

# LAWN INSECTS

## Integrated Pest Management for the Home Gardener

Insects are not a common cause of residential lawn damage in California, but certain species occasionally damage or kill turfgrass. Insect feeding can cause grass to turn yellow or brown, or die, especially if the grass is already stressed. Damage usually begins in small, scattered patches, which may merge into large dead areas. However, lack of proper cultural care and use of inappropriate grass species in a particular location are more likely responsible for unhealthy or dying lawns than insects. Disease-causing pathogens, excessive or inappropriate use of chemicals such as fertilizers and herbicides, and dog urine also produce damage resembling that of insects. Before taking any insect control action, be sure that it is insects causing the problem and not something else.

Insects that may cause damage in California lawns include various root-, crown-, and leaf-feeding caterpillars; white grubs, which are the larvae of scarab beetles such as the black turfgrass ataenius and masked chafers; billbugs, which are weevils with white, grublike larvae; and chinch bugs, which are true bugs in the order Hemiptera. Each species produces somewhat different damage symptoms and must be managed differently. Study Figure 1 for identifying characteristics and Table 1 for damage symptoms associated with each species. In addition to the pests in Table 1, leafhoppers may occur in lawns, sometimes causing yellowing of leaf blades, but rarely occur in numbers justifying treatment. Many other insects may be observed while examining grass. However, control is rarely or never needed for most types of insects because they are harmless or beneficial. Common beneficial insects include predatory ants, ground beetles, rove beetles, and blister

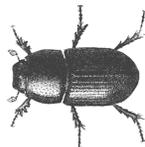
Figure 1. Identifying features of various lawn pests.



**Billbug adult** is a small weevil (snout beetle),  $\frac{1}{3}$  inch long, with a long, downward-pointing snout and elbowed, clubbed antennae. It is often seen walking on paved areas but is difficult to find in turf unless a drench test is used.



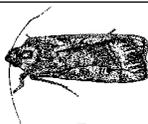
**Billbug larva** is a creamy white, legless,  $\frac{3}{8}$ -inch-long grub with a brown head. The absence of legs distinguishes a billbug larva from a white grub larva.



**Black turfgrass ataenius adult** is a shiny jet black beetle,  $\frac{1}{5}$  inch long, with club-end antennae.



**Chinch bug (southern) adult** is small (less than  $\frac{1}{5}$  inch long) and black with mostly white wings folded flat over the body. Both long- and short-winged forms may be present. Nymphs are bright red to black.



**Armyworm and cutworm adults** are dull brown or grayish, relatively large (up to  $1\frac{1}{2}$  inches long), night-active moths.



**Armyworm and cutworm larvae** are up to 2 inches long at maturity; larvae often curl up and lie still when disturbed.



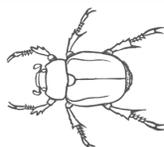
**Skipper (fiery) adult** is a 1-inch-long, orange to brownish butterfly with a hooked knob at the end of the antennae.



**Lawn moth** has an appendage in front of the head resembling a snout. Resting adults appear slender. When disturbed, the moth makes a short flight close to the grass. Adults are up to  $\frac{3}{4}$  inch long.



**Sod webworm (lawn moth) larva** is cream colored,  $\frac{3}{4}$  inch long, and has a distinctive double row of brown or black spots down its back, located at the base of long bristles.



**White grub (chafer) adult** is a golden brown, up to  $\frac{3}{4}$ -inch-long beetle with a dark brown head; it is hairy on the underside of its thorax.



**White grub larva** has a distinct brown head capsule and legs, is up to  $1\frac{1}{2}$  inches long; the posterior portion of its abdomen is enlarged, and it typically curls tightly into a C-shape.

beetles. Other common arthropods that are primarily decomposers and do no significant injury to turfgrass include springtails and millipedes.

### MANAGING LAWN INSECTS

Good cultural practices are the primary method for managing insect damage to lawns. Growing appropriate grass species for a particular location and providing lawns with proper care are especially important. Practices such as irrigating and fertilizing have a major impact on lawn health. Physical controls, such as thatch removal, choice of mowing height and frequency, and providing grass with more light by pruning tree branches, are also important in certain situations. Naturally occurring biological control may limit some insect pests. Most home lawns in California do not need to be treated with insecticides if proper cultural practices are followed. Insecticides should never be applied unless a pest is identified and detected at damaging

levels. If insecticides are necessary, choose materials that have minimum impacts on beneficial organisms and the environment.

