



Integrated Thrips Management in Landscape Settings

Summer can be prime time for pest thrips infestations in California's urban landscapes. All thrips belong to the insect order Thysanoptera and are characterized by small (less than 2 mm), slender, cigar-shaped bodies, piercing-sucking mouthparts, and fringed wings as adults. Most species range from light amber to almost black, depending on the life stage. The life cycle includes a kidney-shaped egg often inserted into plant tissue, two active but wingless larval stages, the nonfeeding prepupal and pupal stages, and a winged adult.

Common Damage

Pest thrips feed on developing plant tissues and can scar or distort leaves, flowers, and fruit. Thrips extract plant cell contents as they feed, so high-density infestations can result in leaves or petals that appear bleached, stippled, or deprived of color. Some species of thrips are efficient vectors of certain plant viruses, although this is rarely an issue in the landscape.

Thrips can attack annual and perennial plants, both herbaceous and woody, although healthy woody plants usually tolerate thrips damage. Some thrips move into gardens and landscapes in the summer, as

adjacent agricultural and natural areas dry out. Others are associated with the active tender growth seen in landscapes during spring and summer. Regular monitoring during these times can help to confirm the presence of pest thrips and their natural enemies and whether local populations are increasing or decreasing. Yellow or blue sticky cards can be employed to intercept adult thrips in flight, while striking or shaking foliage or flowers over a white sheet or a piece of paper is a useful sampling method for settled adults and larvae.

Thrips You'll See Most Often

Common pest species on landscape ornamentals include greenhouse thrips (Figure 1), western flower thrips (Figure 2), and the recently introduced myoporum thrips (Figure 3). Greenhouse thrips attack many woody perennials, including *Rhododendron* species, and are usually found feeding in groups on the undersides of leaves. They deposit conspicuous specks of black excrement at feeding sites. Western flower thrips are common on most flowering plants when pollen is present. Generally, flower thrips don't cause damage in landscapes, but high densities can scar and sometimes distort developing flowers such as roses (Figure 4) and annual bedding plants. A recent invader to the state, myoporum thrips causes extensive shoot twisting and galling (Figure 5), but only on several species of *Myoporum* landscape shrubs in coastal regions.

Not all thrips are pests, however, and many plant-feeding species also eat pollen, fungi, small insects, or mites. Addi-



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Figure 1. Black adult and yellow larvae of greenhouse thrips.



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Figure 2. Western flower thrips adult.



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Figure 3. *Myoporum thrips* adult.

tionally, some species such as the banded-wing (Figure 6), sixspotted (Figure 7), and black hunter thrips (Figure 8) are highly predatory and should be considered beneficial and desirable in the landscape.

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Biological and Cultural Control

Management may not be necessary, depending on the thrips species and density, the plant species affected, and the landscape situation. Most of the time, healthy and vigorous plants, especially woody perennials, will be able to out-grow damage. If management is desired or necessary, however, there are several cultural and physical tactics that are effective in reducing thrips numbers.

Thrips species that cluster together to feed, such as greenhouse thrips and gall-forming thrips such as the myoporum thrips, can be removed by pruning out infested plant parts. In general, interior thinning or long pruning cuts will promote less susceptible tissue than shearing, heading, or short pruning cuts. Pressurized hose nozzles can be used to direct streams of water at infestations in small gardens to dislodge and remove some thrips. For highly sensitive or valuable small plantings, row covers or screening materials can be used to exclude thrips and prevent their establishment during peak abundance.

For some pest thrips species, alternative plant species or cultivars resistant or unpalatable to thrips can be planted to avoid infestations. For instance, myoporum thrips only attack *Myoporum* species. These plants can be replaced with evergreen shrubs of similar form that may be native to California and will never be subjected to attack by myoporum thrips; see <http://www.plantright.org/recommended-alternatives-myoporum-laetum> for alternative species.

Natural enemies of thrips may be present in the landscape and may contribute significantly to management. Predators such as the minute pirate bug (Figure 9), lacewings, predatory thrips, and predatory mites consume thrips eggs and larvae while tiny wasps parasitize thrips eggs and sometimes larvae. Conserve these beneficial arthropods by providing floral resources such as pollen and nectar in the landscape and by avoiding broad-spectrum insecticide applications.



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Figure 4. Feeding scars from western flower thrips on rose sepals.



D. Rosen

Figure 5. Galling and twisting of leaves caused by myoporum thrips.

