preferred hosts

Acer (Japanese and Norway Maple)
Aesulus hippocastanum (horse chestnut)
Althaea (holly hock)
Amalanchier (serviceberry)
Asparagus
Betula (Birch)
Bougainvilla
Cornus (Dogwood)
Glycine max (soybean/edamame)
Hibiscus (Rose of Sharon)
Juglans
Malus (Apple and crabapple)
Oenothera
Parthenocissus
Phaseolus (Bean)
Platanus
Polygonum
Populus
Potentilla
Prunus (fruit trees)
Quercus rubrum (red oak)
Rhamnus (buckthorn)
Rheum (rhubarb)
Rhus
Rosa
Rubus (raspberry)
Salix
Sorbus (Mountain Ash)
Tilia (Linden)
Ulmus (Elm)
Viburnum
Vitis (Grape)
Zea mays (Corn)

General Information and History

Japanese beetle is an invasive species native to Asia. It was accidentally introduced in North America in 1906. It took over 90 years to move West to Colorado through nursery trade and the first established population was documented in 2003 in the Palisade area on the West Slope. Efforts to eradicate the Palisade population have been successful.

More recently (2005), Japanese beetle was discovered around golf courses in the southern Denver Metro area and (2009) Pueblo. Currently the insect has become heavily established in pockets located along the Front Range. Japanese beetle cannot be eradicated along the Front Range due to the nature of urbanization and irrigation.

Japanese beetle is the target of quarantines restricting intra and interstate shipment of nursery stock and soil. Nursery stock originating in the front range counties of Adams, Arapahoe, Boulder, Broomfield, Denver, El Paso, Jefferson, Larimer, Pueblo and Weld are may only be moved to the West Slope, Eastern Plains or mountains of Colorado if certified by the Colorado Department of Agriculture.

Japanese Beetle Biology and Life Cycle

Photo credit: entomology.ca.uky.edu

A Japanese beetle life cycle is completed in one year. In Colorado, adult beetles emerge from the soil mid to late June with peak emergence occurring in mid to late July. Adult beetles can be detected in traps until early September depending on weather conditions.

Adult beetles are most active in the heat of the day and are voracious feeders on ornamental and agricultural plant leaves and fruits. If an adult is bothered or threatened while feeding it will feign death and drop to the ground to avoid predators.

Beetles mate and lay eggs near the plants they feed on, seeking well irrigated turfgrass areas for egg deposition. Japanese beetle eggs require at least 10" of soil moisture to thrive and develop into larvae. This is easily provided by turf irrigation systems.

Larvae hatch within 10 to 15 days, depending on soil temperature, feed on roots of turfgrass and begin to move vertically and horizontally in the soil in response to moisture and temperature. During the summer months the larvae will inhabit an average soil depth of 2—4 inches, moving lower in the soil profile as temperatures decrease. Larvae begin to move back up in the soil profile in March and pupate in May.

Where is Japanese Beetle in Colorado?

Japanese beetle populations are known to exist in portions of the following cities and counties. While detection of the insect has been documented via trapping, the pest may not be evenly distributed over a region, rather populations exist in 'pockets' and are not necessarily wide spread.

Heavy populations exist in Boulder, Denver, Englewood, Lakewood, Littleton and Pueblo.

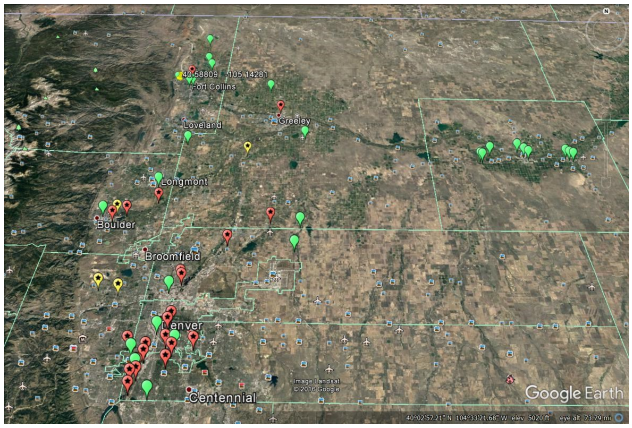
Moderate populations exits in Colorado Springs, Golden, Greeley and Highlands Ranch.

