

## Leaffooted Bugs: An Increasing Problem

**I**n recent years, your customers may have asked about a strange “new” bug in their gardens, especially on tomatoes and pomegranates. These insects may be leaffooted bugs. Although they are native to the western United States and not new to California, leaffooted bugs seem to be occurring more commonly in gardens. These distinctive bugs get their name from the small leaf-like enlargements on the hind legs (Figure 1). They are medium to large sized insects that prefer to feed on fruits and seeds and are often found in groups.

### Recognizing Leaffooted Bugs

Adult leaffooted bugs are readily recognized by their characteristic hind legs. There are three common species of leaffooted bugs in California: *Leptoglossus zonatus*, *L. clypealis*, and *L. occidentalis*. Adults of all three species are about 0.75 to 1 inch long, have a narrow brown body, and have a white zigzag pattern across the wings. They have different feeding preferences, but management is similar.

The brown, cylindrical eggs of all three species are laid end-to-end in a string-like strand on the host plant (Figure 2), often along a stem or leaf midrib. Eggs hatch into small nymphs that have dark heads and dark legs on bodies that range in color from orange to reddish-brown (Figure 3).

Leaffooted bugs overwinter as adults, typically in aggregations located in protected areas, such as in woodpiles, barns

or other buildings, palm fronds, citrus or juniper trees, under peeling bark, or in tree cracks. Overwintered adults stay hidden from fall until late spring. When the weather gets warm, adults disperse to find food sources. Adults are strong flyers that may feed initially on the seeds of winter weeds and later move into gardens and landscapes in search of early-season fruit and a place to lay eggs.

Populations vary from year to year but are typically highest after mild winters that allow high survival of overwintering adults. Seasonal fluctuations in the number of bugs can also be related to rainfall, food availability, and the prevalence of natural enemies.

### Damage to Plants

Leaffooted bugs have piercing-sucking mouthparts that extend more than half of the length of their narrow body. They probe into leaves, shoots, and fruit to suck plant juices. For most ornamentals and many garden plants, feeding on the leaves and shoots causes no visual damage and is of little concern. Feeding on small tomatoes can cause the fruit to abort, while feeding on medium sized fruit can result in depressions or discoloration at the feeding site as the fruit expands and ripens. Feeding on mature tomatoes can cause slight discoloration to the surface of the fruit that should be of no concern to backyard gardeners. Damage is similar to that caused by stink bugs and other plant bugs.



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Figure 1. Adult leaffooted bug, *Leptoglossus clypealis*.



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Figure 2. Eggs of leaffooted bugs, *Leptoglossus* sp. on a pistachio.



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Figure 3. Leaffooted bug nymphs on *Hesperaloe parviflora*.

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# Leaffooted Bugs ... continued from Page 1

## Management

During most years, leaffooted bug populations are low enough that damage to gardens is tolerable and damage to landscape plants is negligible. When outbreaks occur, a combination of methods will likely be needed to manage this pest, which may include removing overwintering sites or the use of weed host removal, row covers, physical removal, natural enemies, and insecticides.

## Are Pesticides Effective?

Insecticides are rarely needed for leaffooted bug control because small blemishes on most fruit are tolerable in

gardening situations and because landscape plants are rarely damaged. Also, leaffooted bugs are most common on edible plants near harvest, when applying pesticides to fruits to be consumed is undesirable or not allowed by the label. In addition, most insecticides available to homeowners only have temporary effects on the leaffooted bug.

However, in severe cases, insecticides can be considered as a last resort. If needed, insecticides will be most effective against small nymphs. The most effective insecticides against leaffooted bugs are broad-spectrum, pyrethroid-based insecticides, such as permethrin. However, these products are quite toxic to bees and beneficial insects. Insecticidal soap

or botanicals, such as neem oil or pyrethrin, may provide some control of young nymphs only. If insecticides are used close to harvest, make sure to tell your customers to observe the days-to-harvest period stated on the insecticide label; and wash the fruit before eating.

Read more about managing the bug in the newly published Pest Note, *Leaffooted Bug*. It is available at <http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn74168.html>.

— Excerpted with modifications from the Pest Note, *Leaffooted Bug*, by Chuck Ingels, UCCE, Sacramento Co., [caingels@ucanr.edu](mailto:caingels@ucanr.edu); David Haviland, UCCE, Kern Co., [dhaviland@ucdavis.edu](mailto:dhaviland@ucdavis.edu)

# Biological Control for Fungus Gnats

**F**ungus gnats are small flies that infest soil, potting mix, or plants grown in pots or containers. Your customers may complain about fungus gnats resting on or swarming around plants or soil or flying around windows in their houses.

Adult fungus gnats don't harm plants or people, but they can be annoying. On the other hand, fungus gnat larvae, which live in soil and feed on roots, can be damaging when their numbers are very high, sometimes causing plants to wilt. Their feeding may cause seedling plants to die or injure roots which allowing entry of plant pathogens. Larvae are whitish to clear with black heads and, with a length of less than ¼ inch, very difficult to see. When abundant, they may leave shiny trails on the soil surface.

