



Green Bulletin

A newsletter for landscape and structural pest management professionals

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Managing *Aedes* Mosquitoes: Target Adults or Larvae?

Historically, Californians didn't have to worry much about mosquito bites during the day. Now, everyone needs to be prepared for mosquito bites at any time of day. Why? About a decade ago, invasive mosquitoes belonging to the genus *Aedes* arrived in the state and have since become well-established in many parts of Southern and Central California.

What are these invasive mosquitoes?

The yellow fever mosquito, *Aedes aegypti*, and the Asian tiger mosquito, *Aedes albopictus*, are day-biting pests that can transmit various viral diseases to humans and animals, including dengue fever, yellow fever, Chikungunya, and Zika.

The first breeding populations of the yellow fever mosquito were found in California in 2013 and the Asian tiger mosquito is believed to have been established in California in 2011 in Los Angeles County. A third species, *Aedes notoscriptus*, has also been detected in Los Angeles County since 2014. These invasive mosquitoes have made outdoor activity unpleasant and difficult wherever they are found.

How are these mosquitoes being controlled?

One of the main questions when managing mosquitoes is whether to control the immatures (larvae) or the adults. Managing adult mosquitoes is the preferred choice for quickly reducing mosquito bites. However, this approach will require broadcast or fog applications of liquid insecticides, increasing the risks of pesticide exposure to people and nontarget



Aedes mosquito eggs laid on a paper cup.

L Cohnstaedt, USDA



Cluttered backyard with multiple potential *Aedes* mosquito breeding sites.

District Staff, LAVCD

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Managing *Aedes* Mosquitoes

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organisms, contamination of the environment, and insecticide resistance. In addition, some adulticides are only registered for use by employees of public health agencies and cannot be applied by pest management professionals.

Managing immature mosquitoes can decrease the number of next-generation adult mosquitoes, leading to fewer mosquito bites over time. Unlike native species such as *Culex* “house mosquitoes” commonly found breeding in marshes, wetlands, rice fields, and abandoned swimming pools, invasive *Aedes* mosquitoes are container breeders. Container breeding mosquito larvae can survive in small containers, tree holes, roof gutters, and any other voids in the landscape that become filled with water. Finding and treating all those potential breeding sites is extremely difficult. These hard-to-find breeding sites will keep producing adult mosquitoes, making larval control efforts challenging.

Products targeting adult mosquitoes

Adult female mosquitoes can be divided into those that are host-seeking and those that are gravid. A host-seeking mosquito is a female mosquito that is actively searching for a human or animal host for feeding. A gravid mosquito is a female mosquito that has recently fed and is now ready to lay eggs.

Host-seeking mosquitoes can be killed or repelled with adulticide products. When treating landscapes with adulticide and repellent products, these products can be applied around buildings and landscapes, targeting mosquito resting sites on the undersides of leaves, inside shrub canopies, under eaves, and under outdoor furniture.

Liquid insecticides that target adult mosquitoes are available as both ready-to-use and concentrated products. Ready-to-use products are designed for small-scale applications, while concentrated insecticides are more suitable for large-scale applications, especially as a part of professional pest control services.

Products targeting adult mosquitoes can repel, kill, or do both. Adulticide products that target host-seeking mosquitoes include natural insecticides like pyrethrin, garlic oil, citronella, and geraniol oil as well as synthetic pyrethroid insecticides. When applying



S. Taravati, UC IPM

An In2Care mosquito trap.

insecticides for mosquitoes, it's vital to read the label thoroughly to understand mode of action, residual activity, and allowed application sites.

Other mosquito management tools include lure-and-kill devices that attract host-seeking mosquitoes using carbon dioxide, octanol, synthetic host odors, or other attractants and then trap them by drawing them into an inescapable chamber using a suction fan. Such devices may be powered by batteries or gasoline.

Bug zappers and similar products that attract insects using blacklight or UV lights are not known to be effective against *Aedes* mosquitoes.

A gravid trap uses a female mosquito's sensory abilities to find suitable water sources for deposition and development of her eggs. These “ovitrap” usually contain screens that are large enough to allow eggs to be laid or dropped into the container, but small enough to prevent adult mosquitoes that develop from these eggs from escaping.

Gravid mosquito trap types:

- Adult mosquitoes killed inside trap
 - ◇ Sticky traps
 - Catchmaster Ovi-Catch AGO Mosquito Trap
 - Biogents Gravid *Aedes* Trap
- Insecticide-containing trap
 - ◇ Inzecto Mosquito Trap
- Delayed killing of adult mosquitoes
 - ◇ In2Care: this device doesn't have a screen but prevents larvae from becoming adults using an insect growth regulator. It also exposes adults to a fungus that will slowly kill them.

