Information for pest management professionals and pesticide applicators

UC IPM University of California Agriculture and Natural Resources

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The Three-Lined Cockroach:
An Introduced Nuisance Pest in California

The three-lined cockroach, *Luridiblatta trivittata*, (Figure 1) is the smallest cockroach species in California, with adults averaging only 5–7 mm in length. This newly introduced cockroach is native to North Africa and the Eastern Mediterranean. It was first detected in California around 2004 in Marin County, but it was not positively identified until 2009. Since then, the three-lined cockroach has slowly expanded its range to include the entire San Francisco Bay Area, south to San Luis Obispo, east to the foothills of El Dorado County, and north to Mendocino County.

Life cycle and biology

The three-lined cockroach lives in some of the most densely populated parts of northern California, but it's not a domestic pest species since it is rarely found indoors. Instead, these cockroaches prefer to live outdoors in natural or ornamental landscapes and can be found in matted thatch, compost bins, and leaf litter. Occasionally in late summer and early fall, adults will wander indoors through poorly sealed exterior doors and windows.

C HUBBLE, UCCE

Figure 1. Adult three-lined cockroaches, *Luridiblatta trivittata*.

When inside, they are often misidentified as German cockroach nymphs (*Blattella germanica*), sometimes leading to unnecessary indoor insecticide applications. However, the number of stripes on the cockroach's body can help distinguish the species. The three-lined cockroach has three distinct stripes that run down the length of the adult's body, while German cockroach adults and nymphs have only two stripes (Figure 2).

It is unclear what the three-lined cockroach likes to eat in the landscape. Within the San Francisco Bay Area, this species has been observed feeding on the juices from overripe fruit in trees, and various food scraps from compost bins. Though these food items may

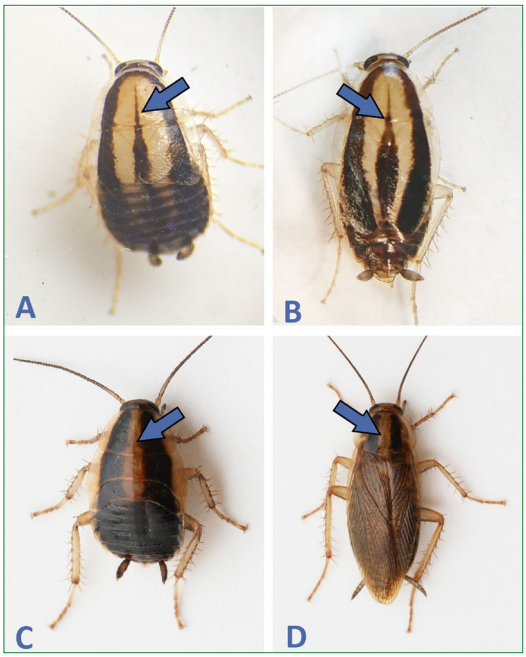

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Figure 2. Identifying characteristics separating three-lined cockroaches (*Luridiblatta trivittata*) from German cockroaches (*Blattella germanica*). A: *L. trivittata* female; B: *L. trivittata* male; C: *B. germanica* nymph; D: *B. germanica* adult with two dark stripes.

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be delicious treats for the cockroaches, they would appear to be atypical meals, since large populations of this insect have been found far from fruit or human food resources. Though scant, existing scientific literature classifies them as detritivores (organisms that feed on decaying organic material, especially plant matter), but it is unclear exactly what kinds of detritus might be preferred. Unfortunately, this question remains a mystery, since insect field diets can be notoriously difficult to determine.

Virtually no research has been conducted on this species, even in its native range. To better understand the biology and ecology of *L. trivittata* in California, the SF Bay Area Urban IPM Team launched a field study and several lab studies in 2021 revealing some interesting observations:

- Three-lined cockroaches have only one generation per year (Figure 3).
- Juveniles hatch in mid-April and develop through spring and early summer, eventually maturing into adults during July and August.
- Once mature, females lay egg cases (called oothecae) that will overwinter until next spring. Oothecae start out mint green in color, and as they develop, turn from olive green to dark brown before they are deposited into the landscape (Figure 4).