## Cultural Practices and Trapping

For many customers, changing watering practices may solve fungus gnat problems. For instance, allowing soil surfaces to dry between waterings or using pasteurized potting mix and keeping infested plants away from clean ones. In

some cases it may be possible to manage the situation by placing small pieces of yellow sticky traps in pots to control adults.

## Biological Controls

Where cultural practices haven't effectively controlled the problem, customers may ask about treatment options. Although insecticides such as pyrethrins are available for this use, the safest and often most effective products for home use are the commercially available biological insecticide *Bacillus thuringiensis* subspecies *israelensis* (Bti) and the insect-attacking *Steinernema* nematodes.

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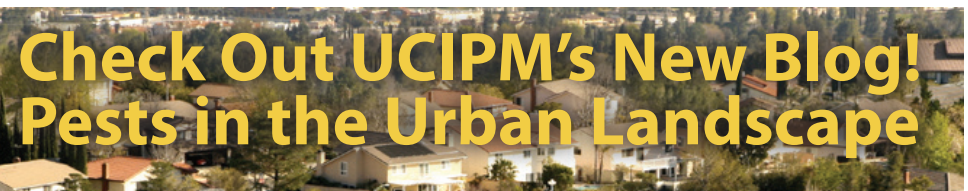
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Figure 1. Fungus gnat adult trapped on yellow sticky trap.



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Figure 2. Fungus gnat larvae.



Our new blog will provide a one-stop site for UC IPM news related to pests of homes, gardens, landscapes, and structures. We will be posting articles from our newsletters as well as announcing new and revised Pest Notes and other new educational materials or activities of interest to urban and residential audiences.

View or subscribe to the blog at: [ucanr.edu/blogs/ucipmurbanpests](http://ucanr.edu/blogs/ucipmurbanpests)

# Understanding Neem-based Pesticides

**D**emand for naturally-derived pesticides is likely to increase as consumer concerns about risks and hazards associated with pesticides grow. Many “green” products are new to store shelves, but some active ingredients within these products have been used for decades. These include the pesticide products derived from the neem tree, *Azadirachta indica*.

The neem tree, *Azadirachta indica*, has historically been utilized as a source of traditional medical treatments prepared from its seeds and leaves. The tree’s natural repellency to insects, though well known in its native India, became internationally recognized in 1959 when an invasion of desert locusts devoured all vegetation except the neem trees. Upon further investigation, neem extracts were found to have significant insecticidal, nematocidal, and fungicidal properties. Analysis of the various extracts found within the neem tree pointed to a compound new to science, which was named azadirachtin, as the chief active ingredient responsible for the observed insecticidal properties.

Today, numerous pesticide products are derived from the neem tree (Tables 1-2); some citing azadirachtin and many listing neem oil as the active ingredient. Each of these active ingredients has a different mode of action and is effective on a different spectrum of pests. Your customers will be more successful when using these products if they understand how these different formulations and active ingredients affect the target pests.

## Azadirachtin

The azadirachtin compound is extracted from neem seeds using various solvents. Azadirachtin acts on insects in two important ways: as a natural insect growth regulator (IGR) and as an antifeedant. The IGR qualities of azadirachtin are due to its chemical similarity to ecdysones, important insect hormones necessary for molting and reproduction. Azadirachtin competes for molecular binding sites with ecdysone, leading to

Table 1. Examples of General Use Azadirachtin Products.\*

Product Name	% Azadirachtin	Comments
Azatrol Hydro Botanical Insecticide	1.2	
Biosafe Insect Control	3	
De-bug for Organic Gardening—for Home Gardens	0.15	Also contains 15% neem oil
Safer Brand Bioneem Insecticide and Repellent	0.09	
Safer Brand Grub Killer RTS	0.09	

\*These don't contain neem oil unless noted.

incomplete molting in immature insects followed by death due to starvation and desiccation. In adult female insects, the same hormonal competition leads to sterility. Additionally, many insects will stop feeding once they have ingested azadirachtin, also leading to death by starvation. This antifeedant phenomenon has been observed in caterpillars, aphids, true bugs, beetle larvae, grasshoppers, sawflies, and many other insects. Azadirachtin is also known to move systemically within some plant species, so that sprays to one part of a plant may be effective in other parts of the same plant.

## Neem Oil

Most neem-based pesticides for retail sale list the active ingredient as “cold-pressed neem oil” or “clarified hydrophobic extract of neem oil.” Both refer generally to neem oil, obtained by cold pressing neem seeds. Some of these neem oil preparations may contain low concentrations of azadirachtin, but the lion’s share of azadirachtin is extracted from neem seeds using a different process once the oil has already been removed.

Neem oil is effective against soft-bodied insects and other arthropods such as spider mites, as well as some foliar plant pathogens, in much the same way other horticultural oils may be: as smothering agents, desiccants, and internal



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Neem tree fruit and leaves.