Insecticides May Not Be Needed

Chemical control of pest thrips is often ineffective. Thrips responsible for observed plant damage are often long gone once stippling, bleaching, or scarring is visible. Most thrips species seek out tight crevices, rendering them naturally protected from contact insecticides. And thrips populations become rapidly resistant to insecticides when only one active ingredient or class of active ingredients is used.

If cultural and biological methods don't achieve the desired level of control, however, some insecticides can be used in certain situations. For greenhouse thrips, which are more exposed as compared to other species, use oil, soap, neem, or pyrethrin sprays directed at the undersides of infested leaves. Damaging populations of more protected species can sometimes be managed using the naturally derived insecticides spinosad and abamectin. For myoporum thrips, which can be pervasive and potentially damaging to high-value landscapes such as golf courses, basal trunk applications of dinotefuran have



F. Dlott

Figure 6. Banded-wing thrips.



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Figure 7. Sixspotted thrips.



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Figure 8. Black hunter thrips larva.



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Figure 9. The minute pirate bug is a common and voracious generalist predator with a taste for thrips eggs and larvae.

proven highly effective at providing near season-long control. Always follow label guidelines and practice pesticide safety.

For more photos and information, see *Pest Notes: Thrips* at <http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7429.html>.

—Andrew Sutherland, UC Statewide IPM Program, San Francisco Bay Area, asutherl@ucanr.edu

Deer Mouse Infestation? Be Aware of Hantavirus

Deer mice aren't normally found within urban and residential areas unless fields, forests, or other suitable habitats surround those areas. However, deer mice may enter vacated homes, cabins, and other structures where they build nests and store food. If you are called on to manage a deer mouse problem, be sure to protect yourself and building occupants from potential exposure to hantavirus, which can be deadly.

Deer mice (Figure 1) are similar to the common house mouse (Figure 2) but can be distinguished by their bicolored tail, larger eyes, and white undersides.

Hantaviruses and Precautions

Hantaviruses are a group of viruses that rodents in the family Muridae carry. Deer mice are the principal reservoir of one of these viruses called *Sin Nombre* virus, which causes Hantavirus Pulmonary Syndrome (HPS) in people. Although human cases of this virus are rare, HPS can be a severe respiratory disease in humans with fatality rates of about 36%. Deer mice shed the virus in their saliva, urine, and droppings. A person may be exposed to hantavirus by breathing contaminated dust after disturbing or cleaning rodent droppings or nests or by living or working in rodent-infested settings. There is no evidence that North American hantaviruses spread from one person to another.

The most effective way to avoid contracting hantavirus from deer mice is to keep them out of houses, cabins, and dwellings by rodent-proofing and excluding them from these structures by sealing all small gaps and cracks. Once deer mice infest a dwelling, it is critical to avoid working and sleeping in these areas until the infestation has been controlled and the area has been made safe for humans.

Before occupying an infested building, open the doors and windows to air out the room for at least 30 minutes. Where possible, use an electric fan on windowsills and in door entrances to assist the process. Be sure to vacate the building during the ventilation process to prevent

inhaling aerosolized particles. Wearing a commercially available cloth or paper breathing mask offers some protection and is better than no protection at all. However, only an approved respirator equipped with high-efficiency particulate air (HEPA) filters offers total respiratory protection against airborne viruses.

It is important to wear nonfabric gloves (e.g., rubber, latex, vinyl, or nitrile) when cleaning deer mouse-infested buildings. Because humans can contract the virus by inhaling aerosolized deer mouse urine and feces, never stir up dust by vacuuming or sweeping or through any other activity.

It is important to properly disinfect the potentially contaminated areas. Thoroughly wet contaminated areas including trapped deer mice, droppings, and nests with an appropriate disinfectant solution such as Lysol or a 10% hypochlorite (bleach) solution. To make this bleach solution, mix 1 1/2 cups of household bleach in 1 gallon of water (or one part bleach to nine parts water). Note that a bleach solution may damage rugs and fabrics and irritate skin. Wear nonfabric gloves whenever touching or cleaning contaminated surfaces or when handling mouse nests, dead mice, or mouse traps.

Once everything has soaked for 10 minutes, remove all nest material, mice, and droppings with a damp towel and then mop or sponge the area with the disinfectant solution. Upholstered furniture and carpets can be shampooed and steam cleaned. If you wish to reuse the gloves used while cleaning contaminated areas, you must properly disinfect them before removal. After removing the gloves, it is important to thoroughly wash hands with soap and water or use a waterless alcohol-based hand sanitizer when soap is unavailable and hands aren't visibly soiled.