Mediterranean climates with long dry summers and short wet winters, found in California as well as their native habitat, seem to be ideal for this species. Juveniles do not seem able to hatch from their oothecae without some spring precipitation. On the other hand, too much water throughout the overwintering cycle may cause the eggs to mold, killing the nymphs before they can hatch. Females lay on average two or three oothecae per year. Each ootheca is very small (2 mm in length) and contains about 10 tiny cockroaches on average. This number is smaller than that observed

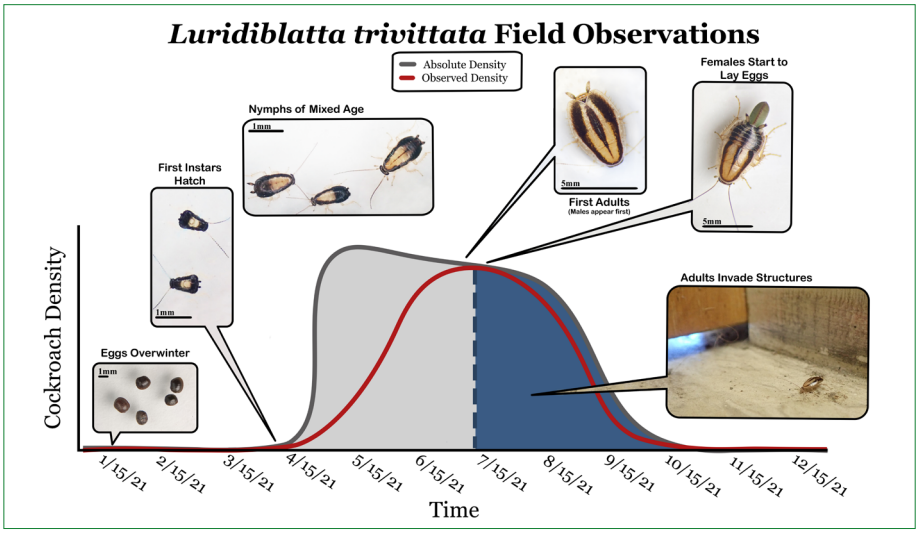

Figure 3. Life history of *Luridiblatta trivittata* in California.

C HUBBLE, UCCE

Figure 4. Female three-lined cockroaches with oothecae at different stages of development.

for other outdoor cockroach species in California, where most average between 11–21 nymphs per ootheca.

The common name "three-lined cockroach" was suggested by the SF Bay Area Urban IPM team and officially adopted by the Entomological Society of America. This name is not only an accurate description of the insect's appearance but is also reflected in the scientific name *Luridiblatta trivittata*.

What can you do?

Proper identification is crucial to providing effective pest control services. While the three-lined cockroach prefers to live outside (only occasionally wandering indoors), the German cockroach lives exclusively indoors and is considered a major public health pest. Signs of the three-lined cockroach indoors may signal the need for better structural exclusion while German cockroach infestations will need immediate remediation. If you are unsure of the pest species, contact your county's UC Cooperative Extension office, Department of Agriculture, or Vector Control District for confirmation.

Though the three-lined cockroach may be considered a nuisance pest when found in large numbers, it may not ever call for control measures. There are many unknowns remaining about this species, such as how far it may expand throughout California and neighboring states.

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To help us track the spread of the three-lined cockroach, you can submit photos and report sightings to iNaturalist www.inaturalist.org/ or BugGuide bugguide.net/node/view/15740; these civic science data can be pooled to create distribution maps (Figure 5).

This research was funded by the California Department of Pesticide Regulation.

—Casey Hubble,
Staff Research Associate,
San Francisco Bay Area Urban IPM
cwhubble@ucanr.edu

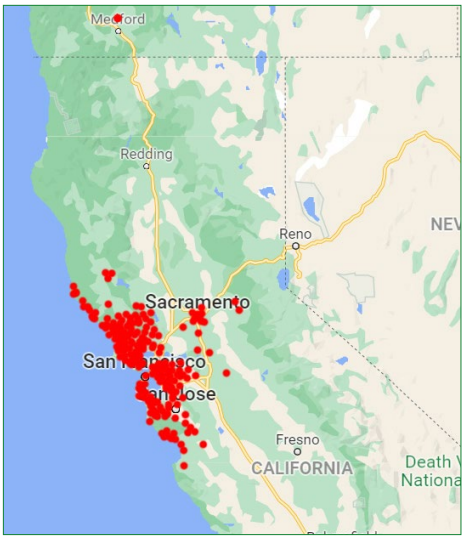

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Figure 5. Geographic records of Luridiblatta trivittata between 2004 and 2021. This map was created by using civic science data from GBIF, iNaturalist, BugGuide, and entomology museums throughout California.