### Preventing Pest Problems

The best way to prevent damage from lawn pests is to keep grass healthy. Healthy lawns require few, if any, insecticide treatments. Also, if the turfgrass is under stress and a pesticide is applied, it stands a greater chance of suffering phytotoxic damage from the pesticide itself. The publications on managing your lawn listed in "Suggested Reading" give detailed information on how to grow a healthy lawn.

**Choose Appropriate Varieties.** There are a number of grasses available for planting in California. These grasses are often referred to as either cool-season grasses (examples include annual ryegrass, bentgrass, fine fescue, Kentucky bluegrass, perennial ryegrass, and tall fescue) or warm-season grasses (bermudagrass, kikuyugrass, St.

Augustinegrass, and zoysiagrass). Warm-season grasses produce most of their growth during summer and usually have a dormant period when they turn brown during winter. Cool-season grasses are green year-round, but produce most of their growth in spring and fall. The type of grass and the varieties within each type vary in their shade tolerance, salinity tolerance, water needs, disease resistance, and cultural needs. A formerly thriving lawn variety may decline with changes in light, such as more or less shade caused by growth or removal of nearby trees. These factors are outlined in *Selecting the Best Turfgrass*, listed in "Suggested Reading." Selection of the appropriate grass species and variety will allow you to grow a hardy lawn with minimal maintenance inputs.

**Care for Lawns Properly.** Inappropriate irrigation is the most common cause of lawn damage. Overwatering (shallow, frequent sprinkling) retards deep root growth and increases lawn

**Table 1. Some Lawn Pests, Appearance of Their Damage, and Cultural Control Methods.**

Pest (Scientific name)	Hosts	Damage appearance	Cultural control
armyworms, cutworms ( <i>Pseudaletia unipuncta</i> , <i>Peridroma saucia</i> , <i>Agrotis</i> spp.)	all grasses, dichondra	leaves and base of leaves chewed and cut beginning in small, irregular spots that can spread to patches extending many feet in width	reduce thatch; eliminate soggy areas; overseed lawn
billbugs ( <i>Sphenophorus</i> spp.)	all grasses	brown, thin, dying grass, beginning in small, irregular spots that can spread to patches extending many feet in width	irrigate and fertilize adequately; increase mowing height
black turfgrass ataenius ( <i>Ataenius spretulus</i> )	annual bluegrass, bentgrass, ryegrass, Kentucky bluegrass	brown, dying grass, few roots; lawn is easily peeled off soil	increase mowing height; aerate to improve root growth
fiery skipper ( <i>Hylephila phyleus</i> )	bentgrass, bermudagrass, St. Augustinegrass	1- to 2-inch-diameter spots of lawn turn brown; spots may join to form large, irregular dead patches; leaves chewed or missing	reduce thatch; overseed with grass species that are not preferred
lawn moths, sod webworms ( <i>Crambus sperryellus</i> , <i>Tehama bonifatella</i> )	all grasses, especially bentgrass, bluegrass, clovers	lawn brown; leaves chewed or missing	reduce thatch; irrigate and fertilize appropriately
southern chinch bug ( <i>Blissus insularis</i> )	primarily St. Augustinegrass	irregular patches of lawn turn yellowish, then brown and begin dying during hot weather	reduce thatch; reduce nitrogen fertilization; irrigate adequately; plant resistant varieties such as Floralawn, Floratam, or FX-10 if growing St. Augustinegrass
white grubs—immatures of masked chafers ( <i>Cyclocephala</i> spp.), May and June beetles ( <i>Phyllophaga</i> spp.)	all grasses, especially bluegrass, ryegrass	brown dying grass; lawn can be rolled up if heavily infested	irrigate and fertilize appropriately; overseed lawn

