Japanese Beetles: An Invasive Pest

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History

The Japanese beetle is a native of Japan. It was accidentally introduced into the United States in 1916 near Riverton, New Jersey allegedly in root-ball nursery stock containing larvae (grubs). Since then, it has spread and is currently present from southern Maine to South Carolina and Georgia and westward to Illinois, Iowa, Missouri, and portions of Wisconsin and Minnesota as well as parts of southern Ontario. As for the state of Wisconsin, currently, Japanese beetle infestations have been confirmed in Beloit, Eau Claire, Milwaukee, and the westside of Madison.

Importance

The Japanese beetle is one of the most important and destructive pests of turfgrass and woody-ornamental plants in the eastern United States. Many millions of dollars are spent each year to control Japanese beetle adults and grubs, and for replacing and renovation of damaged turf and ornamentals. Adult beetles attack a wide range (over 300 species) of ornamental plants. To make matters worse, Japanese beetle grubs are also destructive. They typically feed on the roots of all cool-season turfgrasses and on ornamental plant roots. This feeding can cause severe damage or death to plants.

Description

Japanese beetle adults are shiny, metallic green, oval, and approximately 1/2 inch long. They have coppery-brown wing covers with five patches of white hairs along the sides of their bodies. Male Japanese beetle adults are

usually smaller than females, but otherwise look similar. The eggs are approximately 1/16 inch long, oblong, and pearly white. Upon absorbing moisture from the soil, they double in size within a couple of days becoming spherical in shape. Thereafter, larvae emerge from the embryo. Japanese beetle grubs have three pairs of jointed legs, and a yellow-brown head capsule. Like other white grub species, Japanese beetle grubs assume the C-shape position in the soil. They can be readily identified by their distinctive arrangement of hairs on the ventral (underside) of their abdomen (rear) near their anus. The arrangement of hairs includes two rows of short spines that are arranged in the shape of a truncated V pattern.

Damage Symptoms

Japanese beetle adults usually feed from the upper leaf surface, leaving only a lace-like skeleton of veins. Feeding damaged caused by adults beetles results in leaves turning brown, dying, and eventually falling-off. Certain plant materials are preferred over others. Preferred hosts include lindens, grapes, Norway maples, purple-leaf plums, and roses to name a few. Adult beetles are particularly attracted to flowers and fruits.

The Japanese beetle grubs are below-ground feeders that feed on the roots and rhizomes of all commonly used turfgrass species, cultivars, and varieties. They can eliminate the plant's entire root system. Where abundant, grubs can destroy large areas of turf in a relatively short period of time. First evidence of injury by grubs is localized-patches of pale, discolored and dying turfgrass that displays symptoms of drought stress. The small damaged areas rapidly enlarge and coalesce as grubs grow and expand their feeding range. Such areas of turf will have a "spongy" feel under foot and can be easily lifted or rolled much like a carpet. Raccoons, moles, and skunks are highly attracted to white grub infested turf, and the foraging of these animals are strong indicators of white grub activity. Also, flocks of birds, especially starlings, feeding are potential indicators of possible white grub infestations.

Life Cycle

The Japanese beetle has a one-year life cycle. Adults emerge from the soil beginning mid to late-June, and peak adult activity occurs in mid-July in Wisconsin. Mating and egg laying begins soon after emergence. Virgin females produce a pheromone (air-borne sex attractant) that attracts males. Greater than 20 males may aggregate on the ground around a single female. Japanese beetle adults typically feed in direct sunlight in groups on foliage that has been damaged by other Japanese beetles. Adult feeding usually begins at the top of a tree or shrub and progresses down until most of the plant foliage has been fed upon. Adults prefer to feed in groups in direct sunlight on foliage that has been damaged by other adults. Once mated, females leave host plants in the late afternoon and fly to suitable sites to begin laying eggs. They prefer to lay eggs in areas with moist, loamy soils covered with turf or pasture grasses, particularly when sites are located near preferred food plants. Females will lay their eggs in irrigated turf rather than in dry, compacted soil. Each females lays between 1—4 eggs in the upper three inches of soil, and this cycle is repeated every few days until the life-span of the female is completed. A typical life-span ranges from 30—45 days and as many as 60 eggs can be laid by each female.