References:

California Plant Pest & Disease Report Vol. 25. 2009. California Department of Food and Agriculture. Sacramento, CA.

Sutherland AM, Choe D-H, Rust MK. 2019. UC IPM *Pest Notes: Cockroaches*. UC ANR Publication 7467. Oakland, CA. ipm.ucanr.edu/PMG/PESTNOTES/pn7467.html

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Ask the Expert!

Q: How do you tell the difference between Turkestan and Oriental roaches?

A: While these two species occupy the same outdoor landscapes and can look very similar, there are some helpful traits to tell them apart.

Oriental cockroach (*Blatta orientalis*)

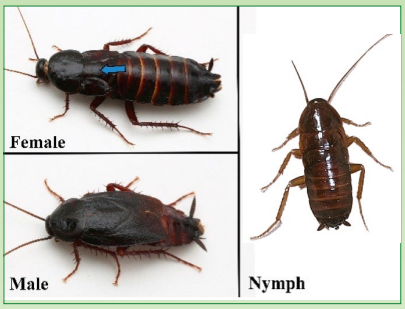
Adults are black to dark brown in color and are on average, 1.25 inches in length. The wings are shorter than body, and in females, the gap between the wings is as wide, or wider than the width of the wing.

Turkestan cockroach (*Shelfordella lateralis*)

Male and female adult Turkestan cockroaches look quite different. Females are black to dark brown in color and are on average, 1 inch in length. The gap between the wings is smaller than the width of the wing. Males have a uniform yellowish-tan coloration with wings that are as long, or longer than the body. Both males and females have cream-colored markings along the edges of the wing, but these traits can be unreliable depending on the health and age of the insect in question.

Nymphs of both species are the toughest to tell apart, especially early instars. Turkestan cockroach nymph upper body and legs are often bright red in color, while oriental nymphs are a uniform black to dark brown.

For more information about common cockroach species, see the *Pest Notes* at ipm.ucanr.edu/PMG/PESTNOTES/pn7467.html.



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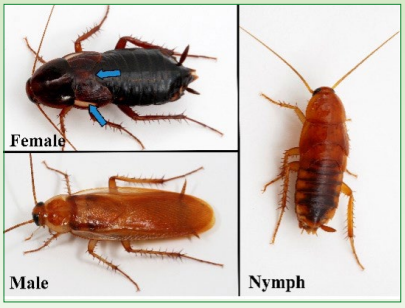
Oriental cockroach life stages.



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Turkestan cockroach life stages.

Rats, Rodenticides, and Research

Where is rodenticide exposure in wildlife coming from? Is it from use by residents or farmers? Applications by marijuana growers? Or from applications by qualified and trained structural pest control professionals? These questions are being asked by state legislators and regulators, special interest groups, and state pest associations across the country.

However, even though we don't fully know where all the exposure is coming from, action is already being taken to restrict the use of rodenticides in urban areas. In 2020, California legislators placed a moratorium on almost all uses of second-generation anticoagulant rodenticide. And local jurisdictions have also added restrictions to rodenticide use. For example, in southern California, the California Coastal Commission granted special approval to the city of Malibu to ban all uses of rodenticides.

What's being done?

Researchers at the University of California Division of Agriculture and Natural Resources (UC ANR) South Coast Research and Extension Center in Irvine have been examining some of these questions over the past seven years. UC ANR's Human-Wildlife Interactions Advisor Dr. Niamh Quinn and colleagues have looked at urban coyotes' exposure to anticoagulant rodenticides (ARs), which active ingredients they were exposed to, and the amounts of AR exposure.

Almost all coyotes examined had been exposed to at least one anticoagulant rodenticide and usually, multiple active ingredients (Table 1). Some were exposed to low amounts of ARs and some were exposed to very high levels. However, less than 1% of the coyotes examined had died from AR exposure. Recent studies on the sublethal effects of exposure have not shown any clear links between AR exposure and sublethal impacts (such as reduced body condition or parasite load). There is also no link between AR exposure and mange in coyotes in urban southern California.

PHOTO BY GAME CAMERA

Figure 1. A coyote scavenging a dead rat in a suburban backyard.

