# The Oriental Beetle

*by Steven R. Alm*
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The Japanese beetle is still the single most important insect damaging to turfgrasses in most of the U. S., however, the oriental beetle is fast becoming an important pest of turfgrasses in many areas on the East Coast from North Carolina to Massachusetts (Fig. 1). The oriental beetle was recently classified as *Exomala orientalis* (Waterhouse) by Baraud (1991). In the American literature, the beetle was classified as Anomala orientalis, while in the Japanese literature it was known as *Blitopertha orientalis.* The oriental beetle was introduced into Connecticut around 1920, probably from Japan in balled nursery stock.

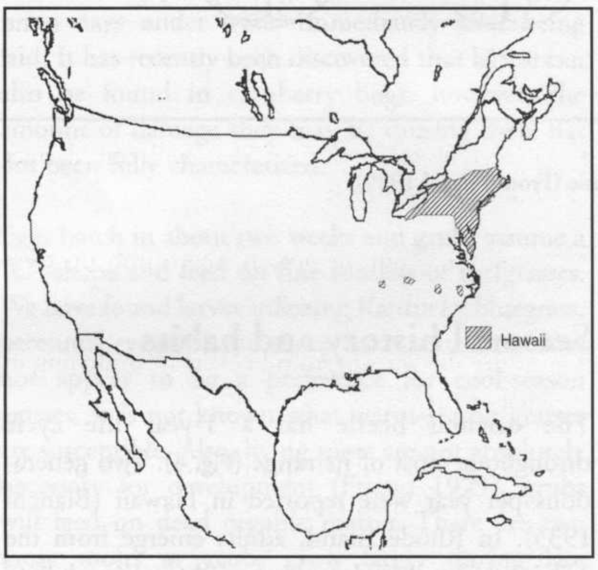


**Fig. 1. Distribution of the oriental beetle. Courtesy of the Entomological Society of America**

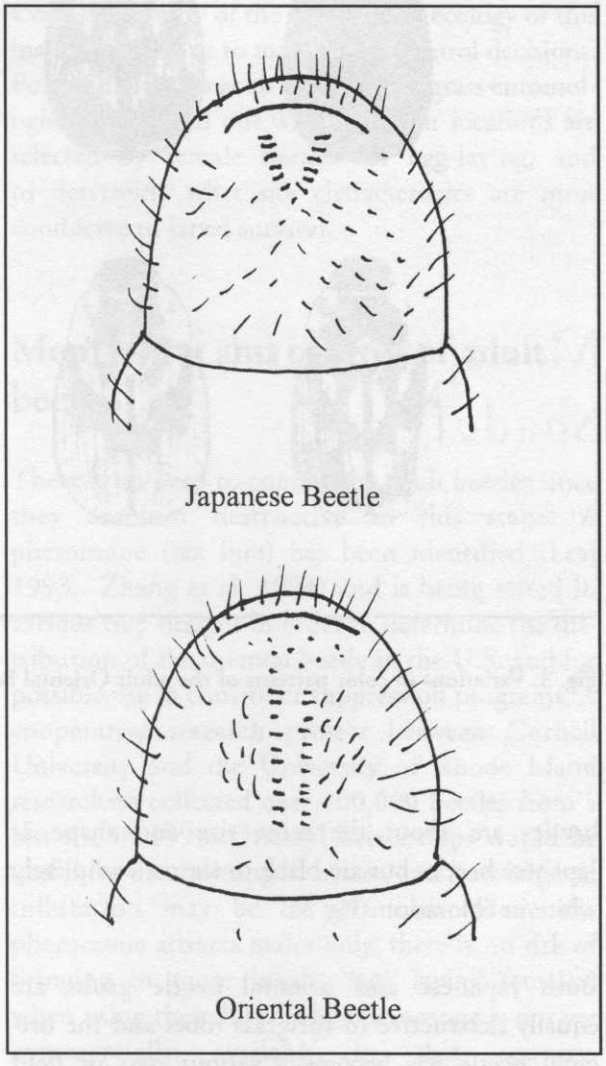


**Fig. 2. Rastral patterns of two of the major turf infesting grubs. Courtesy of Dr. Steven R. Alm.**

It has since spread to Delaware, Maryland, Massachusetts, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode Island and there are some data to suggest it can be found in New Hampshire, Tennessee and West Virginia. The larvae of the oriental beetle look exactly like the larvae of Japanese beetles except for a series of spines on the raster that are visible only with a hand lens or microscope. The spines on Japanese beetle grubs are arranged in a "V" shape (Fig. 2). On the oriental beetle, the spines are arranged in two parallel rows (Fig. 2). The anal slit, which is a smooth curve, is also important in distinguishing these grubs from other white grub species. Adult oriental

