FEATURE ARTICLE

Green June Beetle Management on Golf Courses and Sports Fields

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In early September, I was contacted by a sports turf manager seeking advice about an outbreak of green June beetle, *Cotinis nitida* (GJB), grubs at a college baseball facility. The grubs had reached nearly full-size and were wreaking havoc on the bermudagrass (*Cynodon* spp.) playing field by burrowing, throwing up mounds of soil, and uprooting the turf. That same day, a golf superintendent called with a similar problem on a driving range. Despite my forewarning, both turf managers applied a curative insecticide and the following morning were confronted by the sight and stench of countless thousands of fat, juicy grubs dying and rotting on the turf surface. The aftermath and cleanup required closing both sites to use. **GJB populations seem to be increasing in many areas.** With an ounce of prevention, problems such as the aforementioned ones can be avoided.

Distribution. GJB is a native species that is widely distributed east of the Mississippi River. It occurs from the Gulf states as far north as St. Louis and Columbus, Ohio in the Midwest, north into New Jersey along the Atlantic coast, and west to Texas, Oklahoma, and Kansas. It is especially abundant in the transition zone from Arkansas and Missouri east to the Carolinas. Local infestations have been reported in southern California, probably originating from beetles that were accidentally transported on aircraft originating from eastern states.

Description. Adult GJB are larger than Japanese beetles, measuring 0.75 to 1 inch (19–25 mm) long and about 0.5 inch (12.5 mm) wide. The upper body and wing covers vary from uniform velvety, forest green, to dull brown with lengthwise stripes of green. The underside is shiny, metallic green or gold. GJB grubs are larger (1.75 inch [45 mm] long when full-sized), more robust, and more parallel-sided than other grub species. They have a brown head, six stubby legs, and typically curl into a tight C-shape when first disturbed. GJB grubs can be easily recognized by their unique mode of locomotion—when placed on the soil or any flat surface they "shimmy" along on their back, like a lumbering, upside-down caterpillar.

Life History, Habits, and Damage. GJB have a 1-year life cycle, with the adults active in late June or July. The beetles are active by day. Swarms of males may be seen flying back and forth, just over the turf, in search of virgin females as they first emerge from the soil. The buzzing sounds of their flight, and their superficial resemblance to wasps, may cause unfounded fear of being attacked or stung. Females attract males with an airborne sex pheromone. The beetles form jostling clusters in the grass as several males try to mate with a single, virgin female. Adult GJB feed on ripening tree fruits or berries, oozing tree sap, and other sugary foods. They often remate at such food sources. **Like the grubs, adults throw up small piles of soil as they burrow in and out of turf for egg-laying and resting.** On putting greens and collars, such mounds mark the beetles' presence beneath the surface.

Once mated, female GJB fly to moist soils in which to lay eggs. They seem to favor soils with plenty of decaying organic matter; in fact, this is more important than the species of grass present. They are attracted to piles of rotting mulch or compost, and may also favor turf sites where manure-based fertilizers have been applied. The female burrows down 2 to 5 inch (5–13 cm), excavates a small cavity, and lays a cluster of 10 to 30 eggs. Each female lays several such clutches, depositing as may as 75 eggs over several weeks. Eggs hatch in about 2 weeks, and young grubs are present by early August. By September, the grubs will have molted twice, reaching about three-quarters of their full size. GJB grubs may burrow down 12 inch (30 cm) or more, remaining within the burrow by day but often coming to the surface at night to graze on thatch, decaying grass clippings, or other plant matter. They are especially active on the surface following rains or heavy dew. Burrowing and surface activity also occur in the spring, following overwintering. As the large grubs creep about on the turf surface, they may wind up in swimming pools, garages, outdoor stairwells, or basements.

GJB grubs do not eat living roots to the extent of other white grubs, but their tunneling loosens the surface soil and dislodges the grass, causing it to thin. Loose soil is pushed out of the burrows, forming unsightly mounds that dull reel mower blades, smother the grass, and cause the turf to feel lumpy underfoot.

