Information for pest management professionals and pesticide applicators

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Reducing the Spread of Invasive Pests in Cut Wood

Best Management Practices for Arborists and Tree Care Workers

Invasive insects and diseases are threatening numerous tree species throughout the country. Impacts include tree mortality, destruction of forest and urban habitats, and other significant changes in forest ecosystems due to the decline or elimination of tree species. Many of these pests can be transported in inadequately-processed wood, including firewood and discarded wood debris left behind from tree care operations (Figure 1). Preventing the spread of these pests to new areas is critical for protecting valuable forest resources. Invasive forest pests of concern include those established in other parts of the country (e.g. emerald ash borer and Asian longhorned beetle), as well as those with limited distributions in California and other areas of the western U.S. (e.g. invasive shot hole borer, goldspotted oak borer, various bark beetle species, and the pathogens responsible for pitch canker and sudden oak death).

Properly managing cut wood can effectively reduce the risk of spreading these threats to new areas. Arborists and tree care workers can help by using best management practices (BMPs) for cut wood.

BMPs need to be broad for a number of reasons:

- Some species, such as shot hole borers (Figure 2), can infest over a hundred tree species.
- They are intended to prevent the spread of a number of invasive pests.
- These pests are located in many different areas and their distributions are not definitively known.
- Incipient or outlier infestations may not be reported, making it less certain which areas may be free of invasive pests.
- It can be difficult to determine if a particular tree or wood cut from it is infested (or contaminated) with an invasive pest, including trees that appear healthy.
- Wood can become infested after it is cut from a tree.
- Even insects and pathogens that are native to a particular region of the U.S. can become serious pests when moved to an area where they don't exist. Goldspotted oak borer and pitch canker are good examples.

K. WINDBIEL-ROJAS, UCIPM

Figure 1. Firewood left behind from tree care operations can harbor pests.

C. EWING, CALFIRE

Figure 2. Polyphagous shot hole borer. Actual size 1/10 inch.

Basic recommendation—avoid moving unprocessed wood

The safest approach is to assume that all untreated wood can harbor invasive pests and therefore should not

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be moved from the local area. Utilize or dispose of untreated wood near the site where it was cut. Firewood outreach campaigns like "Don't Move Firewood" and "Buy It Where You Burn It" encourage this approach.

Untreated cut wood should not be left on the curbside for free pick-up (Figure 3) as there is no way to control where the wood is moved to. If wood is to be left with the landowner, talk to them about the danger of spreading invasive pests in infested wood. Handouts explaining the risk can be found at the California Firewood Task Force's website firewood.ca.gov/outreach.html and includes a Firewood Question and Answer Factsheet and Firewood Postcard. These can be printed and distributed to landowners.

Treatments to discourage or destroy invasive pests in wood

- Grinding wood to a 1-inch minus chip size greatly reduces but does NOT eliminate all shot hole borers (SHB). Therefore, composting chips originating from near or within known SHB infestation areas is recommended. Wood should be chipped before being transported to a biomass or composting facility more than 50 miles away. If that is not possible, the receiving facility should promptly chip the material upon arrival.
- Heat treatment of infested firewood to a core temperature of 160° F for a minimum of 75 minutes has been shown to eliminate most insects and diseases. Complete removal of bark from branch and trunk rounds can eliminate certain insects that feed solely in or under the bark, such as bark beetles and some wood borers. Debarking does not eliminate insects that burrow in the wood or pathogens infecting the wood.

K. WINDBIEL-ROJAS, UCIPM

Figure 3. Untreated cut wood should not be left on the curbside for free pickup.

- Seasoning (drying) firewood on site for at least 2 years can reduce the risk of transporting most invasive insects. Similarly, wood that is cut from trees that have been dead for greater than 2 years is unlikely to contain living invasive insect pests, though invasive pathogens may still be present.
- Never treat firewood with an insecticide or pesticide. Doing so could result in exposure to toxic fumes when the wood is burned.

Invasive pests associated with firewood in the western U.S.