For additional up-to-date information on rodent cleanup, visit the Centers for Disease Control and Prevention Web site, <http://www.cdc.gov/rodents/cleaning/index.html>.



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Figure 1. Adult deer mouse. Note the large ears and eyes and white underside of the body and tail—all characteristics that distinguish it from the house mouse.



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Figure 2. House mice are frequently found in residential households. They lack a white underside and have a relatively hairless tail. They don't carry the hantavirus.

Managing Deer Mice in Residential Settings

Although rodenticides are available for controlling house mice and rats, there are no toxic baits registered for controlling deer mice in residential settings. It is a violation of the product label to use rodent baits labeled for use "only against house mice, Norway rats, and roof rats" in an attempt to control deer mice. Instead, residential deer mouse control should be accomplished by using traps, excluding mice from structures, and modifying the habitat to remove sources of food and shelter. See the *Pest Notes: Deer Mouse* at <http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn74161.html> for more information about managing these pests.

—Excerpted with modifications from the Pest Note by Niamh Quinn, *Evolution, Ecology, and Behavior*, University of Liverpool, Liverpool, U.K., niamh.quinn@liverpool.ac.uk; Roger Baldwin, UC Statewide IPM Program, Kearney Agricultural Center, Parlier, rabaldwin@ucanr.edu; and Bob Timm, UC Research and Extension Center, Hopland, rmtimm@ucanr.edu

Iron HEDTA: A Natural Selective Herbicide

After writing an article about natural herbicides in the November issue of this newsletter, I was asked what I thought about the iron HEDTA (FeHEDTA) herbicides that recently came on the market. These products are believed to have minimal human health or environmental effects.

My first finding was it's difficult to obtain herbicides with FeHEDTA in Southern California where I am based, but apparently products are easier to find in Northern California. Of the four nurseries I went to, I found only one that carried even a single product that contained FeHEDTA, Whitney Farms Lawn Weed Killer (Scotts), although according to the California Department of Pesticide Regulation's pesticide product database, there are four other registered products with the same active ingredient (Table 1).

Various sources of information about FeHEDTA state it provides control or suppression of a number of common broad-leaf lawn weeds (e.g., dandelion, English daisy, white clover, black medic, common chickweed, and broad-leaved plantain) but won't injure grasses, making this a selective herbicide for use on lawns.

I did some of my own testing, although not a controlled study, on broadleaf plantain, dandelion, oxalis (creeping woodsorrel), and black medic in a tall fescue lawn and on weeds in concrete cracks. It took about one week for broadleaf plantain to die, and there was only foliar damage to

Table 1. California-registered Herbicides Containing FeHEDTA.

Formulation	Company	Name	Percent of active ingredient
concentrate	Bayer	Bayer Advanced Natria Lawn Weed Control Concentrate	26.5%
concentrate	Engage Agro	Fiesta Turf Weed Killer	26.5%
concentrate	Gardens Alive	Iron-X Selective Weed Killer for Lawns	26.5%
ready to use	Scotts	Ortho Elementals Lawn Weed Killer	1.5%
ready to use	Scotts	Whitney Farms Lawn Weed Killer	1.5%



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Figure 1. Foliar injury to black medic five days after spraying.

black medic (Figure 1). However, both oxalis and dandelion were showing injury within one day and were controlled in about three days. There was no turf injury. The product also provided good control of oxalis growing in cracks in concrete sidewalks and didn't stain the sidewalk.

There was no observable difference if the herbicide was applied in the sun or shade. However, on some weed species, especially black medic, the herbicide didn't adhere well to the leaf and beaded up, which



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Figure 2. FeHEDTA on black medic had poor spray coverage due to the solution beading.

could explain the lack of good control (Figure 2). More testing is needed to see if use of a surfactant could improve activity.

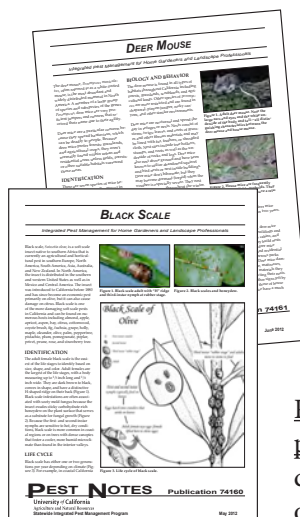
I do want to caution that there is no soil residual. The area I sprayed for oxalis had new plants, although not as many as the untreated section, within about a month after I did the treatment.