Some pests specific to bermudagrass and dichondra are not included in this table. Other invertebrates that occasionally damage lawns include crane flies, frit flies and other flies, flea beetles, leafhoppers, Lucerne moths, plant bugs, mealybugs, scale insects, and mites. Adapted from Ali and Elmore (1989) and Costa et al. (2000); for more information consult publications in "Suggested Reading."

susceptibility to stress. Poorly maintained sprinklers can apply too much water in certain spots while under-watering other areas. Brown spots from uneven water applications occur frequently and are often caused by improperly spaced irrigation heads, sunken or tilted heads, or unmatched heads that apply differing amounts of water. Correcting these physical problems with irrigation systems can decrease water waste by over 50%, decrease water bills, and most importantly, improve the health of your lawn. Lawns should be irrigated deeply and no more often than twice a week.

Appropriate fertilization encourages a dense, thick lawn that allows grass to tolerate some insect feeding. The appropriate timing and amount of fertilizer (primarily nitrogen) varies depending on factors including season, grass species, and local growing conditions. In general, most California grasses used for lawns require from 3 to 6 pounds of actual nitrogen over a 1,000-square-foot area annually during their active growing season.

Keep the blades on your lawn mower sharp and cut your turf at a mowing height appropriate for the type of lawn grass to minimize depletion of food reserves needed to outgrow insect injury. Mowing frequency and height depend on grass species, season, and the particular use of that lawn. Cool-season lawns have suggested mowing heights of 1½ to 2½ inches, while warm-season lawns should be mowed to a height of ¾ to 1 inch. No more than one-third of the grass height should be removed at one time.

Lawns also benefit from aeration. To increase water penetration and reduce soil compaction, periodically remove soil plugs using hollow tines. Thatch, which is the layer of undecomposed organic material on the soil surface, can build up and result in poor water, fertilizer, and air penetration. Thatch that is greater than ½ inch thick encourages caterpillar and chinch bug populations. Thatch also reduces insecticide efficacy because insecticides cannot penetrate to reach root-feeding insects. Prevent thatch by avoiding ex-

cess nitrogen application, irrigating deeply and infrequently, and minimizing the use of lawn pesticides that can reduce populations of microorganisms responsible for decomposing the thatch. If it is more than ½ inch thick, physically remove thatch with a garden rake, mechanical dethatcher, vertical mower, or power rake. Other methods include topdressing lawns by adding a thin layer (⅛–¼ inch) of soil and raking or sweeping it into the thatch to encourage decomposer microorganisms. Core aeration also mixes soil into thatch, speeding decomposition.

### **Biological Control**

Certain insects, other invertebrates, and microorganisms that occur naturally in lawns feed on or parasitize lawn pests. This type of control, called biological control, may help to prevent many lawn-dwelling insects from becoming pests. To protect beneficial insects, avoid using broad-spectrum pesticides that will kill them along with the pests. Biological pesticides containing organisms such as *Bacillus thuringiensis* (Bt) and beneficial nematodes are commercially available for controlling specific lawn insects. These materials have minimal impacts on natural enemies of insect pests and other beneficial organisms such as earthworms. Birds, moles, and other vertebrates also feed on lawn insects from time to time.

### **Detecting Problems in Your Lawn**

Examine your lawn weekly or just before each mowing to detect problem areas. At the same time, look for weeds. A dense stand of healthy grass prevents most weeds from growing, so abundant weed growth indicates that the lawn is unhealthy and susceptible to other pests. New turfgrass is especially vulnerable to problems and has different irrigation and fertilizer requirements than established turfgrass. An indication that a lawn may be infested with insects is when the adults (e.g., moth or beetle stage) of pests are drawn to lights at night or when vertebrate predators (birds, raccoons, or skunks) are digging in your lawn for caterpillars and grubs. However, the insects coming to light may be drawn

from far away and vertebrate activity is not a foolproof indicator. They may be feeding on earthworms instead of insects; also, vertebrates will return to where they previously found food, so they may dig in lawns even if insect pests are no longer abundant.

If you observe damage, the next step is to determine the actual cause. If you think the damage is caused by insects, confirm your suspicions by looking for the pest. The most accurate way to do this is by using either the drench test or by inspecting around roots (Table 2). The drench test is effective for detecting chinch bugs and caterpillars including armyworms, cutworms, and sod webworms, but it does not detect grubs. Locating and correctly identifying a pest is important because different pests require different treatment materials, timing, and application methods.