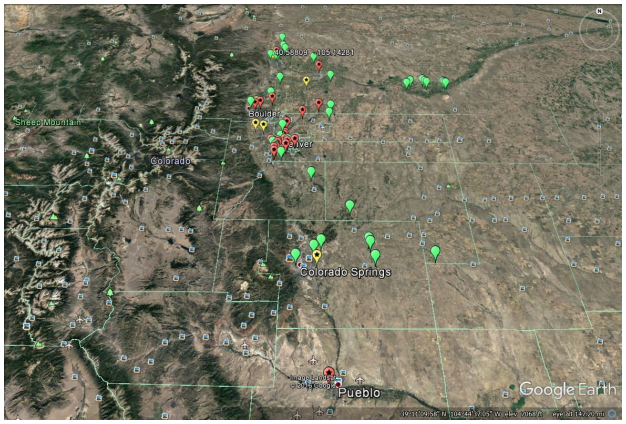
Low populations are present in certain areas of Fort Collins and Longmont.

Palisade has officially eradicated its population of Japanese Beetle detected in 2003 and remains Japanese Beetle free to date (2016).

Geographically the insect is not widespread in Colorado, however, there are heavy infestations that exist in the Denver metro area , Boulder, and Pueblo.

Japanese beetle populations based on 2016 trapping data





Map legend: red= heavy populations; yellow=moderate –low populations; green= no Japanese beetle detected.

Best Management Strategies for Japanese Beetle in Colorado

Integrated Pest Management (IPM)

Use of a variety of integrated pest management (IPM)/Plant Health Care (PHC) approaches, which combine multiple management tools, is highly encouraged.

Management of Japanese beetle is complicated because adults and grubs (larvae) are very different from one another and cause injury to a variety of hosts. Control of just one life stage will not necessarily guarantee control of the other.

Successful management strategies for this invasive pest are most effective when more than one of the following techniques are used utilized:

1. Utilize plants that are not susceptible to Japanese Beetle whenever possible.
2. Reduce irrigation to turfgrass areas.
3. Hand pick or physically remove adults.
4. Use of biological controls.
5. Use of labeled pesticide controls.

Management of Japanese Beetle will be most successful following an integrated pest management program, or IPM.

Photo credit: Laura Pottorff

Prevention, Deterrents and Physical Controls

Address over-irrigation. The most critical factor that influences the Japanese beetles' ability to thrive is soil moisture during the egg laying and larval development periods. Therefore decreasing the amount of irrigation input to turfgrass will deter development of Japanese beetle. Colorado's climate is naturally semi arid. Without irrigation Japanese beetle would not thrive. However, the challenge is to water just enough to support our non-native landscape plants and turf, while discouraging the invasive insect.

Avoid preferred Japanese beetle hosts. With over 300 susceptible plants, it is challenging to only grow plants that are not preferred by Japanese beetle. However, limiting the plants that the insect prefers in a landscape will detract from the attractiveness of a landscape to hoards of Japanese beetles.

Physically remove beetles from plants. While time consuming, physically removing adult beetles from plants and placing them in a bucket of soapy water, is a method employed by many.

Trapping. Trapping is an excellent monitoring tool for detecting the insect when it necessary to know if its' range has expanded. It is not recommended as a management tool when populations are extensive, in this case it will only serve to attract more beetles to an area.

Biological and Alternative Controls

Many **biological controls** for Japanese beetle have been researched. Currently, the use of entomopathogenic nematodes (microscopic rounds worms that only parasitize insects) have been shown to be effective for controlling grubs. Cost of implementation is high and results are inconsistent when compared to conventional controls. Available in many garden centers or by mail order, *Steinernema glaseri* and *Heterorohabiditis bacteriophora* may be effective controls if attention to pre and post irrigation is noted.

An additional biological control called Milky Spore, a bacterial disease of grubs can also be purchased for Japanese beetle control, however, research has not shown this product to be very effective.

Alternative controls such as products containing azadiractin a derivative from neem seeds are also labeled for control of Japanese beetle. Look for trade names such as Bioneem, Aazatin or Azasol. While these products may provide short, but effective impact on adults they must be reapplied frequently.