Table 2. Examples of General Use Neem Oil Products\*

Product Name
Bayer Advanced Natria Neem Oil Concentrate or RTU
Bonide Neem Oil Fungicide Miticide Insecticide RTU
Bon-Neem II Fungicide Miticide Insecticide Concentrate or RTU <sup>1</sup>
Bonide Rose Rx 3-in-1 Concentrate or RTU
Cirkil RTU (5.5% Neem Oil)
Concern Garden Defense Multi-Purpose Spray Concentrate or RTU
Ferti-Lome Triple Action (and RTS formulation) concentrate <sup>2</sup>
Ferti-Lome Triple Action Plus II (concentrate) <sup>1</sup>
Garden Safe Brand Fungicide 3 Concentrate or RTU
Garden Safe Brand Neem Oil Extract Concentrate
Green Light Fruit Tree Spray (concentrate) <sup>1</sup>
Green Light Neem Concentrate
Green Light Neem II (RTU) <sup>1</sup>
Green Light Rose Defense Concentrate or RTU
Monterey Fruit Tree Spray Plus (concentrate) <sup>2</sup>
Monterey Neem Oil RTU
Natural Guard Brand Neem Concentrate or RTU
NimBioSys Neem Oil <sup>3</sup>
Ortho Tree & shrub Fruit Tree Spray Concentrate
Plasma Neem Oil Biological Insecticide <sup>3</sup>

\* Concentrates contain 70% neem oil and Ready-to-Use (RTU) products contain 0.09 Neem Oil unless otherwise noted.

<sup>1</sup>Also contains pyrethrins and the synergist piperonyl butoxide.  
<sup>2</sup>Also contains pyrethrins.  
<sup>3</sup>Contains 100% neem oil plus 0.00375% azadirachtin as a constituent of the oil.

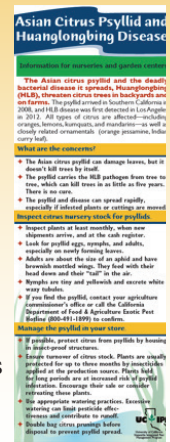
membrane disruptors. Apart from these physical modes of action shared by other oils, neem oil contains volatile sulfides that have been shown to have fumigant action against insects and some microorganisms. Thus, the strong sulfur smell associated with most neem oil preparations may actually kill and repel pests some distance away from the site of application.

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# Just for Stores: Asian Citrus Psyllid Info

Retail nurseries and garden centers play a key role in the fight against Asian citrus psyllid and the deadly disease it carries, Huanglongbing disease (ACP/HLB). One role is to keep customers informed about the problem. Another responsibility is to maintain a vigilant inspection program in your store and know how to manage the pest if you find it.

Find out more about what retailers can do in a new Quick Tip card on the UC IPM web site at <http://www.ipm.ucdavis.edu/RETAIL/QT/asiancitruscardrn.html>. The card's author, UC Riverside entomologist Matt Daugherty, is coordinating an ACP/HLB research and outreach program for stores as described in the June 2013 issue of this newsletter. If you would like printed copies of the special ACP/HLB card for retail nurseries and garden centers, contact Matt at [matt.daugherty@ucr.edu](mailto:matt.daugherty@ucr.edu). (Numbers are limited).



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In conclusion, azadirachtin, though an important component of neem seeds and leaves, is typically not present in high concentrations within neem oil products. Pesticides listing azadirachtin as an active ingredient can be expected to have systemic insecticidal effects as IGRs and antifeedants and are more effective than neem oil against caterpillars, beetles, and

other insects with complete metamorphosis or hard bodies.

Similar to other horticultural oils, pesticides listing neem oil as the only active ingredient can be expected to kill soft-bodied arthropods (aphids, scales, psyllids, lace bugs, whiteflies, thrips, spider mites) and some plant pathogens

(such as powdery and downy mildews), but may also be associated with small-scale fumigant activity. Good coverage of infested plant surfaces is essential.

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*Bacillus thuringiensis ssp. israelensis* is the most common of these products on store shelves. Mosquito Bits and Gnatrol are common trade names. Bti is a bacterial byproduct that kills flies and is related to *B. thuringiensis ssp. kurstaki* products available for caterpillar control, but Bti is toxic only to fly larvae such as mosquitoes, crane flies, and fungus gnats. Repeat applications are often needed for long-term control.

Nematode products must be refrigerated and have a short shelf life so many stores don't carry them, but some stores provide customers with a mail-order voucher to obtain fresh products. There are several species of insect attacking nematodes, and it is important to use the correct species. *Steinernema feltia* is the most effective commercially available species for managing fungus gnats. Nematodes are mixed with water and applied as a soil drench. Nematodes reproduce and search for hosts so they

may provide longer-term control after several applications when soil is moist and temperatures are warm.

For more information on fungus gnats and their management see Pest Notes: *Fungus Gnats*. It is available at <http://www.ipm.ucanr.edu/PMG/PESTNOTES/pn7448.html>.

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Figure 3. Shiny trails left by fungus gnat larvae on the soil surface of a plant pot.

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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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**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.