Identify the insects you find using descriptions in this publication (Fig. 1) and other publications such as *Handbook of Turfgrass Pests* or *Turfgrass Pests* listed in "Suggested Reading." The *UC IPM Pest Management Guidelines: Turfgrass* is available on the World Wide Web ([www.ipm.ucdavis.edu/PMG/selectnewpest.turfgrass.html](http://www.ipm.ucdavis.edu/PMG/selectnewpest.turfgrass.html)) and contains color photos of some turfgrass pests. After identifying the insects, count the number of each type of insect found. Some of the insects you find may be beneficial or nondamaging. In home lawns, you usually need only to be concerned with the insects listed in Table 1.

Remember that the mere presence of an insect pest does not imply that it is the cause of unhealthy lawns or that an insecticide treatment is needed. It is normal to find a few pest insects in any healthy lawn. Generally treatments are not recommended unless the population level of the insect pest reaches a predetermined level called a *threshold* (Table 2). Thresholds are the population levels at which the number of insects feeding exceeds the ability of a healthy lawn to withstand the damage they cause. For example, an insecticide usually is not needed unless there are more than about 5 armyworms and cutworms or 15 lawn moth larvae per

**Table 2. Lawn Pest Detection Methods, Treatment Targets, Thresholds, and IPM-compatible Materials.**

Insect	Detection method	Treatment target	Suggested treatment threshold	IPM-compatible materials
armyworms, cutworms	drench test for fat, dull gray, green, or brownish larvae up to 2 inches long; inspect outdoor lights around dawn for 1 <sup>1</sup> / <sub>4</sub> inch brownish to gray moths	crowns, leaves, thatch	5/yd <sup>2</sup>	A, Bt, P, Sc
billbugs	dig around roots for whitish, C-shaped, legless grubs up to <sup>3</sup> / <sub>8</sub> inch long with reddish heads; inspect outdoor lights around dawn for <sup>1</sup> / <sub>3</sub> inch brownish to gray snout beetles	crown, roots	1/ft <sup>2</sup>	I, Sc
black turfgrass ataenius (see also white grubs)	dig around roots for whitish, C-shaped grubs up to <sup>1</sup> / <sub>3</sub> inch long with 6 legs and reddish heads; inspect outdoor lights around dawn for shiny black adults <sup>1</sup> / <sub>5</sub> inch long	roots, thatch soil interface	40/ft <sup>2</sup>	Hb, I, Sc
chinch bug, southern	drench test or inspect around grass bases for reddish, purple, black, or gray bugs up to <sup>1</sup> / <sub>2</sub> inch long	crowns, stems	135/yd <sup>2</sup> or 15 nymphs & adults/ft <sup>2</sup>	P
lawn moths (sod webworms)	drench test for slender, grayish larvae up to <sup>3</sup> / <sub>4</sub> inch long; whitish or brownish moths up to <sup>3</sup> / <sub>4</sub> inch long fly when grass is disturbed	crowns, leaves, thatch	15/yd <sup>2</sup>	A, Bt, P, Sc
skipper, fiery	drench test for larvae up to 1 inch long with pink-green body and red and black head; orangish butterflies 1 inch wide with knobbed antennae feed at flowers; mere presence of this insect does not warrant control	leaves, stems	15/yd <sup>2</sup>	Bt, Hb, P
white grubs (the immatures of masked chafers, May and June beetles; see also black turfgrass ataenius)	dig around roots in late winter or summer for whitish to yellow, wrinkled, C-shaped grub up to 1 <sup>1</sup> / <sub>2</sub> inches long with 6 legs and a reddish head; look for yellowish brown adults <sup>1</sup> / <sub>2</sub> inch long.	roots	6/ft <sup>2</sup>	Hb, I, Sg

Check current labels for permitted uses and proper application methods.

Adapted from Ali and Elmore (1989) and Costa et al. (2000).