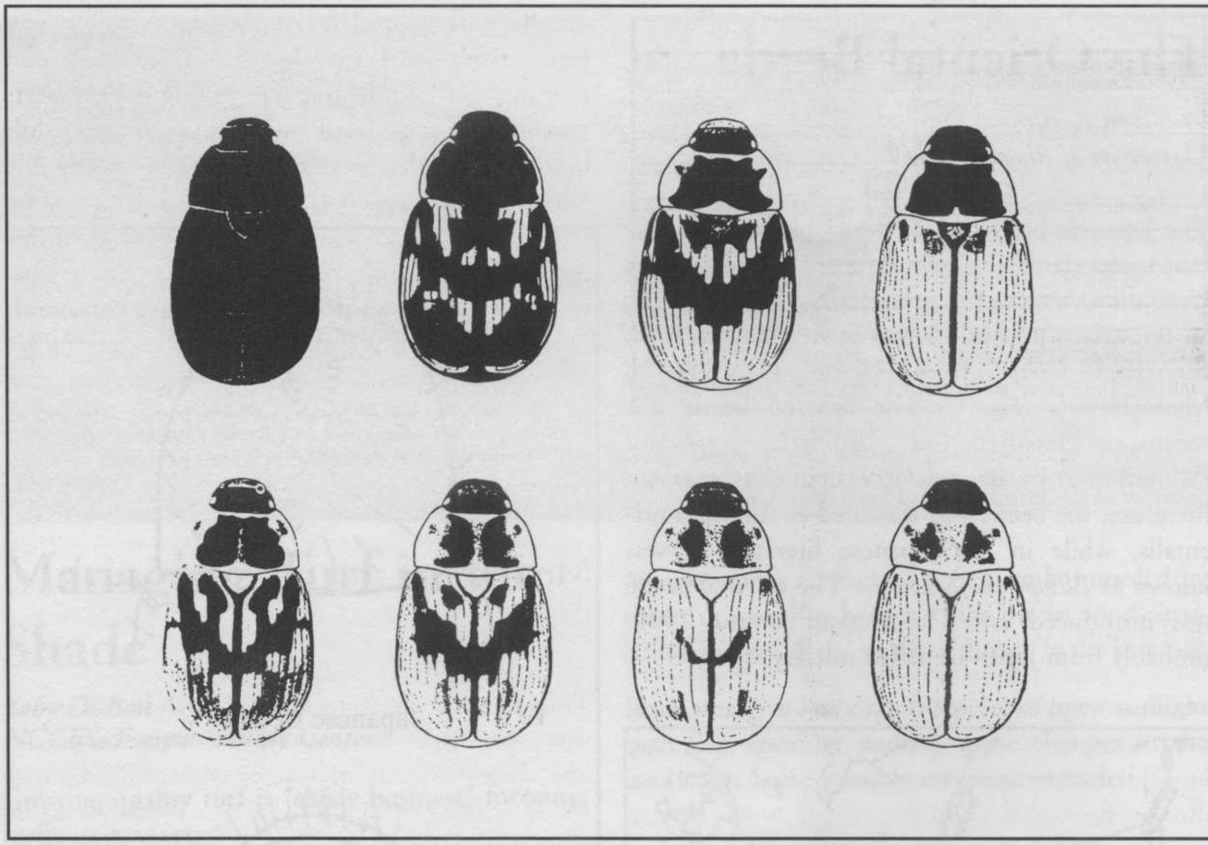

**Fig. 3. Variations in color patterns of the adult Oriental beetle (From Friend 1929).**

beetles are about the same size and shape as Japanese beetles but are black to almost completely white in coloration (Fig. 3).

Both Japanese and oriental beetle grubs are equally destructive to turfgrass roots and the oriental beetle has become a serious pest of field grown nursery stock (e.g. Canada hemlock) on Long Island, NY. The peak flight activity of the oriental beetle is between 7 and 11 PM with a maximum at 9 PM (Facundo, personal communication). Adults feed at night on roses, hollyhock, phlox, petunias and dahlias but this is not considered serious as oriental beetles are not the voracious ornamental feeders Japanese beetles are. Since adult beetles are rarely noticed by the turf manager, they are often surprised at the extent of larval infestations that can develop.

