LAWN INSECTS

Integrated Pest Management for Home Gardeners and Landscape Professionals

Insects are not a common cause of residential lawn damage in California, but certain species may 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 much more likely to cause unhealthy or dying lawns than insects. Vertebrate predators such as skunks, raccoons, wild pigs, and birds may be attracted to turf infested by insects, especially white grubs in autumn, and cause further damage by uprooting grass in search of their prey. For more information about these pests see the vertebrate pests section of the UC IPM Home and Landscape web site. 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 certain insects are causing the damage and not something else and that the insect pest is present in life stages susceptible to control actions.

IDENTIFICATION

Insects that may cause damage in California lawns include various root-, crown-, and leaf-feeding caterpillars (Figure 1); grubs, which include the larvae of scarab beetles such as the black turfgrass ataenius and masked chafers (white grubs) (Figure 2); billbugs, which are weevils with white, grublike larvae (Figure 3); and chinch bugs, which are true bugs in the order Hemiptera. Leafhoppers (Figure 4) may occur in lawns, sometimes causing yellowing of leaf blades; but they rarely occur in numbers justifying treatment.

Figure 1. The black cutworm, *Agrotis ipsilon*, is one of several cutworm species that may damage lawns.

Leatherjackets, the larvae of crane flies (Figure 5), can sometimes cause significant damage by feeding on turfgrass roots and crowns in the cooler, wetter north coast areas of California in Humboldt and Del Norte Counties and at commercial sod farms but rarely are numerous enough to cause damage in other areas of California. See the UC Guide for Healthy Lawns for help in identifying features of key lawn insect pests. Each species produces somewhat different damage symptoms and must be managed differently. Figure 6 shows identifying characteristics, and Table 1 shows damage symptoms associated with each species.

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

MANAGING LAWN INSECTS

Following good cultural practices is the primary method for managing insect damage to lawns. Growing

Figure 2. A healthy white grub larva next to a darker one infected with the nematode *Heterorhabditis bacteriophora*.

Figure 3. The larva of the billbug is much smaller than white grubs.

Figure 4. Leafhoppers often occur in lawns, sometimes causing yellowing of leaf blades.

Figure 5. Larva of a crane fly.

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appropriate grass species for a particular climatic region and providing lawns with proper care are especially important. Practices such as irrigating and fertilizing have a major impact on lawn health. Practices 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 agents, such as predators and parasites, may limit some insect pests. Most home lawns in California do not need to be treated with pesticides if proper cultural practices are followed. Pesticides should never be applied unless a pest has been identified, is present at damaging levels, and is present in a susceptible life stage. If pesticide applications are necessary, choose IPM-compatible materials (Table 2) 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, pesticide applications. 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 UC Guide to Healthy Lawns on the UC IPM web site and the publications on managing your lawn listed in References give detailed information on how to grow a healthy lawn. Table 1 lists cultural practices important for preventing specific problems.

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 bentgrass, fine fescue, Kentucky bluegrass, perennial ryegrass, and tall fescue) or warm-season grasses (bermudagrass, kikuyugrass, St. Augustinegrass, seashore paspalum, zoysiagrass, and buffalograss). 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

	**Billbug adult** is a small weevil (snout beetle), 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, 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, 1/5 inch long, with club-end antennae.
	**Chinch bug (southern) adult** is small (less than 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 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 3/4 inch long.
	**Sod webworm (lawn moth) larva** is cream colored, 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 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 and is up to 1 1/2 inches long. The posterior portion of its abdomen is enlarged, and it typically curls tightly into a C-shape.

Figure 6. Identifying features of various lawn pests.

year-round, but they 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 *Turfgrass Selection for the Home Landscape*. 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) predisposes turf to diseases, retards deep root growth, and increases lawn susceptibility to stress. Poorly maintained sprinklers can apply too much water in certain spots while underwatering other areas. Brown spots from uneven water applications occur frequently and are often caused by improperly spaced sprinkler 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 significantly, decrease water bills, and, most importantly, improve the health of your lawn. Lawns should be irrigated deeply and not more 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 2 to 4 pounds of actual nitrogen over a 1,000 square foot area annually during their active growing season. Some native grasses and drought tolerant species like buffalograss and fine leaf fescue may require less. If grasscycling is practiced (leaving lawn clippings on the lawn after mowing, instead of removing), then the lower rate of nitrogen application may be used.