Do coyotes eat rats?

The diet of the urban coyote in southern California was questioned, specifically "Do they eat roof rats?" and "If they don't eat roof rats, how else could they be getting exposed to anticoagulant rodenticides?" It turns out that coyotes do eat rats (Figure 1). They eat a variety of other things too, but rats are among their preferred mammalian prey items, along with rabbits and domestic cats (Table 2).

In one of the first studies of its kind, we examined which animals were actually visiting rodenticide bait stations. We were surprised to find that in southern California, it is mostly roof rats, rather than nontarget animals. This was confirmed in another study sponsored by BASF. In southern California, less than 1% of mammals entering bait stations in urban area were nontarget wildlife. This is good news!

However, if pest management professionals are using anticoagulant rodenticide and are exposing just roof rats, and coyotes are eating said rats, does this mean that legal applications are responsible for the urban coyote AR exposure?

Another interesting finding from these studies concerned how rats use bait

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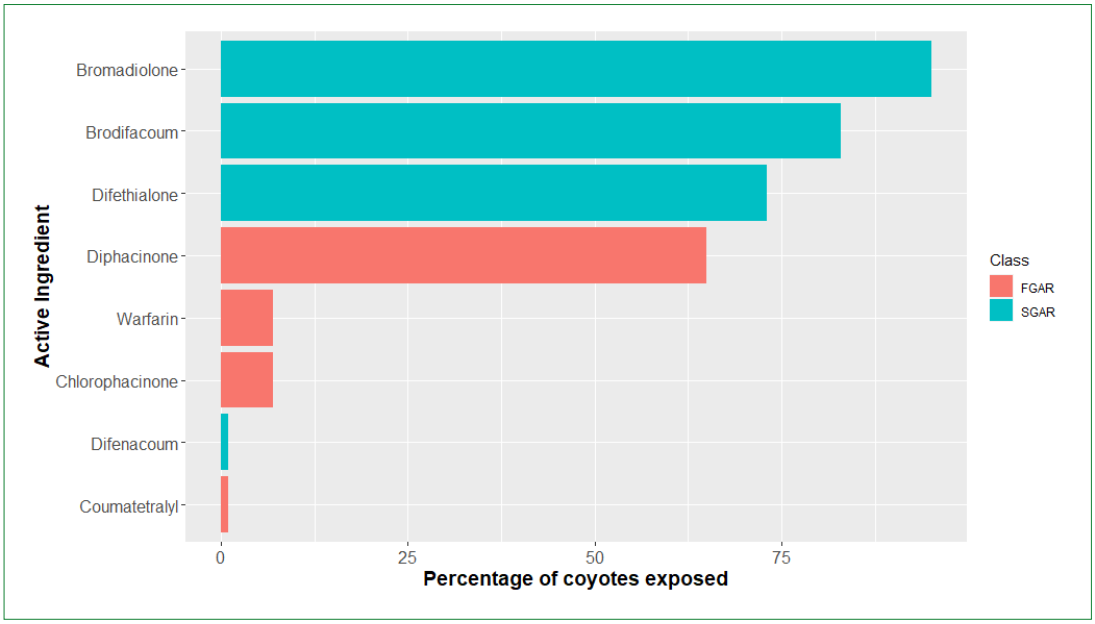
Table 1: Percentage of coyotes submitted to Quinn Lab that were exposed to specific anticoagulant rodenticides.



Rodenticide Research ...continued from page 4

stations. With non-toxic baits used during this study, we photographed rats entering only 59–70% of the bait stations, suggesting that roof rats may be reluctant to enter bait stations, even when no rodenticide was present. Even in yards where rats eventually entered stations, it took 7 to 8 days for them to first encounter the bait directly.

What does this mean?