## Seasonal history and habits

The oriental beetle has a 1-year life cycle throughout most of its range (Fig. 4). Two generations per year were reported in Hawaii (Bianchi 1935). In Rhode Island, adults emerge from the soil in mid-to-late June, just a short time before Japanese beetles are seen. Adults emerge one to two weeks earlier further south. They feed and mate after emergence. After mating, adult females burrow into the soil to a depth of 2-4 inches and deposit eggs. A female may enter the soil several times and deposit several eggs per entry. Females prefer to enter the soil and lay eggs in well watered turf, however, dryer sites are also infested. Friend (1929) stated that moisture seems absolutely essential to the development of the embryo, since a lack of moisture retards development, and exposure to

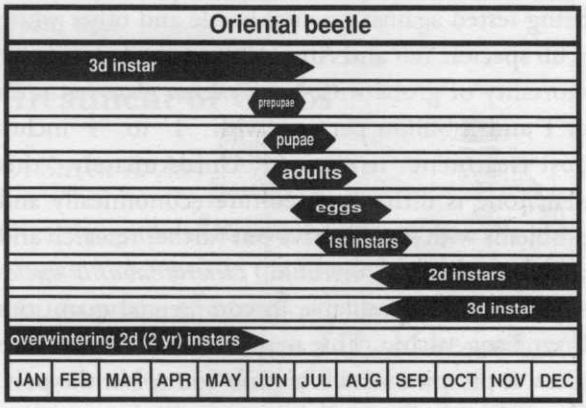


**Fig. 4. Life cycle and stages of the oriental beetle. Courtesy of the Entomological Society of America**

air-dry conditions for the first ten days after oviposition is fatal. Submergence of eggs in water also retards development, but eggs can survive at least seven days under water immediately after being laid. It has recently been discovered that larvae can also be found in cranberry bogs, however, the amount of damage they may be causing there has not been fully characterized.

Eggs hatch in about two weeks and grubs assume a "C"-shape and feed on fine rootlets of turfgrasses. We have found larvae infesting Kentucky bluegrass, perennial ryegrass, and sheep fescue, so, there does not appear to be a preference for cool-season grasses. It is not known what warm-season grasses are susceptible. Also, living roots are not absolutely necessary for development (Friend 1929), grubs will feed on dead organic matter. There are two more molts as grubs grow larger during late summer and fall, each molt producing a slightly larger C-shaped grub. During this time the grubs are within the top two inches of soil.

Grubs continue to feed on roots in the fall until the soil temperatures reach about 59° F. At that temperature, grubs will begin to move downward and continue to do so until soil temperatures reach 50° F. Grubs become inactive at that temperature and will remain at their hibernation level (8-17 inches) throughout the winter. As temperatures warm in the spring, grubs will migrate upwards usually during April in Rhode Island. Grubs will feed actively for 4-5 weeks, then move downward to transform into the pupal or resting stage. Insects stay in that stage until transformation into adult beetles is complete in mid-to-late June or early July when adults emerge and repeat the cycle. Continued study of the biology and ecology of this insect will help us to make better control decisions. For example, two goals of many turfgrass entomologists are to find out why particular locations are selected by female beetles for egg-laying, and to determine what site characteristics are most conducive to larval survival.

## Monitoring and control of adult beetles

There is no need to control the adult beetles since they are not destructive in this stage. A pheromone (sex lure) has been identified (Leal 1993, Zhang et al. 1994) and is being tested in various trap designs in order to determine the distribution of the oriental beetle in the U.S. and for possible use in control or suppression programs. A cooperative research project between Cornell University and the University of Rhode Island researchers collected over 100,000 beetles from a test site in 1993. Oriental beetle traps would be useful for determining if, where, and how large an infestation may be in your area. Since the pheromone attracts males only, there is no risk of bringing in more insects (egg laying females) when using these lures. The pheromone is not yet commercially available in this country. Pheromone lures and traps can be obtained from Fuji Flavor Co., Ltd., 3-5-8 Midorigaoka, Hamura-Shi, Tokyo 205, Japan.

Traps used for Japanese beetle monitoring can also be used for oriental beetles. We have found that traps with the funnel rim placed at ground level capture significantly more beetles than traps with funnel rims above ground level. We used a standard cup changer to make a hole for the collection container, and a turf mender (6" diameter) to allow the funnel rim to be placed at ground level.

## Natural enemies

Like all other insects, the oriental beetle is attacked by a large number of microorganisms, parasites and predators. Grubs are beset by various microorganisms including bacteria, rickettsiae, fungi, protozoa, and nematodes. Other predators such as skunks and raccoons digging in turf are a dead giveaway that a grub population has developed. Holes in turf and soil caused by starlings, grackles, or robins also indicate the presence of grubs.