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- Adult mosquitoes left intact
 - ◇ Simple ovitraps that allow female mosquitoes to lay eggs but prevents adult mosquitoes developed from larvae from escaping.

Products targeting mosquito larvae

Mosquito larvae are aquatic and need water to survive and develop into adults. They can be managed by dumping out or draining their habitat or by using insecticides to treat water bodies.

Larvicides

- *Bacillus thuringiensis (israelensis or sphaericus)* (Bti or Bts): a bacterium and its toxins that kill actively feeding mosquito larvae and some related fly species.
- Insect growth regulators: insecticides that kill developing mosquito larvae by disrupting their molting process, preventing them from becoming adults
- Oils: materials that suffocate larvae by preventing access to surface air

Traps: an ovitrap with a screen to prevent emerging mosquitoes from flying out but don't kill larvae.

Summary

While numerous mosquito control tools are available, not all are equally effective against *Aedes* mosquitoes. Killing and repelling adult mosquitoes is the fastest way of reducing bites in an area. However, this approach requires regular spraying of large areas which increases the chance of non-target organism exposure, pesticide drift, and pesticide run-off. Additionally, there are often restrictions on the use of adulticides in certain locations, such as hospitals, on fruit trees, and in areas where children and pets frequently spend time. Effective mosquito control using adulticides requires thorough coverage of sites listed on the label as detailed earlier.

Managing *Aedes* mosquitoes using larvicides and ovitraps is an environmentally safer option when compared to using adulticides. However, the long-term efficacy of these traps in reducing bites is questionable in some cases. As mentioned before, the container-breeding behavior of *Aedes* species makes it difficult to find and treat all their breeding sites with

larvicides. Furthermore, seeing mosquito larvae in ovitraps may imply that the product is working while there is limited proof indicating any significant reduction in the number of biting mosquitoes in the area. If done right, targeting mosquito larvae alone may provide adequate control during some non-emergency situations. However, targeting adult mosquitoes is necessary during disease outbreaks.

On average, *Aedes* mosquitoes can easily fly up to 344 feet from one property to another in search of a host. Therefore, managing mosquito larvae in urban areas may require a neighborhood-wide effort or at the very least, two or more neighbors adopting the same mosquito control method.

Acknowledgements

I would like to thank Laura Krueger for her invaluable contribution in reviewing and improving this article.

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What is the Rodenticide PID?

Have you heard the term PID? You might be wondering what it means, or even how it might affect you.

The United States Environmental Protection Agency (EPA) reviews each registered pesticide at least every 15 years to ensure the pesticide is not causing any unreasonable adverse effects to humans or the environment. As part of the EPA's registration review process, they published a Federal Register notice for the proposed registration decision, formally known as the PID (Proposed Interim Decision).

A recent example of a PID is due to growing concerns about the impacts of rodenticide products caused by either primary or secondary exposure of wildlife to applications. This PID had a public comment period of 60 days which ended on February 13, 2023. Another window for comment will be opening again in late 2024 or early 2025.

Many changes to rodenticides are being proposed under the PID. Below we will discuss some of the changes that may impact applications of rodenticides in urban areas. California already has some of the most stringent pesticide regulations in the country, so some of the changes proposed by EPA will already have been in effect at the state level for California. Significant changes have also been proposed for production agriculture, but these will not be covered here. Read more at www.epa.gov/pesticides/epa-proposes-new-mitigation-measures-rodenticides-including-pilot-protecting-endangered.

Proposed Changes to Rodenticide Use

All professional-use rodenticides are proposed to be classified as federal Restricted Use Pesticides. This means all applicators of rodenticides at non-structural sites, such as landscaping, golf courses, recreation areas, and other non-production agriculture sites, will be required to have a license issued by the California Department of Pesticide Regulation (CDPR).

Applicators of rodenticide products in and around structures must have a licence issued from the Structural Pest Control Board (SPCB) of California.

All applicators will be required to wear respirators when applying loose bait formulations, including



N Quinn, UCCE

A heavy infestation of ground squirrels in a regional park.

pellets or grain baits. An example of this would be using a rodenticide grain or pelletized bait for the control of ground squirrels in bait stations.

The PID is also proposing the cancellation of spot and broadcast applications of the first-generation anticoagulant rodenticides (FGARs) and zinc phosphide in turf, lawns, parks, golf courses, campsites, and other recreation areas.

While many labels already have language to “collect and dispose of all dead animals”, the PID is also proposing that applicators search for carcasses every other day for 2 weeks after an application. These will be mandatory for field and other non-structural use sites, and for all zinc phosphide applications.