The following insects and tree diseases are found in limited areas of the western United States and represent forest health threats to hardwood and conifer species throughout the nation. Compliance with federal and state regulations is required to move wood from quarantine areas. Adhering to BMPs will limit the spread of all invasive pests and help protect our urban and native forests.

Federally quarantined species:

- Sudden oak death, *Phytophthora ramorum*

Non-quarantined invasive species:

- Invasive shot hole borers, *Euwallacea* spp.
- Goldspotted oak borer, *Agrilus auroguttatus*
- Redhaired pine bark beetle, *Hylurgus ligniperda*
- Mediterranean pine engraver, *Orthotomicus erosus*
- Balsam wooly adelgid, *Adelges piceae*
- Pitch canker disease, *Fusarium circinatum*
- Thousand cankers disease, *Geosmithia morbida*

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Online Resources

- Don't Move Firewood — dontmovefirewood.org/
- APHIS — aphis.usda.gov/newsroom/hot_issues/firewood/index.shtml
- USDA Forest Service — na.fs.fed.us/firewood/
- CA Firewood Task Force — firewood.ca.gov/
- Yosemite National Park — nps.gov/yose/naturescience/forest-pests.htm
- Buy It Where You Burn It — firewood.ca.gov/pressreleases.html

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General recommendations for handling and using firewood

- Don't move firewood long distances from where it was purchased. Use wood from local sources: "Buy it where you burn it."
- Ask about the firewood you are buying. Is it from a local source (less than 50 miles preferred) or has it been treated to eliminate or reduce pests (e.g. heat treated or seasoned for 2 or more years)?
- When purchasing firewood for camping, buy an amount that can be completely burned during your stay. If firewood is left over, leave it for the next camper; don't take if home with you.
- Plan on cutting firewood within 50 miles of where it will be used.
- Seasoning of green wood (letting it dry) for at least 2 years or using wood from trees that have been dead for at least 2 years can reduce the danger of transporting most invasive insects threatening trees.
- Note that cutting standing trees can be dangerous, especially dead trees which often are unstable. Only cut standing trees if you have the proper equipment and training to do it safely

—Reprinted with permission, courtesy of the California Firewood Task Force

Ask the Expert!

Q: What kind of firewood is safe to move?

A: Most packaged heat treated firewood with a USDA APHIS, or a state based (such as State Department of Agriculture) heat treatment seal is considered safe to move. Certified heat-treated firewood is heated to the approved heat treatment level for emerald ash borer so most insect pests and pathogens in the wood have been killed. Firewood labeled "kiln-dried" is not considered safe to move. Read more at dontmovefirewood.org/kiln-dried-vs-heat-treated-firewood-html/. Even with heat-treated firewood, it's best not to move it but instead Buy It Where You Burn It.

CA FIREWOOD TASK FORCE

Subscribe to the UC IPM urban pest management blog!

UC IPM's blog provides readers with timely information about pests in and around homes, gardens, landscapes, and structures in California. We post articles about common seasonal pests, invasive pests, beneficials, and new UC IPM resources, including new and revised Pest Notes, training events, and other educational materials for residential audiences and pest management professionals.

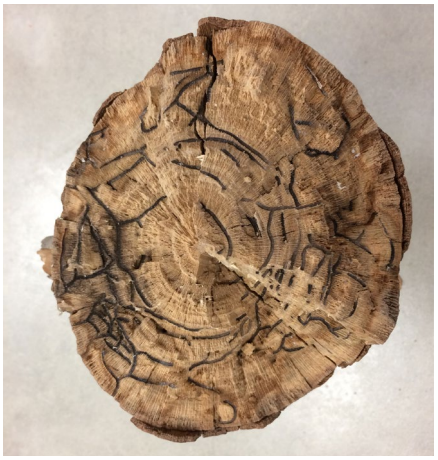
View or subscribe to the blog at ucanr.edu/blogs/ucipmurbanpests/.

Managing Invasive Shot Hole Borers in Southern California

Invasive wood-boring beetles are attacking hundreds of thousands of trees in southern California, including commercial avocados, and trees within urban landscapes and wildland environments.