Keep the blades on your lawn mower sharp and cut your turf at a mowing height appropriate for that type of lawn grass so as 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 1 1/2 to 3 inches, while warm-season lawns should be mowed to a height of 3/4 to 1 inch. No more than 1/3 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. In bluegrass and bermudagrass lawns, thatch (the layer of undecomposed organic material on the soil surface) can build up and result in poor water, fertilizer, and air penetration, as well as provide a protected home for many unwanted pests and pathogens. Presently, most California lawns are planted with tall fescue, which is not as susceptible to thatch buildup as other species. Thatch that is greater than 1/2 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 excess nitrogen application, irrigating deeply and infrequently, and minimizing the use of broad-spectrum lawn pesticides that can reduce populations of microorganisms responsible for decomposing the thatch. If more than 1/2 inch thick, physically remove thatch with a mechanical dethatcher, vertical mower, or power rake. Other methods (although not as effective in reducing thatch) include topdressing lawns by adding a thin layer (1/8–1/4 inch) of soil and raking or sweeping it into the thatch to encourage decomposer microorganisms. Core aerification 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 (such as carbaryl, neonicotinoids, and pyrethroids) that will kill them along with the pests. Some biological pesticides containing live organisms, such as entomopathogenic nematodes or biological metabolites from *Bacillus thuringiensis* (Bt) and other organisms, 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 (see Figure 7). 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. Since inappropriate watering is the most common cause of lawn damage, check your irrigation system first to make sure all nozzles are functioning properly and that adequate and uniform coverage is provided, as discussed above. 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 are managed differently. Some may not require treatment. If treatment is required, then materials, timing, and application methods will vary according to pest species.

Identify the insects you find using descriptions in this publication and the online UC Guide to Healthy Lawns. 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 only need to be concerned with the insects listed in Table 1. Figure 7 shows approximate times when you might expect to see common pests in your lawn.

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 square yard. Sample several different areas of the lawn to better estimate the overall population levels, 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 to a gallon of water. If you are using a concentrate version of a dishwashing liquid, 1 1/2 tablespoons per gallon of water is adequate. Two gallons may be required where soils are dry.

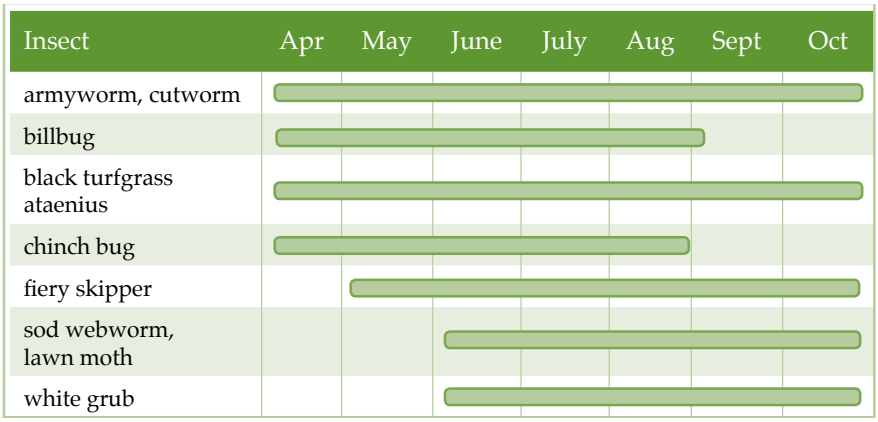

Figure 7. Approximate time to monitor for some lawn insects.

Apply the solution to 1 square yard of lawn as evenly as possible using a sprinkling can (Figure 8). 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 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 (Figure 9). If you find more than about 1 billbug larva, 6 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. Microbial insecticides derived from *Bacillus thuringiensis* (Bt) and entomopathogenic nematodes have minimal negative impacts on nontarget organisms. The insecticides azadirachtin, pyrethrum (pyrethrins), and spinosad also pose less risk for nontarget

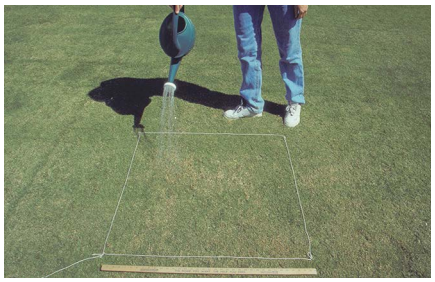

Figure 8. Detect chinch bugs, adult billbugs and caterpillars by drenching a 1-square-yard area of lawn with a soap solution to irritate insects so they come to the surface.

Figure 9. Turf killed by chafers or billbugs often can be rolled back like a carpet because roots are eaten away. Two white grub larvae are revealed here.

organisms. Each of these products is effective only on certain pests and must be properly timed and applied to be effective. Broad-spectrum insecticides, including carbaryl, chlorantraniliprole, imidacloprid and other neonicotinoids, and pyrethroids, such as bifenthrin, are available to control certain pests. However, these materials pose risks for beneficial, nontarget organisms and water quality. Avoid their use unless IPM-compatible insecticides cannot control the infestation.