—Cheryl Wilen, UC Statewide IPM Program, South Coast, cawilen@ucanr.edu

New Resources

UC IPM recently added two new titles to its Pest Notes series of publications about home, garden, and landscape pests.

Deer Mouse, <http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn74161.html>, provides information about the most abundant and widely distributed mammal in North America. Deer mice are a particular concern because they spread hantavirus, which can be deadly to people. Other topics discussed include sanitation, exclusion, and habitat



modification as well as rodent cleanup tips.

The second title, *Black Scale*, <http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn74160.html>, details the biology, identifica-

tion, and management of this insect pest of citrus, olive, and many other fruit and ornamental trees. Black scale has several natural enemies that often keep this insect under control naturally. When pesticides are needed, properly timed applications of narrow range mineral oil or canola oil help manage the insect while being less toxic to natural enemies and the environment.

To access more than 150 Pest Notes titles, visit the UC IPM Pest Notes Web page, <http://www.ipm.ucdavis.edu/PDF/PESTNOTES/index.html>.

Asian Citrus Psyllid, Huanglongbing Update

You may have heard about the Asian citrus psyllid (Figure 1) or ACP for short, an insect that has invaded California. It's been found on citrus trees and related plants such as kumquats and *Citropsis*. Other preferred host plants that aren't as commonly found in home gardens or landscapes in California include orange jasmine (*Murraya paniculata*), Indian curry leaf (*Berbera koenigii*), and Chinese box orange (*Severinia buxifolia*).

While this insect can damage a plant just by feeding on it, a bigger problem, which threatens the citrus industry and home garden trees, is that the ACP can transmit the most devastating disease of citrus in the world, huanglongbing (HLB). In March, the first tree infected with HLB in California was found in a backyard in Los Angeles. This tree has been removed and destroyed and no additional infected trees have been found, but everyone should watch for diseased trees.

Symptoms of HLB include yellow shoots; asymmetrical blotches on leaves (Figure 2); and, worst of all, small, lopsided, inedible fruit with a bitter flavor. Infected trees decline in health and eventually die. There is no cure for HLB, and infected trees must be removed and destroyed. The disease is working its way from Mexico toward California in the bodies of infected ACP or infected citrus trees. The best way to keep HLB disease out of California is to keep the ACP in very low numbers and eliminate HLB-infected trees when they are discovered.

Management

When the ACP was first found in 2008 in backyard citrus in San Diego, the California Department of Food and Agriculture (CDFA) treated all infested host plants. These treatments were very effective in most areas where the ACP initially was found—San Diego and Imperial counties. However, in Los Angeles, San Bernardino, and Riverside counties, the ACP has spread out far and wide and now there are too many ACP infested sites for CDFA to treat them all. Landscape professionals and homeowners play a very important role in protecting

California citrus by keeping the psyllid, and potentially HLB, from spreading.

Always purchase plants from a reputable nursery that sells disease-free trees. If you purchase a citrus plant from a nursery that is within an ACP quarantine area, it will have a blue or yellow tag on it that requires the plant to stay within the quarantine area. Be careful not to move any citrus trees out of the quarantine area to uninfested areas. As you are planting, carefully check the leaves and stems for psyllids.

If you or your customer suspects you have seen the pest or disease, immediately call the CDFA hotline. If you report the psyllid, CDFA personnel will tell you if they will be treating the reported trees or if you are to manage the ACP population yourself. If you are managing ACP-infested trees in the areas of Southern California that CDFA doesn't treat, you can greatly assist in the fight against the psyllid by making sure infested trees are properly treated. If you think you have seen the disease, CDFA personnel will take samples to confirm infection of the tree by a biochemical test, and if the infection is found, regulatory actions such as tree removal will take place.

It is very important to know if you are in an ACP infested area and, if you are, to handle green waste carefully. Quarantine maps are



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Figure 1. Asian citrus psyllid adult (left) and nymphs with waxy tubules.



Courtesy of CDFA

Figure 2. Symptoms of huanglongbing disease include asymmetrical blotches on leaves.

available at http://www.cdffa.ca.gov/plant/pe/interiorexclusion/acp_quarantine.html.

If you are pruning citrus or other ACP hosts, dry out the prunings for at least a week to disinfest them of psyllids, or double bag prunings before transporting them to avoid moving ACP to new areas. Also, educate homeowners to dry out their clippings before placing them in green waste bins to avoid spreading ACP.

There are currently no effective natural controls for the ACP in California. Some

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Table 1. Insecticides for Managing ACP in Areas of Southern California Not Being Treated by CDFA.