Management. GJB grub populations tend to be sporadic and patchy, so routine, nonselective treatments usually aren't warranted. **High-risk sites are those where the beetles were seen swarming over the turf during their mating flights, areas treated with compost or**

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manure-based fertilizers, and sites with a history of infestation. Preventively spot-treating such areas with imidacloprid (Merit®), either during or up to 2 weeks after the mating flights, will control young GJB grubs soon after egg hatch, before turf damage occurs. Halofenozide (MACH 2®) does not seem to be as effective against this particular grub species. Turf managers who treat with imidacloprid in June or July for preventive control of Japanese beetle, masked chafer, or other annual grub species will suppress GJB at the same time. Imidacloprid must be applied as a preventive—it is not effective as a curative treatment after the damage appears.

Alternatively, GJB can be effectively spot-treated with a short-residual insecticide, e.g., trichlorfon (Dylox®), carbaryl (Sevin®), or bendiocarb (Turcam®), after the eggs have hatched, but while the grubs are still small (i.e., before the mounds appear). As with all grub treatments, water-in the residues to move them into the soil. Presence of young grubs can be verified beforehand by sampling with a spade or golf hole cutter. Even small GJB grubs tend to be a few inches deeper than grubs of other species. **To confirm the identification, recall that GJB is the only species that crawls on its back**.

Your options are more limited once damage from the large grubs has appeared. Raking or sweeping down the soil mounds may be adequate with light infestations. Cultural practices that enhance turf vigor will help to encourage recovery from GJB damage. Overseeding thinned, damaged areas in the autumn helps to prevent weed encroachment the following spring.

Treating with a fast-acting, short-residual soil insecticide (e.g., Dylox®) will stop the mounding and burrowing, but almost certainly will result in piles of dead grubs littering the surface (see above). **Be prepared for a messy, morning-after cleanup**—indeed, I once saw a youth soccer game canceled because of the GJB grub kill on a playing field that had been treated the evening before. In such situations, the best strategy may be to wait, and then use a preventive approach the following summer.

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ried into these depressional areas may be emitted as CO_2 or CH_4, depending on the degree of anoxia. Under reducing conditions in wetlands, methanogenesis can lead to the emission of CH_4 to the atmosphere.

- **Subsistence farming and low-input or resource-based agriculture are environmentally friendly.** It should be recognized that agricultural practices that are based on mining soil fertility will produce low returns and adversely effect the environment. The risks of soil erosion are increased by management practices that produce less ground cover and return little, if any, biomass to the soil.
- **Application of nitrogenous fertilizer leads to carbon emission due to fossil fuel used in their manufacture, transport and application.** Countering this myth, studies reveal that judicious applications of nitrogen fertilizers can lead to positive carbon balances in commercial agricultural. In other words, soil carbon sequestration occurs if the nitrogen fertility program is soundly based and judicious.
- **The net effect of irrigation on soil carbon sequestration is negative because of the power use of lifting the irrigation water and the release of carbon dioxide and carbonates brought to surface from ground water.** Contrary to this theory, judicious irrigation increases the biomass by 2 to 3 times compared with rainfed production systems and leads to additional sequestration of soil organic carbon.

Turfgrass Aspects. The authors of this book did not include the value of turfgrass vegetation in terms of potential sequestration of soil organic carbon. However, as one reads the book and as summarized in this article, **it is obvious that a turfgrass vegetative cover can be very important, and offers significant potential for the sequestration of carbon that affects global warming.** This is especially true for irrigated, judiciously fertilized turfgrass areas at higher cutting heights that enhance the depth of root growth. It is also obvious that turfgrasses can play a significant role in the restoration of eroded or agricultural soils that have been depleted of organic matter. There is a need to better understand turfgrass-soil processes and properties that influence the soil carbon pool under turfs, as well as their changes as affected by cultural practices. Hopefully those scientists involved in the study of soil carbon sequestration will recognize this turfgrass dimension as an important component and develop specific science-based information for use.