**IPM-compatible materials**

- A = azadirachtin or neem (Safer BioNeem)
- Bt = *Bacillus thuringiensis* (BT WormKiller, Caterpillar Clobber)
- I = imidacloprid (Bayer Advanced Lawn Grub Control, GrubEx, etc.)
- P = pyrethrin (Safer Yard & Garden Insect Killer)

**Predaceous nematodes**

- Hb = *Heterorhabditis bacteriophora*
- Sc = *Steinernema carpocapsae*
- Sg = *Steinernema glaseri*

square yard. Sample several different areas of the lawn to better estimate populations overall, especially if numbers are close to suggested thresholds.

**Drench Test.** To detect chinch bugs, adult billbugs, and caterpillars including armyworms, cutworms, and larvae of lawn moths (sod webworms), perform a drench test by mixing 1 to 2 fluid ounces (2–4 tablespoons) of dishwashing liquid (such as Lemon Joy) to a gallon of water. If you are using a concentrate (i.e., Ultra) version of a dishwashing liquid, 1<sup>1</sup>/<sub>2</sub> tablespoons per gallon of water is adequate. Two gallons may be required where soils are dry.

Apply the solution to 1 square yard of lawn as evenly as possible using a sprinkling can (Fig. 2). Test an area that

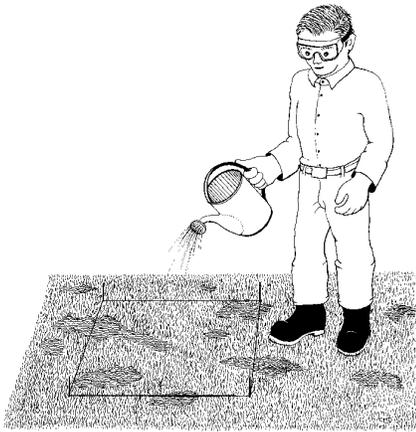
includes both relatively healthy grass and adjoining unhealthy grass. The drench will cause insects to move to the surface. During the next 10 minutes, identify and count the number of pest insects.

**Inspect Around Roots.** The drench test does not indicate the presence of billbug larvae, black turfgrass ataenius larvae, or white grubs (masked chafers, May beetles, and June beetles). To detect white grubs, dig or cut beneath thatch (Fig. 3) and examine the soil around roots and crowns (where roots and stems meet). Look for the white, legless larvae of billbugs (a weevil) or the C-shaped, six-legged larvae of scarab beetles such as black turfgrass ataenius and masked chafers. When these are numerous, roots are eaten

away and turf often can be rolled back like a carpet. If you find more than about one billbug larva, six white grubs, or 40 black turfgrass ataenius grubs per square foot, control may be needed.

**TREATMENT**

If cultural practices are not enough to prevent damage, and a drench test or root inspection indicates treatment is warranted, choose selective, least toxic, IPM-compatible products (Table 2) whenever possible to control pests. The microbial insecticide *Bacillus thuringiensis* and insect-killing nematode products that can be applied like insecticides have minimal negative impacts on nontarget organisms. The insecticides azadirachtin, pyrethrum (pyrethrins), and imidacloprid are also



**Figure 2.** Detect chinch bugs, adult billbugs, and caterpillars by drenching a 1-square-yard area of lawn with a soap solution to irritate insects so they come to the surface.

relatively safe products for lawn insect management. Each of these products is effective only on certain pests and all must be properly timed and applied to be effective. Avoid the use of chlorpyrifos and diazinon; urban use of these materials has been identified as a source of pollution in California's creeks and rivers. Other broad-spectrum insecticides, including carbaryl, pyrethroids, and acephate, are available. However, these materials pose risks for beneficial and nontarget organisms. Use them only when IPM-compatible insecticides cannot control the infestation.

Avoid the use of lawn fertilizer products that also contain insecticides for preventative treatment. Insecticide treatment at the time of fertilizing is usually not justified and may reduce the presence of beneficial insects.

Mow the lawn and reduce excess thatch (greater than 1/2 inch) before applying insecticides. Unless otherwise directed on the product label, irrigate and allow grass blades to dry before treating caterpillars and other insects that feed on grass blades and stems. Do not treat if rainfall is expected and do not irrigate for at least 48 hours after spraying for leaf-feeders to allow the insecticide to remain on grass blades as long as possible. When treating white grubs and other root-feeders, wait to

irrigate until after application so the insecticide is moved down into the soil.

