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INSECTS

All Grubs Are *Not* Created Equal

By Pat Vittum

Over the years, turf managers have identified white grubs as their most consistent insect pest. To be sure, other insects cause problems as well. Superintendents in the metropolitan New York area are certainly more familiar with the annual bluegrass weevil than they would like, and superintendents in the Southeast lose sleep over mole cricket infestations. But overall, white grubs are more widespread and have a wider impact in turf settings than any other insect, particularly in cool-season turf.

Until recently, white grub management was fairly straightforward. Turf managers had an arsenal of traditional insecticides, most of which were effective against grubs as long as they were applied at the right time and were watered in. But in the last two years, we have seen the elimination of registrations of several standard turf insecticides, including bendiocarb, isofenphos and chlorpyrifos.

More than ever, turf managers must ascertain which species of grubs may be present in their turf because management strategies vary.

Some of the insecticides that remain on the market must be applied preventively, which limits the opportunity to monitor and react as grub populations develop.

Japanese beetles occur throughout much of the eastern United States, and their grubs can cause significant damage to turf roots. At the same time, several species of white grubs have become noticeably more active and more widespread over the past 10 years. European chafers are now found throughout much of southern New England, especially within 30 miles of Boston. Oriental beetles are found throughout coastal New England, Long Island and New Jersey.

Asiatic garden beetles are on the increase throughout the Northeast. Masked chafers are widely distributed throughout the Midwest and Plains states.

More than ever, turf managers must ascertain which species of grubs may be present because management strategies vary considerably from one species to another. Life cycles vary slightly, and some species are markedly less sensitive to insecticides. As always, timing of applications is critical, but now turf manages need to refine their efforts, selecting the appropriate material and applying it at the right time.

A generic grub life cycle

If we consider the Japanese beetle to be the "generic" grub species, we can describe a generalized life cycle fairly easily. Timing of events varies from one year to another, of course, and adults emerge earlier in the year in Southern locations and later in the year in Northern sites. So let's assume we are discussing Japanese beetle activity in

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Superintendents must know the difference between a Japanese beetle grub (right) and a masked chafer grub (left).

the metropolitan New York area — northern New Jersey, southeastern New York or southwestern Connecticut.

Adult beetles start flying in late June or early July, and are particularly evident on warm sunny days with light breezes or no wind. Japanese beetle adults are active in daylight and have been reported feeding on more than 300 species of ornamental plants, so they can cause significant damage to trees and shrubs.

After nearly a week of feeding and mating, females return to the soil and begin to lay eggs — usually two to four eggs per "event," with a day or two of recovery in between. Each female can lay as many as 40 eggs in her lifetime. Note that not all beetles emerge at the same time, so the earliest ones may begin laying eggs in early to mid July, while others may not begin to oviposit until sometime in August.

Eggs take about a week to mature in the soil, absorbing moisture from the soil and undergoing cell reproduction as the tiny larva begins to develop within the egg. A young larva (first instar) emerges from the egg after about seven to 10 days, and begins to feed on small roots and rootlets. It feeds for about two weeks, and then molts to a second instar (medium-sized grub) and feeds for an additional three or four weeks. By mid-September, most grubs have molted one more time to the third and largest instar. They continue to feed well into autumn and begin to move down into the soil profile as the soil temperatures drop.

By December, most Japanese beetle grubs have moved below the root zone (and stay an inch or two below the frost line where appropriate). They spend the next several months in a semi-dormant state. As soil temperatures warm in the spring, grubs move back up to the root zone, where they resume feeding by mid-April in most years.

Adult Japanese beetles start flying in late June or early July, and are particularly evident on warm, sunny days with light breezes or no wind.

They will feed fairly actively for four to six weeks, and then spend a few days eliminating the last of the undigested food in their digestive system. Then they form a pupa, usually about an inch below the thatch-soil

interface. The pupa persists for about seven to 10 days. The insect does not move or feed during this time, but many physiological changes occur. The new young adults emerge from the soil in late June or early July, completing the cycle.

Differences between species

Japanese beetle grubs tend to prefer relatively light soils that retain some moisture throughout the growing season. They begin to migrate down in anticipation of winter as early as mid November in the Northeast, and do not return to the root zone until soil temperatures are well into the 40s (usually April).

European chafers, on the other hand, prefer drier soils than Japanese beetles. Often the damage from European chafers is most severe in non-irrigated roughs, while Japanese beetles cause more damage on irrigated fairways. In addition, European chafers are less sensitive to cold conditions, so they remain in the root zone feeding much later in autumn (as late as mid-December) and resume feeding in the spring much earlier (as early as late February) than other species. Finally, the life cycle of the European chafer is about two weeks ahead of the Japanese beetle in most locations. For example, adults emerge and lay eggs earlier and grubs begin feeding about two weeks earlier than Japanese beetle grubs.

Oriental beetles lay eggs 1 to 8 inches deep in the soil (deeper than the Japanese beetle). They lay eggs slightly earlier than the Japanese beetles, but it takes the eggs longer to hatch. Therefore, the timing of grub development is similar. There is some evidence that oriental beetle grubs are quicker to migrate downward through the soil profile when conditions are too hot or dry near the surface. This means it can be more difficult to achieve good contact of a soil insecticide with the grubs because they have taken refuge deeper in the soil profile.

The Asiatic garden beetle appears to be increasing in numbers throughout the Northeast. Adults are attracted to lights at night and can be a nuisance at amusement parks or lighted athletic fields. Grubs feed on a variety of vegetation, including less intensively maintained turf and weed patches. The timing of the life cycle generally is within a week of Japanese beetles in most locations.

Northern and Southern masked chafers spend two or three weeks in the egg stage (slightly longer than Japanese beetles)and less than a month as adults (slightly less than Japanese beetles). The life cycle of Northern and Southern chafers tends to be a week or so earlier in many locations, but this difference probably is not significant when considering control strategies. They feed on roots of a variety of grasses, but also can survive by feeding on dead or decaying organic matter in the thatch.

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Green June beetle grubs feed primarily at or near the surface, eating dead or decaying organic matter in the thatch and occasionally eating succulent turf roots. These grubs are much larger than most other species and cause considerable mechanical damage as they burrow through the soil and thatch. They also leave small mounds of soil at the entrances of their burrows, which extend 6 inches to 10 inches into the soil. The burrows can accelerate the rate of desiccation.

When insecticides are used to reduce populations, grubs frequently die on the surface, resulting in a disposal problem. If you don't, the adults feed on ripening fruits — peaches, plums, prunes, apples or pears. Since management strategies are different for adult Green June beetles, and are not discussed in this article.

Pat Vittum is a professor of entomology at the University of Massachusetts. She is primarily an extension entomologist and teaches turf entomology every spring, as well as a course in "Pesticides in the Environment" every fall. She studies the ecology and management of a variety of turfgrass insects, including white grubs and annual bluegrass weevil. She is the senior author of Turfgrass Insects of the United States.