Insecticide*	How applied	Insect stage controlled	Comments
carbaryl	foliar (leaf) spray	adult	Very toxic to honey bees and natural enemies of other citrus pests. Never apply to blooming trees. For homeowner use.
imidacloprid	systemic; apply to ground at base of trees	nymphs and adults	Takes two weeks to move up plant. Effective for one to three months. Use only once a year. Apply August through September before leaf flush to minimize hazards to honey bees. For homeowner use.
cyfluthrin	foliar spray	All stages	Very toxic to honeybees and natural enemies of other citrus pests. Never apply to blooming trees. Requires an applicators license.

*Check the label to be sure the product is registered for use on citrus trees.

ACP ... continued

predators feed on it, and recently an insect parasite, a mini wasp, that attacks the ACP was released in parts of Riverside and Los Angeles. However, biological control is unlikely to reduce the psyllid enough to prevent the spread of HLB.

What You Should Do

If the ACP is found, ask the property owner to call the CDFA pest hotline, 1-800-491-1899. CDFA personnel will let owners know if the organization will treat their trees. If you are asked to treat or make a treatment recommendation for ACP, Table 1 lists insecticides for garden and landscape trees. Recommended choices will depend on the host being treated, life stage of the insect, and time of year. Once an application is made, it is important to monitor the infested plants over the year to determine if re-treatment is necessary.

For more photos of the insect and its damage, see the UC IPM Pest Note at <http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn74155.html>, or view multi-language educational handouts at <http://www.CaliforniaCitrusThreat.org> and <http://www.PeligranCitrusenCalifornia.com>.

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Editor's note: This article is based upon one that ran in the March issue of Retail Nursery and Garden Center IPM News, <http://www.ipm.ucdavis.edu/RETAIL>.

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Produced by the University of California Statewide IPM Program with partial funding from the USDA NIFA EIPM Coordination Program. To simplify information, trade names of products have been used. No endorsement of named products is intended, nor is criticism implied of similar products not mentioned.

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Ask the Expert!

Q I manage a coastal property where ngaio trees are used as screens. In the past few years, most terminal shoots have become distorted, and some branches have died back. What is causing this condition, and what can I do about it?

A The ngaio or myoporum tree, *Myoporum laetum*, is a fast-growing large shrub or small tree from New Zealand that has been used extensively in coastal California for embankment stabilization, windbreaks, and visual or noise screens. The myoporum thrips (see Figure 3 of the thrips article on Page 1 of this publication), likely a specialist herbivore in the plant's natural environment, was introduced to California and began causing noticeable damage in southern parts of the state in 2005. It has since become established along the coast as far north as the San Francisco Bay Area. Adults and larvae of this insect distort and stunt new shoot growth during feeding. This can eventually result in dieback of entire shoots. Fortunately, *Myoporum* species are the only known hosts in California. Insecticide management using the systemic neonicotinoid dinotefuran can be effective, but it is expensive, must be repeated each spring, and may be toxic to natural enemies and pollinators. Selecting alternative plant species is the best long-term management tactic. Additionally, ngaio is considered a moderately invasive plant by the California Invasive Plant Council, www.cal-ipc.org, so new plantings of the species aren't recommended even without considering this new pest. For all these reasons, myoporum removal and installation of nonsusceptible alternatives may be the only sustainable solution for myoporum thrips. For more information about myoporum thrips, visit http://civr.ucr.edu/myoporum_thrips.html.

Q Is there a map showing where Asian Citrus Psyllid has been found in California?

A The California Department of Food and Agriculture and U. S. Department of Agriculture monitor for this pest regularly, and maps are provided at <http://www.cdfa.ca.gov/plant/acpl/>.

Have a question? E-mail it to ucipm@ucdavis.edu.

A New Seed Bug

If your clients live in or near an area that stays wet well into summer, such as tidal flats or seasonal wetlands, they may call you with concerns about a small black bug (Figure 1) that occasionally swarms into their houses by the thousands (Figure 2). The bug doesn't have an official common name yet, but it's a seed bug from the Mediterranean whose Latin name is *Metapoplax ditomoides*. These bugs are harmless to people, although they can be a nuisance in homes and in vehicles such as cars and aircraft that are sometimes parked near moist, flat areas. There are currently no known controls for the problem; however, residents can try to prevent entry into houses by making sure screens on windows and doors are intact and sealing up other entryways. If bugs get into the house, vacuum them up.



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Figure 1. Adult seed bug *Metapoplax ditomoides*.



R. Elb

Figure 2. Swarm of seed bugs.

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