For more information on environmental and health impacts of the insecticides mentioned here visit the UC IPM Active Ingredient Database and the National Pesticide Information Database web sites or click on the *Active Ingredients: Compare Risks* button at the bottom of the online version of this publication.

Avoid the use of lawn fertilizer products that also contain insecticides for preventive 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 improper rates, repeated applications, wrong formulations, or from mixing incompatible materials. Inert ingredients,

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

Pest (Scientific name)	Hosts	Damage Appearance	Cultural Control
armyworms, cutworms (*Mythimna* (= *Pseudaletia*) *unipuncta, Peridroma saucia, Agrotis* 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 (*Sphenophorus* 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 (*Ataenius spretulus*)	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
crane fly (*Tipula paludosa*)	all grasses	primarily in Humbolt and Del Norte counties; dying patches of grass with cranefly larvae feeding on roots and crowns	avoid over-irrigation and poor drainage situations; remove excess thatch
fiery skipper (*Hylephila phyleus*)	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 (*Crambus sperryellus, Tehama bonifatella*)	all grasses, especially bentgrass, bluegrass, clovers	lawn brown; leaves chewed or missing	reduce thatch; irrigate and fertilize appropriately
southern chinch bug (*Blissus insularis*)	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 (*Cyclocephala* spp.), May and June beetles (*Phyllophaga* 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 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 References.			

such as wetters, spreaders, emulsifiers, diluents, and solvents may also injure lawns.

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

Bacillus thuringiensis **(**Bt) kurstaki**.** Bt subspecies kurstaki 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.

Carbaryl. This carbamate insecticide is a cholinesterase inhibitor, exhibiting broad-spectrum activity against insects and other arthropods as well as moderate toxicity to people and other mammals. It will kill pests and beneficial insects on contact or when consumed and will persist in the application area for up to several weeks. Carbaryl should not be applied to blooming plants or to lawns containing clovers or other flowering plants since it is highly toxic to bees and other pollinators. Carbaryl can be used to kill large white grubs in late summer and fall but will not remedy the lawn damage that has already occurred and may not prevent grub damage the following year.

Chlorantraniliprole. This broad-spectrum anthranilic diamide insecticide interrupts the normal muscle contraction of insects, resulting in death. It adheres to plant surfaces and is most effective when consumed by pests. Therefore, it should only be applied when pest insects, such as grubs or caterpillars, are present at damaging levels and are actively consuming turf grass stems, blades, or roots. Chlorantraniliprole may negatively impact beneficial insects and other arthropods and is a potential water contaminant.

Nematodes. Entomopathogenic 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, when grubs or caterpillars are most active (Figure 7). A second application, about 2 weeks after the first, increases the likelihood that nematodes will reproduce and provide long-term pest management. 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 ordered and then received by mail. 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, and check to make sure they are moving and alive before applying them.

Neonicotinoids. Imidacloprid and clothianidin are two broad-spectrum insecticides in the neonicotinoid group that affect the central nervous system of insects, resulting in paralysis and death. They are often used to manage lawn grubs, including white grubs, black turfgrass ataenius, and billbugs. To be most effective, neonicotinoids must be taken up by the plants and then consumed by target insects along with the plant tissue. Therefore, they must be applied when turf is growing and when (or immediately before) insects are actively feeding on turf. These products will not be effective against white grubs if applied in the spring before grubs hatch out; and they are less effective when applied too late in the season, when grass is not growing rapidly and grubs are not eating as much. Because initial effectiveness can be delayed for days after application, it may be best to apply during the early summer, when the grubs are in their earliest stages (Figure 7). In lawns that had damaging infestations the previous year, monitor for adults in May and June and make treatments when adults are found. If lawns are heavily infested with damaging levels of grubs later in the season, entomopathogenic nematodes and carbaryl will be the only pesticidal materials likely to kill these late stage grubs. Timing of treatments for billbugs, which may occur earlier in the season (Figure 7), will be different and more difficult. Neonicotinoids have negative impacts on earthworms, beneficial insects, and surface water quality. They are toxic to bees and other pollinators when applied to flowering plants (such as clovers) that may be in the lawn.

Pyrethrins. Pyrethrum, a botanically-derived contact insecticide made from flowers of certain chrysanthemums, contains pyrethrins, natural chemicals which alter nerve function in insects and other arthropods, resulting in paralysis and death. 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. Pyrethrins may persist in the application area for several days or more. Take care to keep pyrethrum applications away from streams and other surface water habitats since they are highly toxic to aquatic invertebrates.