Eggs usually hatch in approximately two weeks depending upon environmental conditions. Thereafter,

the young grubs (first instar) begin feeding on the fine roots and organic matter in the upper three inches of soil where the eggs were laid. Grubs go through a physiological process called molting, whereby the insect grows from a certain life stage (instar) to an advanced or larger stage. Japanese beetle grubs remain in the second instar for approximately 2—3 weeks and the third instar for 3—4 weeks. Later in the summer (late August), most grubs will feed in the upper two inches of the soil, however they will burrow deeper during periods of drought. The grubs will continue to feed and grow until late fall, or around the first frost. Thereafter, the grubs will begin to burrow deeper as soil temperature fall below 60 degrees Fahrenheit. Most grubs will overwinter 2—8 inches in the soil. However, grubs will continue to burrow further into the soil profile as soil temperatures continue decrease. As soil temperatures begin to reach 50 degrees Fahrenheit in the spring, grubs will move back into the root zone and resume feeding vigorously for another 4—6 weeks. After this event, the grubs will burrow slightly deeper to begin preparation of a earthen cell which is created for the Japanese beetle to transform (pupate) from the grub stage into the adult beetle whereby it begins its life-cycle over again.

Management

Adults

Plant Selection

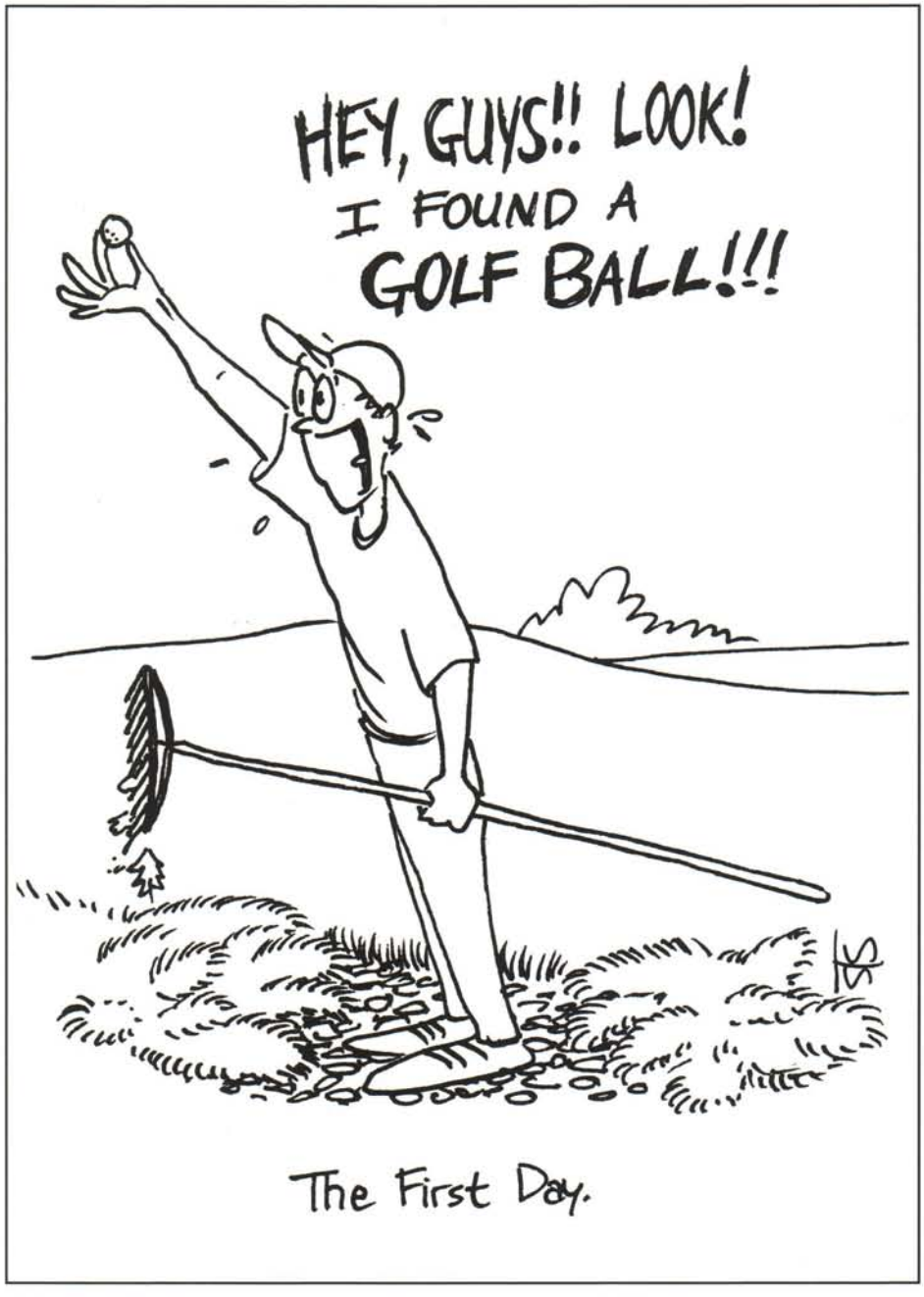
The use of resistant plant species when planning a landscape or replacing plant materials is essential to managing Japanese beetle adults. Certain plants are highly attractive and often sustain heavy feeding damage. Also, other plants such as grapes, multiflora rose, sassafras, smartweed, and Virginia creeper may attract adult beetles resulting in a higher incidence of egg-laying in adjacent turf.