As part of the registration review process, EPA is preparing to request an endangered species consultation with the US Fish and Wildlife Service. In its draft Biological Evaluation and Rodenticide Strategy, which closed for public comment in early 2024, EPA proposed measures that mitigate potential adverse effects identified on endangered or threatened species and their critical habitats under the Endangered Species Act. Some proposed mitigation measures are general label statements while others pertain to individual species.

These species-specific proposed mitigation measures would be implemented within a geographically specific area and may include, but are not limited to:

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Rodenticide PID

- Prohibition of broadcast and in-burrow treatment within the endangered or threatened species' range and/or designated critical habitat or at times of the year when they have access to the area
- Prohibition of any use during certain times of the year
- The use of exclusionary bait stations
- Structural applications limited to bait stations within 5 feet of structures
- Mandatory carcass searches for structural applications

Language on all professional-use rodenticide product labels will require applicators to check EPA's

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“Bulletins Live! Two” website 6 months prior to any application of that product to determine whether any of the above restrictions will apply for the planned treatment site on the date of application and to maintain those records for possible inspection. See the Bulletins Live! Two website at www.epa.gov/endangered-species/bulletins-live-two-view-bulletins for details.

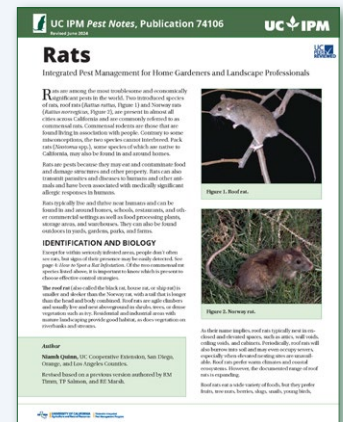
—Niamh Quinn,
Human-Wildlife Interactions Advisor,
UCCE Orange, San Diego, and Los Angeles
Counties,
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Revised Pest Notes

Rats

To help residents and urban pest professionals effectively manage rats, UC Cooperative Extension Human-Wildlife Conflicts advisor Dr. Niamh Quinn, a recognized expert in urban rat management, has updated and revised *Pest Notes: Rats*. This publication includes additional material on rat damage, specific sanitation tactics for both Norway and roof rats, additional tips for rodent-proofing your home and successful trapping. New illustrations are included to clearly show correct placement of traps. Currently available rodenticides are summarized in tables.

Online at <https://ipm.ucanr.edu/home-and-landscape/rats/pest-notes/>



Nutsedge

Pest Notes: Nutsedge was newly revised by UCCE San Diego Area Integrated Pest Management Advisor Emeritus Cheryl Wilen. Details on identification and management of nutsedge are included, including chemical control. Updates for effective herbicides that are available for use to home gardeners and professional landscapers are included.

Online at <https://ipm.ucanr.edu/home-and-landscape/nutsedge/pest-notes/>

Meet UC IPM's Urban IPM Advisors

UC IPM's Urban & Community program works with several IPM advisors who cover urban audiences and pest issues across the state. Here's a little information about each of them so you can find the appropriate advisor in your area for your pest management questions and concerns.



Andrew Sutherland is an urban IPM advisor serving Alameda, Contra Costa, San Francisco, San Mateo, and Santa Clara counties. Andrew's specialty is urban arthropod pests, and he has recently worked on bed bugs and German cockroaches in multi-unit housing, subterranean termites in single-family homes, and biting mites in dwellings and other structures.

Andrew is based in the Alameda UCCE office. Contact him at amsutherland@ucanr.edu.



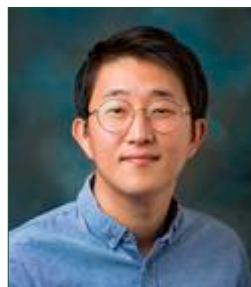
Niamh Quinn is the Human-Wildlife Interactions advisor in Orange, Los Angeles, and San Diego counties. Her specialty is in urban vertebrate pests and she currently studies coyotes and commensal rodents.

Niamh is based at the South Coast Research and Extension Center in Irvine and can be reached at nmquinn@ucanr.edu.



Eric Middleton is an area IPM advisor in San Diego, Los Angeles, and Orange counties. His specialty is ornamental arthropod pests, and he has recently been studying agave mite management in commercial nurseries.

Eric is based in the San Diego UCCE office and can be reached at egmiddleton@ucanr.edu.



Sang-Bin Lee is our newest area urban IPM advisor serving Solano, Sacramento, and Yolo counties. His specialty is urban insect pests.