The invasive shot hole borers (ISHBs) consist of two closely related and morphologically identical species of beetles in the genus *Euwallacea*: the polyphagous shot hole borer and the Kuroshio shot hole borer. Despite their small size (1.8–2.5 mm; see Figure 2 in the Arborist BMP article on page 1), these beetles are causing big problems in Southern California: they are responsible for the fast decline and death of thousands of urban trees, riparian natural forests, and avocado groves.

The beetles bore into trees, creating a series of small galleries (Figure 1). Inside these galleries, they lay eggs and "farm" a fungus (*Fusarium* spp.), which is their main food source. The fungus colonizes the trees' vascular systems, blocking transport of water and nutrients. This causes a disease called Fusarium dieback that manifests as branch dieback, general tree decline and, in many cases, tree death (Figure 2).



B.NOBUA-BEHRMANN, UCCE

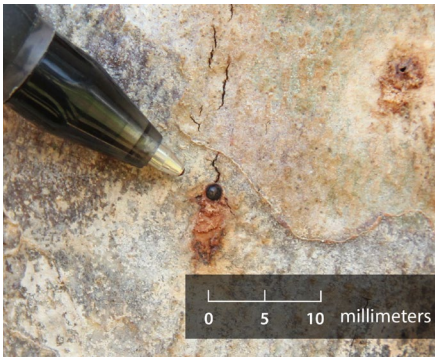
Figure 1. ISHB galleries in a California sycamore (*Platanus racemosa)* branch.

Both insect species are believed to have been accidentally introduced into California via wood products or shipping materials from southeast Asia. Since ISHBs were first identified in Los Angeles County in 2012, the infestation has spread to six other counties: Orange, San Diego, Ventura, Santa Barbara, San Bernardino, and Riverside. Once the beetles arrive at a new location, they colonize susceptible host trees and spread to neighboring areas, infesting more and more trees. Movement of infested firewood and green waste are additional ways the beetles may be transported, allowing them to colonize new areas.

Currently, there are 64 confirmed species of trees in which the beetles can successfully grow their fungus and complete their life cycle. Susceptible trees include many of the species commonly used for landscaping like sycamores, oaks, cottonwoods, and box elder, among many others. UC Riverside researchers found that ISHBs can successfully colonize trees that were previously considered non-suitable hosts by entering and reproducing in canker-infected branches. Canker is another tree disease caused by fungal or bacterial pathogens that enter the tree through open wounds; it typically causes localized dead areas on the trunks and branches, with sunken, discolored bark and, sometimes, dark lesions.The ISHB beetles can establish their galleries and grow their population in the weakened margin of the canker-infected tissue of some of their hosts. Regular monitoring and removal of canker-infected branches is recommended for these tree species. To find the full list of ISHB reproductive hosts (including the canker-associated hosts) please visit pshb.org.

M. DIMSON, UCCE

Figure 2. Branch dieback in a *Koelreuteria bipinnata* tree as a consequence of ISHB infestation.



M. DIMSON, UCCE

Figure 3. ISHB entry hole exposed after removing the first layer of bark. The dark tissue surrounding the hole is infested with the *Fusarium* fungus that the beetles grow inside their galleries.

How do you determine if a tree is infested with ISHB?

Correct identification of the pest is the first step for a successful IPM program. The following are typical symptoms of an ISHB infestation:

- Beetle entry holes: When the beetles excavate their galleries in the trees they make perfectly round small holes, 0.8 mm wide, each roughly the size of the tip of a medium ballpoint pen (Figure 3).
- Symptoms associated with holes: Entry holes are usually accompanied by one of these

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Figure 4. Some trees react to ISHB infestation by gumming.

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Figure 5. White powdery exudate (sugar volcanoes) are a common symptom of ISHB infestation in avocado trees.

symptoms: wet staining, gumming (Figure 4), white powdery exudate (Figure 5), or frass (boring dust). Each species of tree exhibits different symptoms.