Certain chemicals may injure lawns, especially if used on seedlings, when temperatures are too high, or if grass is stressed. Injury may also result from excess amounts, repeated applications, the wrong formulation, or from mixing incompatible materials. Inert ingredients, such as wetters, spreaders, emulsifiers, diluents, and solvents, may also injure lawns.

**Bacillus thuringiensis (Bt).** Bt kills only caterpillars. When infected with Bt, caterpillars stop feeding within a day and usually die within a few days.

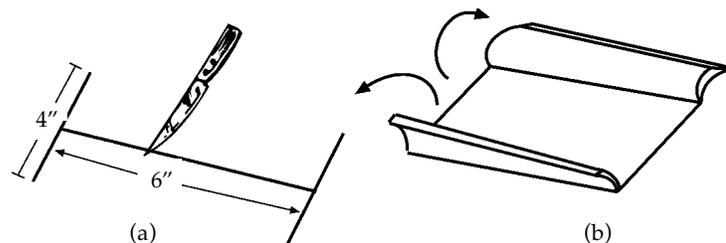
Unlike broad-spectrum insecticides that kill on contact, caterpillars must eat Bt-sprayed foliage to be killed, so proper timing and thorough spray coverage are very important. Bt is most effective on caterpillars when they are young. Once the caterpillars become large they are harder to kill with this material, and other control measures may be necessary. Apply Bt during warm, dry weather when caterpillars are feeding actively. Sunlight inactivates Bt on foliage, so make applications in the evening. Repeat treatment after about 7 to 10 days.

**Nematodes.** Insect-attacking nematodes can be applied to control caterpillars or grubs. Each nematode species is effective on a different range of pests. Select the nematode species most effective against the target pest(s) (Table 2). All nematode species are most effective when applied during the

early part of the season for that pest (Fig. 4) when grubs or caterpillars are active. A second application about 2 weeks after the first increases the likelihood that nematodes will reproduce and provide long-term pest control. Irrigate before and after application. Apply to warm (at least 60°F), moist but not soggy soil. Several irrigations may be needed during the 2 weeks after each application to keep soil moist. Because nematodes are killed by light and heat, apply them in the evening, especially in hot areas.

Nematodes usually must be mail ordered. Because they are very perishable, store them as directed (usually under cool, dark conditions) and do not store them for long periods. Purchase from a reputable producer or supplier of fresh nematodes. Sources include those listed in the free pamphlet *Suppliers of Beneficial Organisms in North America* available from the California Department of Pesticide Regulation, 830 K Street, Sacramento, CA 95814-3510, phone 916-324-4100, or on the World Wide Web at [www.cdpr.ca.gov/dprnews.htm](http://www.cdpr.ca.gov/dprnews.htm). Suppliers and details on nematode use are also available at <http://www2.oardc.ohio-state.edu/nematodes>.

**Azadirachtin.** The botanical pesticide azadirachtin is extracted from the seeds of the neem tree. It is used to control cutworms, armyworms, and the larvae of lawn moths. Azadirachtin is absorbed by the plant and is able to move to a limited degree within the plant. Because azadirachtin acts partly as an insect growth regulator (i.e., it prevents the caterpillar from reaching maturity), most caterpillars are not killed until



**Figure 3.** Detect billbug larvae, black turfgrass ateniens, and white grubs by digging around the root zone with a hand trowel. Alternatively, make three connected cuts through grass and thatch in the shape of a capital "I" (a); then lift back (b) and inspect underneath. If the area examined is 6 inches long and 4 inches wide, inspect six such areas to uncover a total of 1 square foot and compare the number of insects discovered to the suggested thresholds.