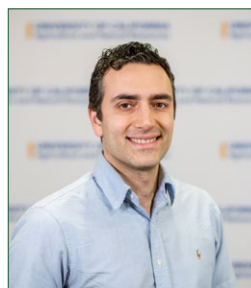
Sang-Bin is based out of the Solano UCCE office in Fairfield. To connect with Sang-Bin about local pest issues, email him at sablee@ucanr.edu.



Karey Windbiel-Rojas splits her time as both the associate director for the Urban & Community IPM unit and an area urban IPM advisor covering Solano, Sacramento, and Yolo counties. Her specialty is general IPM, and her recent projects include research on organic herbicides

and the invasive brown marmorated stink bug.

Contact her at kwindbiel@ucanr.edu.



Siavash Taravati is an area urban IPM advisor in Riverside, Orange, Los Angeles, and San Bernardino counties. His specialty is urban insect pests, and his recent projects were on the dark rover ant, Turkestan cockroach, false chinch bug,

drywood termites, red imported fire ant, and Formosan termites.

Siavash is based in the Riverside UCCE office and can be reached at staravati@ucanr.edu.



Upcoming Meetings and Workshops (CEU opportunities)

There is a lot going on this fall for pest management professionals, including webinars, workshops, trade shows, and conferences. We hope to see you at some of the exciting events listed below!

The Landscape Expo

September 18–19, 2024

Anaheim, CA

Come see us at the UC IPM booth at the annual Landscape Expo in Anaheim. We will be in Booth 750 to share UC IPM resources and answer your pest questions.

<https://thelandscapeexpo.com/>

California Urban IPM Apprenticeship Webinars

For those interested in sustainable pest management, the IPM Institute is offering monthly webinars for free as part of their Urban IPM Apprenticeship program.

The next webinar, Outdoor Pest Monitoring and Assessment Techniques, is on **September 25, 2024**. See the webinar schedule, past webinar recordings, and information about this project at

<https://greenshieldcertified.org/california-urban-ipm-apprenticeship/>

UCR Fumigation School

October 9–10, 2024

Pomona, CA

Attend this two-day fumigation school to learn everything you need to know about structural fumigations in CA.

This workshop is for professional licensees only

<https://birdease.com/ucrfumeschool>

West Coast Rodent Academy

October 9–11, 2024

Irvine, CA

This unique urban rodent management workshop includes lectures to help you better understand rodent ecology and integrated pest management (IPM).

<https://ucanr.edu/sites/WCRA/>

PestWorld 2024

October 22–25, 2024

Denver, CO

Visit the UC IPM booth (#538) at the annual PestWorld conference organized by the National Pest Management Association. This event is a great opportunity to network, learn, and engage with others in the pest management industry. See you there!

<https://www.npmapestworld.org/>

Webinar for Landscape Professionals

October 29, 2024

9:00am– 12:15pm (3 hours of DPR CEUs requested)

Save the date for this 3-hour webinar designed just for landscape professionals in California. Topics covered will be pesticide safety (1 hour of laws & regs), efficacy and considerations for using organic herbicides, and invasive pests. We are putting together the details so if you would like to be contacted once registration is ready, please give us your name and email using this short form:

https://ucanr.edu/webinar_survey

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.

Ask the Expert!

Q: What are the concerns about primary or secondary exposure of wildlife to rodenticides?

A: Rodenticide baits are made to attract target animals (rodents), but nontarget wildlife may also become exposed to the bait if they find it and eat it. Primary exposure occurs when an animal consumes a rodenticide directly. Secondary exposure occurs when an animal consumes prey that have eaten the rodenticide.

The second-generation anticoagulant rodenticides (SGARs) tend to be more effective because they persist longer in the rodent's body, but this can cause a problem with secondary exposure. Raptors like hawks and owls are at high risk of secondary poisoning from difethialone and brodifacoum, both active ingredients in the SGAR group. Mammalian predators like foxes and snakes and scavengers like racoons are also at high risk of secondary poisoning from the first-generation anticoagulant rodenticides chlorophacinone and diphacinone.

Because anticoagulants are cumulative and slow acting to various degrees, poisoned rodents can contain several lethal doses of toxicant, and secondary poisoning of pets and wildlife is possible if they eat rodent carcasses.

Concerns about both primary and secondary hazards of SGAR baits led the US Environmental Protection Agency in 2011 to restrict use to agricultural users and professional pest management professionals. A proposed registration decision to make all rodenticides restricted use pesticides is currently in the US EPA's comment period (see the article on PIDs).



P. Kosina, UC IPM

Burrowing owls prey on rodents and are at risk of secondary poisoning from anticoagulant rodenticides.

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

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