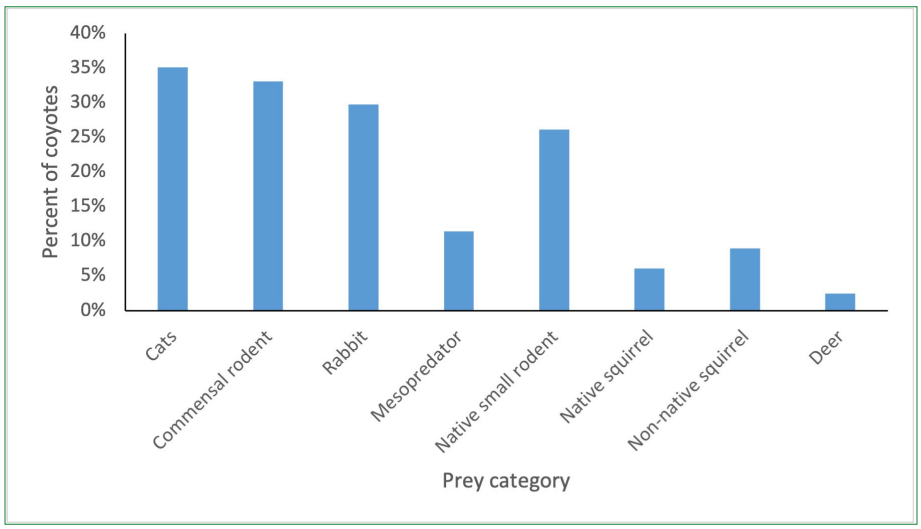
Because the first mortalities from anticoagulant rodenticide might not occur for several more days, pest management professionals should be prepared to communicate these possible delays to their customers. This will prevent customers from becoming impatient and taking more drastic (and potentially illegal) measures when results are not immediate.

Tracing applications of anticoagulant rodenticides

The ability to trace the applications of anticoagulant rodenticides has been lacking, but we may have developed a method to trace AR movement. We have created a bait that can be traced up multiple levels of the food chain. Therefore, we will be able to finally trace the rodenticide bait from its point of application to see if a legal application of anticoagulant rodenticide ends up in multiple levels of the urban and suburban food chain.

Two separate studies were conducted to see where animals exposed to anticoagulant rodenticides die and what scavenges them. One was conducted by Dr. Roger Baldwin in an agricultural setting and one by Dr. Paul Stapp from Cal State Fullerton in the suburban environment. Dr. Baldwin discovered that ground squirrels exposed to first generation anticoagulant rodenticides were mostly dying below ground (Figure 2). Dr. Stapp discovered that rats left in backyards are scavenged on by all sorts

Table 2. Percentage of mammalian prey consumed by coyotes in southern California.



of animals including crows, skunks, opossums, and domestic cats. After 7 days, almost all (65%) of the carcasses had been either partially removed or removed completely.

Do coyotes and other large predators also scavenge rats? In research conducted in Europe, 92% of dead rats were inaccessible to large predators and scavengers. It is thought that rats killed by brodifacoum in and around farm buildings don't seem to present a major secondary exposure risk to large vertebrates.

What is next for rodenticide research?

We are developing methods to monitor rodenticide exposure in wildlife in a more meaningful way. The Quinn Lab and other institutions are working on methods to sample for rodenticides in live mammals and birds of prey with the aim of being able to detect any population level impacts of rodenticide exposure. These methods will provide a mechanism by which rodenticide exposure can be monitored in live populations.

There is a huge need for data-driven mitigation measures for rodenticide

R BALDWIN, UCD

Figure 2. To recover dead collared ground squirrels, researchers need to dig into the ground squirrel burrow system.

exposure in California. We have been testing the efficacy of different management practices. We are testing trapping only, second-generation anticoagulant only, and a mix of both trapping and anticoagulant rodenticide. Using a combination of tracking rodents by collaring them and measuring how long it takes them to die, and by using tracking tunnels, we are measuring how quickly and how effectively these management options manage roof rat populations in southern California.

A mutation associated with second-generation anticoagulant rodenticide resistance, the Y25F mutation, has

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been found in roof rats in California. We don't know what this discovery means for rats in California. We need to explore more and find out to what extent they are resistant. Resistance management is essential for prolonging the life of all pesticide active ingredients.

Rodent management is complex, time consuming, and we are tackling the unknown. We know more about polar bears than we do about commensal rodents. We need to know more to address inadequacies in rodent management. To reduce the amount of secondary AR exposure in the environment, it is necessary to ensure that rodent populations do not rebound and that they are not continually being exposed to active ingredients that can bioaccumulate in the food chain. If predators continue to eat commensal rodents, it is important to figure out ways to reduce the number of them that are exposed to rodenticides.

What does the future of rodent management look like?