**Figure 4. Approximate times to monitor for some lawn insects. Actual treatment time varies depending in part on location, temperature, rainfall, and the specific insecticide used. Before applying an insecticide, monitor for insects to confirm pest presence and that their numbers exceed thresholds.**

Insect	Apr	May	Jun	Jul	Aug	Sep	Oct
armyworm, cutworm	---	---	---	---	---	---	---
billbug	---	---	---	---	---	---	---
black turfgrass ataenius	---	---	---	---	---	---	---
chinch bug	---	---	---	---	---	---	---
fiery skipper	---	---	---	---	---	---	---
sod webworm, lawn moth	---	---	---	---	---	---	---
white grub	---	---	---	---	---	---	---

several days after application, and azadirachtin's effectiveness is not immediately apparent.

For more information contact the University of California Cooperative Extension or agricultural commissioner's office in your county. See your phone book for addresses and phone numbers.

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 ILLUSTRATIONS: Fig.1: Adult chafer from A. S. Packard. 1876. *Guide to the Study of Insects*. New York: Henry Holt; Sod webworm by R. M. Bohart. 1947. *Hilgardia* 17(8):275; other insect line art by Chittenden, Marlatt, or Webster from Sanderson, E. D. and C. F. Jackson. 1912. *Elementary Entomology*. Boston: Ginn.; Fig. 2: C. M. Dewees; Fig. 3: adapted from Gelenter, W. D. *Calif. Fairways*, Jan-Feb: pp. 6-8; Fig. 4: adapted from Ali, A. D., and C. L. Elmore, eds. 1989. *Turfgrass Pests*. Oakland: UC DANR Publ. 4053.  
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This publication has been anonymously peer reviewed for technical accuracy by University of California scientists and other qualified professionals. This review process was managed by the ANR Associate Editor for Pest Management.

To simplify information, trade names of products have been used. No endorsement of named products is intended, nor is criticism implied of similar products that are not mentioned.

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**Imidacloprid.** Imidacloprid is a chloronicotinyl insecticide that moves systemically within plants. It is effective against black turfgrass ataenius, white grubs, and weevils. Imidacloprid has relatively long persistence. Because initial effectiveness can be delayed for days after application, it may be best to apply it during the early part of the season (Fig. 4), when the grubs are in their earliest stages. In lawns that had damaging infestations the previous year, make treatments when adults are found in early to midsummer. If lawns are heavily infested with damaging levels of grubs later in the season, a more quick-acting, broad-spectrum insecticide may be necessary.

**Pyrethrin.** Pyrethrum, a botanical from flowers of certain chrysanthemums, contains pyrethrins, which are toxic to insects. Many pyrethrum products include the synergist piperonyl butoxide. Insects may only be temporarily paralyzed (knocked-down) and pests may

recover from temporary effects of exposure to pyrethrum unless piperonyl butoxide is added.

**SUGGESTED READING**

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**WARNING ON THE USE OF CHEMICALS**

Pesticides are poisonous. Always read and carefully follow all precautions and safety recommendations given on the container label. Store all chemicals in the original labeled containers in a locked cabinet or shed, away from food or feeds, and out of the reach of children, unauthorized persons, pets, and livestock.

Confine chemicals to the property being treated. Avoid drift onto neighboring properties, especially gardens containing fruits or vegetables ready to be picked.

Do not place containers containing pesticide in the trash nor pour pesticides down sink or toilet. Either use the pesticide according to the label or take unwanted pesticides to a Household Hazardous Waste Collection site. Contact your county agricultural commissioner for additional information on safe container disposal and for the location of the Hazardous Waste Collection site nearest you. Dispose of empty containers by following label directions. Never reuse or burn the containers or dispose of them in such a manner that they may contaminate water supplies or natural waterways.

The University of California prohibits discrimination against or harassment of any person employed by or seeking employment with the University on the basis of race, color, national origin, religion, sex, physical or mental disability, medical condition (cancer-related or genetic characteristics), ancestry, marital status, age, sexual orientation, citizenship, or status as a covered veteran (special disabled veteran, Vietnam-era veteran, or any other veteran who served on active duty during a war or in a campaign or expedition for which a campaign badge has been authorized). University Policy is intended to be consistent with the provisions of applicable State and Federal laws. Inquiries regarding the University's nondiscrimination policies may be directed to the Affirmative Action/Staff Personnel Services Director, University of California, Agriculture and Natural Resources, 300 Lakeside Dr., Oakland, CA 94612-3350; (510) 987-0096.