Pesticide Controls for Japanese Beetle

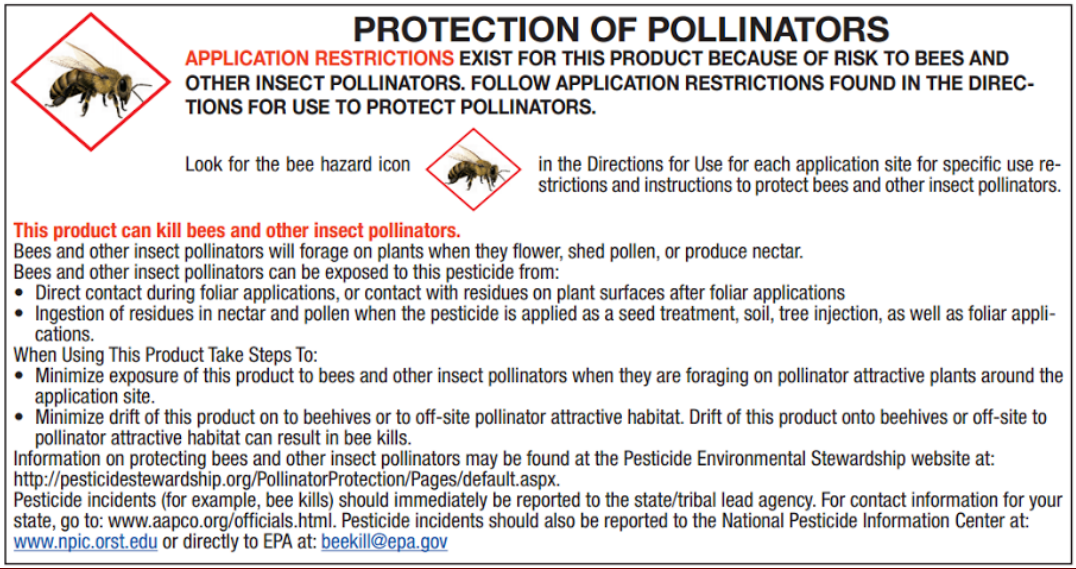
Common Name	Trade Name	Life stage	Chemical class	Pollinator safety issues?
Acephate	Ortene, Lepitect	Adults	Organo-phosphate	Highly toxic to bees
Bifenthrin	Talstar	Adults	pyrethroid	Highly toxic to bees
Cyfluthrin	Tempo	Adults	pyrethroid	Highly toxic to bees
Deltame-thrin	DeltaGard	Adults	pyrethroid	Highly toxic to bees
Permethrin	Astro	Grubs, adults	pyrethroid	Highly toxic to bees
Carbaryl	Sevin	Grubs, adults	carbamate	Highly toxic to bees
Chol-orantranilipr ole	Acelepry n	Grubs in turf and ornamen-tal	Anthranilic diamide	No bee toxici-ty statement on label
Imidaclo-prid	Merit	Grubs, adults	Chloronic-otinyl	These prod-ucts are very toxic to bees do not apply while bees are visiting the area
Clothianidin	Arena	Grubs, Adults	Thi-anicotinyl	
Acetamiprid	Tristar	Adults	Chloronic-otinyl	
Dinotefuran	Safari, Transect	Adults	Chloronic-otinyl	

Insecticide treatment of turf to control larvae (grubs) has been the most common and largely the most effective management strategy employed against Japanese beetle. Timing of insecticide applications is critical. Use insecticides for grub control in early summer, for control of adults apply when feeding and damage is observed. Always read and follow pesticide label directions.

Many of the insecticides that control Japanese beetle are also highly toxic to bees and other pollinators. Pesticide labels will contain information describing how to use the product while protecting pollinators. It is *essential and the law* that all applicators of pesticides follow the pesticide label.

Photo credit: Laura Pottorff

Avoid application of pesticides to all blooming plants when pollinators are active in the area.



PROTECTION OF POLLINATORS

APPLICATION RESTRICTIONS EXIST FOR THIS PRODUCT BECAUSE OF RISK TO BEES AND OTHER INSECT POLLINATORS. FOLLOW APPLICATION RESTRICTIONS FOUND IN THE DIRECTIONS FOR USE TO PROTECT POLLINATORS.

Look for the bee hazard icon in the Directions for Use for each application site for specific use restrictions and instructions to protect bees and other insect pollinators.

This product can kill bees and other insect pollinators.
Bees and other insect pollinators will forage on plants when they flower, shed pollen, or produce nectar.
Bees and other insect pollinators can be exposed to this pesticide from:

- Direct contact during foliar applications, or contact with residues on plant surfaces after foliar applications
- Ingestion of residues in nectar and pollen when the pesticide is applied as a seed treatment, soil, tree injection, as well as foliar applications.

When Using This Product Take Steps To:

- Minimize exposure of this product to bees and other insect pollinators when they are foraging on pollinator attractive plants around the application site.
- Minimize drift of this product on to beehives or to off-site pollinator attractive habitat. Drift of this product onto beehives or off-site to pollinator attractive habitat can result in bee kills.

Information on protecting bees and other insect pollinators may be found at the Pesticide Environmental Stewardship website at: http://pesticidestewardship.org/PollinatorProtection/Pages/default.aspx.
Pesticide incidents (for example, bee kills) should immediately be reported to the state/tribal lead agency. For contact information for your state, go to: www.aapco.org/officials.html. Pesticide incidents should also be reported to the National Pesticide Information Center at: www.npic.orst.edu or directly to EPA at: beekill@epa.gov