- Dieback: Dead or wilting branches can be signs of a severe infestation. If you see dieback on your trees, check for entry holes on the branches or the branch collar.

Best management practices

ISHB-infested trees can quickly become a public safety hazard. Trees with heavily infested branches are especially hazardous, since the combination of tissue decline caused by the fungal pathogen and the mechanical damage from the beetle's galleries weakens the wood, causing limbs to break and fall.

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Figure 6. Trunk of a heavily infested California sycamore. Note the staining around each ISHB entry hole.

Early detection is the key to controlling this pest. So far, no effective preventative treatments have been reported, so regular monitoring is recommended to ensure infestations are managed early, before they cause dieback or death. Regular monitoring also ensures that trees get treated when they are lightly infested and have the most chances of overcoming the infestation. Researchers continue to study different methods for chemical and biological control of this pest. If you suspect you are dealing with an ISHB infestation, contact your local Agricultural Commissioner's office or IPM Advisor for treatment advice.

Trees that are severely infested (with more than 150 beetle attacks and ISHB-related branch dieback; Figure 6) are not likely to recover from the infestation and will become a constant source of beetles that can disperse and infest neighboring trees. Furthermore, weakened branches on such trees pose hazards to people and property. Therefore, severely infested trees should be removed as soon as possible and their wood properly disposed of. Even after an infested tree is removed, ISHBs can continue to live and reproduce in the stump, so following tree removal with stump grinding is always recommended.

Disposing of infested wood

Borers can survive in cut wood for weeks or even months. It is vital to take care of green waste appropriately in order to avoid spreading this pest to new areas. The most recommended practice is to chip infested wood to a size of 1 inch or smaller; this will kill 95% of the beetles. To ensure the elimination of all beetles and fungal spores within wood, you must solarize infested wood chips with a clear tarp. Other effective disposal methods for infested materials include composting, burning at a biogeneration facility, and use as alternative daily cover within landfills. Untreated chips can be used as mulch, but only in areas that are already heavily infested with ISHB. If chipping is not possible, logs should be kiln dried or solarized under a clear tarp to ensure total beetle elimination. Visit pshb.org for more information on solarization and composting guidelines.

ISHB and its associated fungal diseases can be accidentally spread into new areas by the same people who are trying to manage the problem. Make sure you disinfect your tools after pruning (spraying them with 70% ethanol solution works well), and always cover infested material when moving it to a different location (for instance, for treatment) to avoid spreading the pest. Please see the *Best Practices for Arborists* article on page 1 for more information about reducing the spread of ISHBs and other pests through cut wood.

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Current Status of the Dark Rover Ant

The dark rover ant (*Brachymyrmex patagonicus*) is an invasive species which is increasingly being noticed in Southern California. It is a nuisance species that invades structures as both workers and winged (alate) individuals.

This article aims to introduce structural and landscape pest management professionals (PMPs) to the dark rover ant and includes several important references for readers to learn what is currently known about its biology, behavior, and control.

Identification

Dark rover ant (DRA) workers are usually 1-2 mm long and are typically reddish-brown to blackish-brown (Figure 1). They have one node on the waist hidden under the gaster (abdomen), with long erect hairs mixed with sparse fine pubescence on the gaster (Figure 2), and nine-segmented antennae (Figure 3). The only other rover ant species reported from California is *B. depilis* which is rarely seen in the field [1] and can be distinguished from DRA by their yellow to yellowish-brown color [2].

Where are dark rover ants found?

The dark rover ant is native to South America and is found in several countries including Argentina, Paraguay, Brazil, and Venezuela [3]. It was first discovered in the United States in 1978 in Louisiana [4].

This ant was found in California for the first time in 2010 in Orange and Riverside Counties [5]. The author found this species in Los Angeles County in Pacoima and Sylmar as well as Citrus Community Park (Riverside, CA) and Andulka Park (Corona, CA).