Pyrethroids. These very common broad-spectrum insecticides are synthetic chemicals modeled after pyrethrins. Specific active ingredients used for lawn pest management

include bifenthrin, gamma-cyhalothrin, lambda-cyhalothrin, permethrin, and zeta-cypermethrin. They kill insects and arthropods through the same mode of action as pyrethrum but have been designed to persist much longer in the environment, meaning that spray residues remain active for several weeks or more. Pyrethroids are not effective against soil-dwelling pests, such as white grubs, since they bind tightly to soil particles and do not move easily from the surface into the root zone. Take care to keep applications away from streams and other surface water habitats and prevent runoff from treated surfaces since pyrethroids are highly toxic to aquatic invertebrates.

Spinosad. Spinosad is a naturally-based insecticide derived from soil microorganisms. It is effective against lawn caterpillar pests but does not control grubs or other beetles. Although considered organic in most cases, it is broad-spectrum in activity and can have negative impacts on bees and some beneficial insects for several days after application.

Table 2. Lawn Pest Detection Methods, Treatment Targets, Thresholds, Registered Insecticides, and IPM-compatibility.

Insect	Detection Method	Treatment Target	Suggested Treatment Threshold	Available Control 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 1/4 inch brownish to gray moths	crowns, leaves, thatch	5/yd^2	A, Bt, C, Ch, Cl, P, Py, S, Sc
billbugs	dig around roots for whitish, C-shaped, legless grubs up to 3/8 inch long with reddish heads; inspect outdoor lights around dawn for 1/3 inch brownish to gray snout beetles	crown, roots	1/ft^2	C, Ch, Cl, I, Sc
black turfgrass ataenius (see also white grubs)	dig around roots for whitish, C-shaped grubs up to 1/3 inch long with 6 legs and reddish heads; inspect outdoor lights around dawn for shiny black adults 1/5 inch long	roots, thatch, soil interface	40/ft^2	C, Ch, Cl, Hb, I, Sc
chinch bug, southern	drench test or inspect around grass bases for reddish, purple, black, or gray bugs up to 1/2 inch long	crowns, stems	135/yd^2 or 15 nymphs & adults/ft^2	C, Ch, Cl, P, Py
lawn moths (sod webworms)	drench test for slender, grayish larvae up to 3/4 inch long; whitish or brownish moths up to 3/4 inch long fly when grass is disturbed	crowns, leaves, thatch	15/yd^2	A, Bt, C, Ch, Cl, P, Py, S, 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^2	A, Bt, C, Ch, Cl, Hb, P, Py, S, Sc
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 1/2 inches long with 6 legs and a reddish head; look for yellowish brown adults 1/2 inch long.	roots	6/ft^2	C, Ch, Cl, Hb, I

Check current labels for permitted uses and proper application methods.

IPM-compatible insecticides
A = azadirachtin (Biosafe Insect Control, Safer BioNeem)
Bt = *Bacillus thuringiensis* (Javelin (professional use only))
P = pyrethrin/potash soap (Safer Brand Bug Patrol Lawn and Landscape Insecticide)
S= spinosad (Green Light Lawn and Garden Spray with Spinosad 2)

Non IPM-compatible insecticides (may pose risks to pollinators and other beneficial arthropods, may contribute to contamination of urban surface waters)
C = carbaryl (Sevin)
Ch = chlorantraniliprole (GrubEx1)
Cl = clothianidin (Green Light Grub Control with Arena)
I = imidacloprid (many Bayer Advanced products, Spectracide Grub Killer Conc.)
Py = pyrethroids (Amdro Quick Kill, Spectracide Triazicide)

Parasitic nematodes
Hb = *Heterorhabditis bacteriophora*
Sc = *Steinernema carpocapsae*

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AUTHORS: A. M. Sutherland, UC Statewide IPM Program, SF Bay Area**; M. A. Harivandi,** Emeritus**,** UC Cooperative Extension, Alameda Co.; **S. H. Dreistadt,** UC Statewide IPM Program, UC Davis.

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Illustrations: **Figs. 1-4, 8-9**: J. K. Clark**; Fig. 5**: Ken Gray, Image Courtesy of Oregon State University ; **Fig. 6**: Adult chafer from A. S. Packard. 1876. *Guide to the Study of Insects*. New York: Henry Holt; Sod webworm: 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. 7**: Adapted from Ali, A. D., and C.L. Elmore, eds. 1989. *Turfgrass Pests*. Oakland: UC ANR Publ. 4053.

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University of California
2801 Second St.
Davis, CA 95618-7774

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