It is important to continue work with municipal managers, schools, and customers to ensure that they do their parts. Exclusion and sanitation must be important components of a rodent management plan, especially as there continue to be restrictions on rodent management tools. In some countries, the sale and use of glue boards to catch rodents are prohibited. Certain snap traps have failed rigorous testing in some countries and are considered to cause unacceptable pain and suffering so are prohibited for use. It is important that pest management professionals use tools according to labels and trapping specifications. PMPs must rely on safe and effective methods.

Managing rodent populations such as roof rats in increasingly difficult since there are expanding restrictions on management tools and a dearth of applied research on commensal rodents. To solve these issues, we must find more sustainable and effective management practices.

Our funders and collaborators for these research projects were Cal State Fullerton, the Pest Management Foundation, the California Structural Pest Control Board, the National Wildlife Research Center, and the Anticoagulant Taskforce.

—Niamh Quinn
Human-Wildlife Interactions Advisor, UCCE Orange, San Diego, and Los Angeles Counties,
nmquinn@ucanr.edu

Revised *Pest Notes*

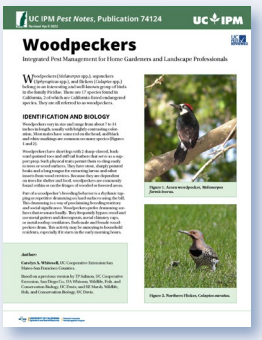
Mistletoes

Mistletoes are parasitic plants that grow on trees or large shrubs, where they can cause damage or simply look unsightly. The authors of the newly revised *Pest Notes: Mistletoes*, UC Cooperative Extension advisors Igor Lacan, Steven Swain, and Edward J. Perry (emeritus) have added new information on biology and management, as well as a section on community approaches to mistletoe management and the ecological benefits of some mistletoes.

Online at

ipm.ucanr.edu/PMG/PESTNOTES/pn7437.html

Woodpeckers



Woodpeckers are colorful, distinctive birds that can sometimes cause structural damage. *Pest Notes: Woodpeckers* has been newly revised by Carolyn A. Whitesell, a UC Cooperative Extension specialist in San Mateo-San Francisco Counties. It includes detailed management methods with discussions of the effectiveness of each as well as new photographs to aid in identification of the most common woodpeckers.

Online at

ipm.ucanr.edu/PMG/PESTNOTES/pn74124.html

Visit UC IPM's *Pest Notes* web page for these and many more titles
ipm.ucanr.edu/PMG/PESTNOTES

Upcoming Meetings and Workshops
(CEU opportunities)

UC Riverside Fumigation School

FUME SCHOOL

This class for licensed professionals is packed with technical information, as well as hands-on demonstrations. Presented by the UCR Urban Entomology Program and Agri-Turf Distribution.

September 14 & 15, 2022, Pomona, CA

ucanr.edu/sites/ucrurbanpest/UCR_Fumigation_School/UCR_Fume_School_2022/

West Coast Rodent Academy

WEST COAST RODENT ACADEMY

This in-person workshop is for pest management professionals who manage urban rodents. It covers rodent ecology and IPM. Hosted by UCCE and PCOC.

November 2-4, 2022, Irvine, CA

ucanr.edu/sites/WCRA/

WHAT IS IPM? Integrated Pest Management (IPM) programs focus on long-term prevention of pests or their damage through a combination of techniques including resistant plant varieties, biological control, physical or mechanical control, and modification of gardening and home maintenance practices to reduce conditions favorable for pests. Pesticides are part of IPM programs but are used only when needed. Products are selected and applied in a manner that minimizes risks to human health, beneficial and nontarget organisms, and the environment.

All pesticide products mentioned have been reviewed by the UC Office of Pesticide Information and Coordination and are current at the time of publication.
Always read and carefully follow all precautions and safety instructions provided on the pesticide container label, as well as any other regulations regarding the use of pesticides. Not following label directions, even if they conflict with information provided herein, is a violation of state and federal law. No endorsements of named products are intended, nor is criticism implied of products not mentioned.

University of California Statewide Integrated Pest Management Program

UC IPM

2801 Second Street
Davis, CA 95618-7774
E-mail: ucipm@ucanr.edu
Online: ipm.ucanr.edu/greenbulletin
Editors: K. Windbiel-Rojas, B. Messenger-Sikes

Connect with us!

@ucipmurban

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Contributors: Casey Hubble, Niamh Quinn, Andrew Sutherland, and Siavash Taravati.

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