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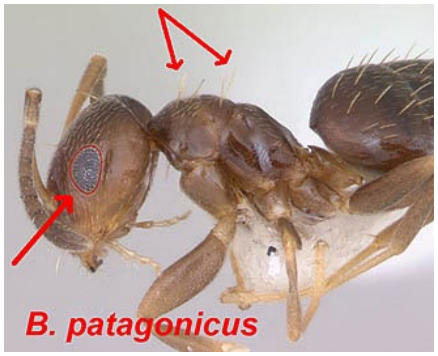
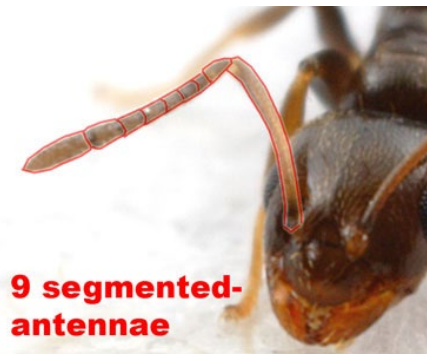
Figure 1. A dark rover ant worker.



A. WILD, U. TX

Figure 2. A dark rover ant showing the hidden node on waist, and erect hairs on body. Eyes are relatively large compared to similar species.



A. WILD, U. TX.

Figure 3. Nine-segmented antenna of dark rover ant.

Pat Copps of Rollins Inc., reported DRA presence in Bakersfield. This species may already be widely distributed in Southern California and could be dispersing to newer areas.

Biology

DRA nests both indoors and outdoors [6]. They forage without making trails but trailing has been observed in the laboratory between the sub-units of a colony [7]. High levels of aggression toward individuals of other colonies has been observed, which may prevent the establishment of multiple colonies in a small area [8].

Different authors have reported that this species can coexist with other ant species, most notably Argentine ant (*Linepithema humile*) and red imported fire ant (*Solenopsis invicta*), and has even nested alongside the latter[4, 5]. In Los Angeles and Riverside counties, the author has seen DRA workers walking near trails of red imported fire ants and Argentine ants without alarming the workers of these other two species.

DRA have been observed feeding on plant nectar in the field. In the lab, a 30% honey solution along with a

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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.

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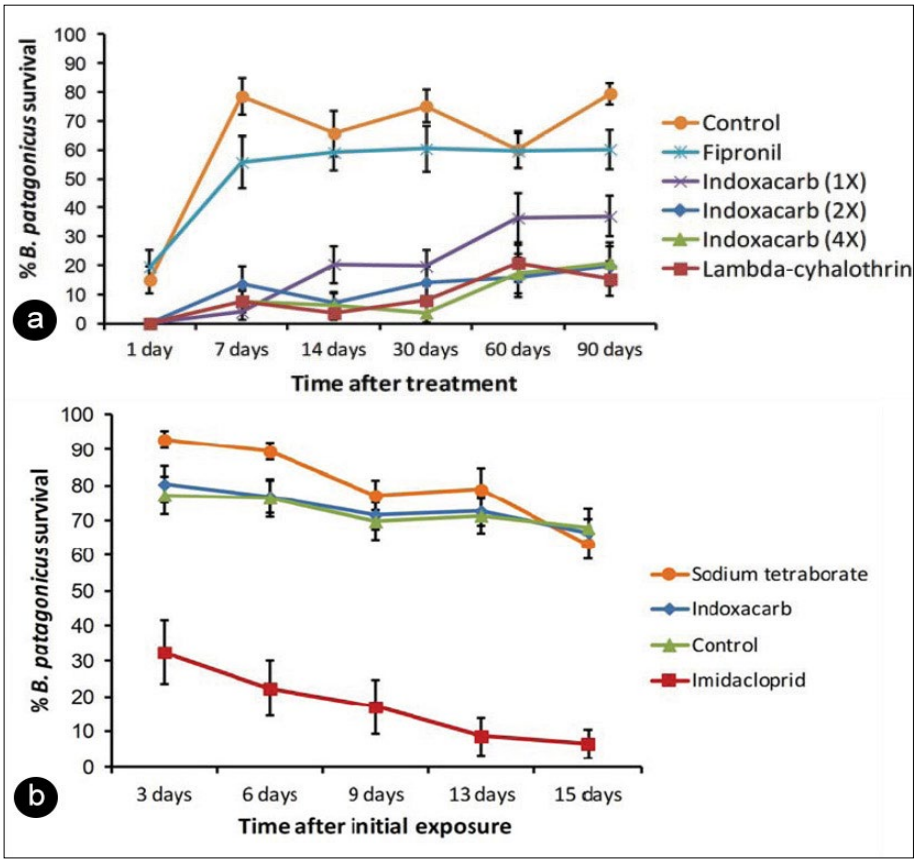