Trapping

There are commercial Japanese beetle traps available, however, research studies have shown that the use of such traps will not protect a landscape from damage. In fact, traps attract more beetles than what are caught, thus susceptible plant material in the vicinity of the traps are likely to sustain greater damage than if no traps were used.

Chemical Control

A number of insecticides are labeled for use for control of Japanese beetle adults. However, the number and selection of products available to a homeowner is vastly different (limited) from what is available to commercial or licensed applicators. Homeowner have a select few products in



which to choose. They include carbaryl (Sevin), acepahte (Orthene), diazinon, and permethrin. The aforementioned products are foliage sprays only, and where beetles are abundant, they require weekly applications to protect susceptible host plants. As for licensed applicators, many more products are available. Such products include pyrethroids (Astro, Delta Guard, Scimitar, Talstar, and Tempo) imidacloprid (Merit), acephate (Orthene), and carbaryl (Sevin).

Grubs

Cultural Control

Because eggs and young grubs can not survive relatively dry soils, withholding irrigation during peak adult beetle flight may help to reduce respective grub populations. However, adequate moisture in late August and September can help the turf tolerate and/or recover from grub damage.

Biological Control

There are plethora of biological products that allegedly control Japanese beetle grubs, however performance of many of these products has been quite inconsistent. Such products include Milky disease spore, insect-infecting nematodes, and fungal pathogens such as *Beauveria bassiana* and *Metarrhizium*.

Chemical Control

Most soil insecticides provide adequate control of Japanese beetle grubs, as well as other white grub species. However, specific criteria or conditions must be fulfilled in order for achieve optimal control. These include factors such as accurate timing of the treatment, treatment must be watered into the turf, and minimal thatch must be present. Until now, the most common approach to grub control was to apply short-residual insecticides after eggs had hatched, and before grubs had caused visible damage. This approach is termed "curative" control. And, the ideal treatment time is early to mid-August. Such curative treatments can be applied later even after the damage appears, but larger grubs (2nd and 3rd instars) are more difficult to control. Similar to the control products available to homeowners for adult beetle control, licensed applicators have a few more products available. From a curative control perspective, homeowners and commercial applicators only have a few options for effective grub control. These products include: diazinon (homeowner and commercial), carbaryl (Sevin, homeowner and commercial), trichlorfon (Dylox/Proxol, commercial only), and chlorpyrifos (Dursban, homeowner and commercial). Although Dursban is labeled for grub control, it is a poor choice. Because spring grubs are distributed variably throughout the soil profile, curative spring grub control applications are not recommended.

Due to the development of novel or improved grub control products, preventative treatments of long-residual insecticides are now available and seem to be the preferred control or management strategy of many turfgrass managers and homeowners. As a result, turfgrass managers are choosing to apply products such as halofenozide (Mach 2 and Grub-Be-Gone, commercial and homeowner, respectively) and imidacloprid (Merit and Grub-X, commercial and homeowner, respectively) during May, June, or July to control young grubs that hatch in late July and early August. This approach seems to provide added value from the standpoint of an "insurance policy" against potential grub damage.