## Larval control (biological)

Microbial Control: Grubs are susceptible to a milky disease, however the exact causal organism is not known. Dunbar and Beard (1975) and Hanula and Andreadis (1988) reported a low incidence of milky disease in Connecticut white grub populations. In 1992, a population of oriental beetles in Norwich, Conn. was found with nearly 50% milky grubs (Alm, unpublished data). The activity of the commercial formulation of milky disease against oriental beetle grubs is unknown. Hanula and Andreadis (1988) also reported a protozoan (Gregarinidae) from *E. orientalis* in a survey of scarabs collected in Connecticut.

A novel isolate of *Bacillus thuringiensis,* designated var. *japonensis* strain Buibui, obtained from a soil sample collected in the vicinity of Tokushima, Japan was found to be highly toxic to oriental beetle grubs in field experiments (Alm, unpublished data). A commercial formulation is scheduled to be released by the Mycogen, Corp. in 1997.

Parasites: *Scolia manilae* Ashmead, a wasp, has been successfully introduced into Hawaii and has been so effective in parasitizing oriental beetle grubs that they are no longer a serious problem in sugar cane fields there. This parasite may prove effective against the southern populations of oriental beetles where climate is more in line with its native habitat. Entomopathogenic nematodes are being tested against oriental beetle and other white grub species. Yeh and Alm (1995) found significant mortality of grubs with *Steinernema glaseri* at rates of 1 and 2 billion per acre with $\frac{1}{4}$ to $\frac{1}{2}$ inches post-treatment irrigation. Unfortunately, this nematode is difficult to culture economically and problems with storage have put further research and commercialization on hold. *Heterorhabditis bacteriophora* will be available in commercial quantities from Ecogen, Inc. This nematode has shown the greatest promise for white grub control in the past. Control with nematodes is generally better when soil temperatures are between 70° and 86° F (Georgis and Gaugler 1991), $\frac{1}{4}$ to $\frac{1}{2}$ inches of irrigation are applied after treatment, and applications are timed to coincide with early instar grubs.

## Larval control (cultural)

There are no data on soil pH and its' effect on oriental beetle populations at this time but there have been surveys that reported average annual Japanese beetle grub populations ranging from 2.2 to 6.0 per square foot in soils with a pH less than 5.0 and from 0 to 0.6 grubs per square foot in neutral and alkaline soils. Adjusting soil pH between 6.5 and 6.8 will at least assist agronomically in growing a dense stand of turf and may help the turf withstand a grub infestation.

## Larval control (chemical)

Larval control should be considered if sampling reveals eight or more grubs per square foot. More detailed information on monitoring grubs and making control decisions can be found in the August 1995 issue of *TurfGrass TRENDS.* Egg hatch may occur as late as mid-September in the Northeast; so continued monitoring throughout this period is necessary. Villani et al. (1988) found differential susceptibility of oriental beetle, Japanese beetle, and European chafer larvae to five soil insecticides, which

**Field tips**

## Treatment of Grubs

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Treat for grubs with insecticides anywhere from August 1 to Sept 7 in the Rhode Island area with the exception of *Merit*®, which can be applied from April 1st to August 15th. Make applications when grubs are at densities equal to or greater than 8 per square foot. *Triumph*® is a good choice for tees, greens, and aprons. However, *Triumph*® is extremely toxic to fish, so, make certain there is no chance to contaminate streams, lakes or ponds. Pay particular attention to the label irrigation requirements, since most labels require materials be watered in with $\frac{1}{4}$ to $\frac{1}{2}$ inch of water. Do not expect the chemical to control grubs in two to three days; you may not see significant mortality until 14-21 days after treatment. Since there is only one generation of beetles per year, a single fall application (or one spring - fall application with *Merit*®) is all that should be required.

indicates a need to develop species-specific insecticide recommendations for the white grub complex. In a laboratory soil bioassay, Diazinon provided good control of oriental beetle and European chafer grubs but very poor control of Japanese beetles. Chlorpyrifos (*Dursban*®) provided good control of Japanese and oriental beetles but very poor control of European chafers in the laboratory.

We know that chlorpyrifos binds to thatch and soil and is generally considered a better insecticide for surface feeding pests but is not as good on grubs as some other insecticides. Isofenphos (*Oftanol*®) provided a relatively low level of control against all grub species, while bendiocarb (*Turcam*®) provided intermediate control. Ethoprop (*Mocap*®) was effective against all three grub species. Field experiments in 1993 also demonstrated a high degree of control with Mocap®. Isazofos (*Triumph*®) and *Merit*® (imidachloprid) have been the most effective materials for oriental beetle grub control in our experiments in the Northeast. Trichlorfon (*Dylox*®, *Proxol*®) have also worked well in most experiments.

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