Figure 4. Survival (%) of dark rover ants after exposure to several liquid insecticides (a) and bait (b) applications in a laboratory study. Products used in this study: a) Termidor SC (fipronil, BASF), Demand CS (lambda-cyhalothrin, Syngenta), Arilon (indoxacarb, Syngenta) b) Maxforce Quantum ant bait (imidacloprid), Intice rover ant bait (sodium tetraborate, Rockwell labs Ltd.), Advion ant gel (indoxacarb, Syngenta) (From Miguelena and Baker, 2014 [6]).

liquid tuna mixture and caterpillars has been observed to support reproducing colonies [7].

DRA as a nuisance pest

Foragers and alates of DRA invade structures and can become nuisances. In Orange County, there were more incidences of DRA infestations in 2018 as compared to 2017. In June and July of 2018, customer calls were made regarding reproductives when clients saw them at bright lights inside. David Taylor from The Bugman Pest and Termite Control reported that clients were often unaware that workers were also present.

According to Pat Copps, in southern California, DRA infestations have been more common in Orange County but are still relatively rare as compared to the pervasive Argentine ant, which accounts for about 90% of customer calls for ant infestations. He also says DRA foragers are usually seen in kitchens, bathrooms, and laundry rooms inside and around grade/wall junctures, stone borders, patios, and tree roots.

How to manage DRA

Pest management professionals have reported difficulty in managing dark rover ants in other parts of the United States [4]. This is believed to be due to the existence of long-lived satellite colonies, which can survive for around three months when separated from the main colony [8]. Consequently, a structure treated for DRA may soon be re-invaded by ant individuals from adjacent satellite colonies.

In California, similar difficulties have been reported in controlling this pest. These difficulties have been overcome by some PMPs by using combinations of baits, dusts, and liquid sprays as interior and exterior treatments. Copps reported that very limited success has been achieved when attempting to control this pest outdoors.

Research by Miguelena and Baker [6] on the efficacy of selected pesticides against DRA showed higher ant mortality when using Arilon (indoxacarb, Syngenta) and Demand CS (lambda-cyhalothrin, Syngenta) liquids as well as Maxforce Quantum ant bait (imidacloprid, Bayer CropScience) when compared to other insecticides used in the study (Figure 4).

Since DRA control failure is very common, it is important for PMPs to consider using products which have been scientifically proven to be effective in controlling DRA. Other products may eventually prove to be effective against DRA, but at this time there has been limited published research on the management of this pest.

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Revised *Pest Notes: Weed Management in Landscapes*

Controlling weeds can be challenging to landscape professionals or home gardeners since landscapes often include a mix of turfgrass, annual plants, herbaceous perennials, shrubs, and trees.

The newly revised publication *Pest Notes: Weed Management in Landscapes* by UC IPM advisor Cheryl Wilen, presents an integrated approach to weed management to help ensure weed control efforts are effective, environmentally-sound, and economical. This science-based publication includes information on methods such as pre-planting considerations, the importance of weed identification, nonchemical practices such as using mulches and barriers, weed management recommendations in different types of landscape plantings, and updated herbicide options.

Read the Pest Notes at ipm.ucanr.edu/PMG/PESTNOTES/pn7441.html. Also see UC IPM's Weed Photo Gallery for help with identifying weeds in various growth stages ipm.ucanr.edu/PMG/weeds_intro.html.

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

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.

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For more information about managing pests, contact your University of California Cooperative Extension office, or visit the UC IPM website at ipm.ucanr.edu.