PSYLLIDS

Integrated Pest Management for Landscape Professionals and Home Gardeners

Psyllids resemble miniature cicadas and are sometimes called jumping plantlice. Over 100 species occur on both native and introduced landscape plants in the United States, but each kind of psyllid feeds on only one plant species or closely related groups of plants. Most psyllids native to the United States are relatively uncommon and rarely become pests. Most pest psyllids in California are exotic species inadvertently introduced from other countries.

IDENTIFICATION AND LIFE CYCLE

Adult females lay eggs that hatch and develop through about five wingless, immature nymphal stages before becoming winged adults. Most pest psyllids in California occur on evergreen plants in mild-climate areas where all life stages may be found year-round. Psyllids become abundant in spring when temperatures warm and host plants produce new growth flushes. One psyllid generation requires only a few weeks during warm weather to complete development from egg to egg. High temperatures may reduce populations of some species.

Adults hold their wings rooflike over their bodies and at maturity are 1/10 to 1/5 inch long (Fig. 1). Psyllids are related to aphids but have strong jumping legs and shorter antennae. Nymphs are flattened and less active than adults. Don't confuse psyllid adults with similar looking but harmless psocids, which feed on fungi, including sooty mold growing on psyllid honeydew. Mature psyllids commonly jump when disturbed, while psocids run or fly away. Psocids have a more narrow "neck" or separation between the head and the thorax and chewing mouthparts, as compared to psyllids, which have tubular, sucking mouthparts. Because several hundred species of psyllids occur just on acacia and eucalyptus in the Australian region, new psyllid species are likely to be introduced into California. Take psyllids you are unable to identify to a Cooperative Extension or agricultural agency expert.

Acacia Psyllid. Acacia psyllid occurs on leaves, terminal shoots, and flower buds of many *Acacia* and *Albizia* species. Adults are green to brownish but often appear darker during cooler weather. The tiny, golden eggs and the orange to green, flattened nymphs are most abundant on the surface of new growth. Up to about eight generations a year are reported in California with the greatest densities in coastal urban regions.

Bluegum Psyllid. At least six species of psyllid occur on eucalyptus in California. The bluegum psyllid infests eucalyptus species that have waxy blue juvenile foliage, such as blue gum (*Eucalyptus globulus*). However, significant damage has largely been limited to foliage of silver-leaved mountain gum, also called baby blue gum (*Eucalyptus pulverulenta*) grown commercially for floral arrangements. Bluegum psyllid adults are grayish. When mating tail-to-tail, pairs may look like a tiny grayish moth unless examined more closely. The pale yellow to cream-colored eggs are laid in crevices between buds and young leaf petioles or openly on young leaves. Young nymphs are orangish, becoming mostly grayish with olive green markings as they mature. Colonies of bluegum psyllids are covered with whitish wax. The insect can have four or more generations per year.

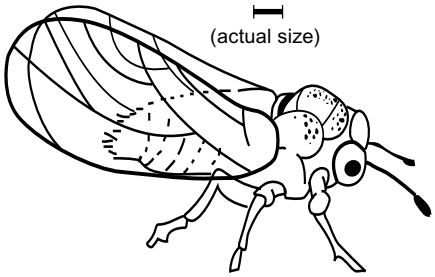

Figure 1. Adult psyllid.

Eugenia Psyllid. Eugenia psyllid occurs primarily on Australian brush cherry or eugenia (*Syzygium paniculatum*). It has also been observed on juvenile foliage of New Zealand Christmas tree (*Metrosideros excelsus*). Adults are mostly dark brown with a white band around the abdomen. Their tiny golden eggs are laid primarily along the edges of young leaves, causing infested leaf margins to glisten in the sun. Nymphs are yellowish with orange-red eyes. Recently hatched first-instar nymphs (called crawlers) settle on new growth and each forms a feeding pit. Settled nymphs resemble a soft scale insect and appear flat when viewed from the lower leaf surface. The upper surface of infested foliage reddens and distorts above these pits. Eugenia psyllid has about three to about five generations a year, depending on temperature and host plant suitability. High populations in California are limited to counties near the coast.

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Peppertree Psyllid. Peppertree psyllid feeds only on the California pepper tree (*Schinus molle*), a plant that despite its common name is native to South America and was introduced into California by Spanish settlers. Adult peppertree psyllids are greenish or tan and somewhat pear shaped. The tiny, translucent, white eggs are deposited on the tender growth of pepper trees. The orangish nymphs feed on young expanding plant growth and the plant forms a pit around where each nymph settled. Infested leaves may become somewhat distorted or crinkled.

Redgum Lerp Psyllid. Redgum lerp psyllid produces conical wax and honeydew coverings called lerps. It severely infests several species of eucalyptus, especially river red gum (*Eucalyptus camaldulensis*). Insecticides have been of limited effectiveness and parasites (*Psyllaephagus bliteus*) are being introduced against this pest, which is discussed in *Pest Notes: Eucalyptus Redgum Lerp Psyllid* (see "References").

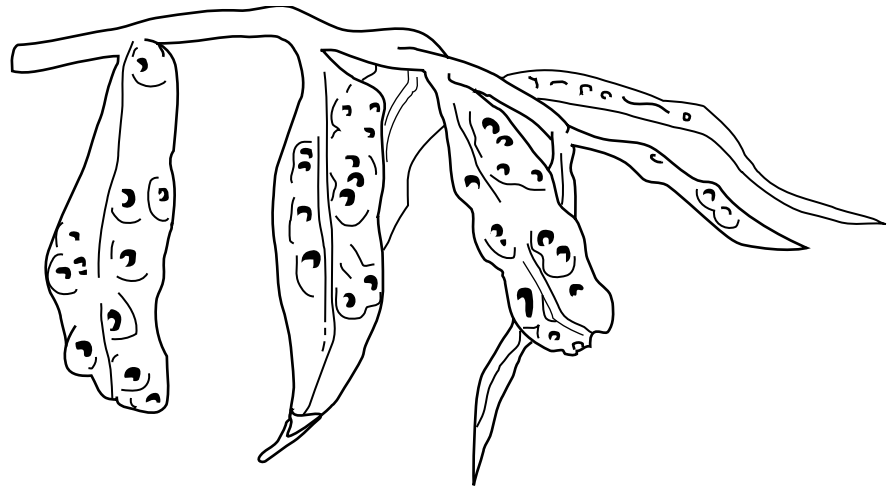

Figure 2. Feeding by psyllid nymphs pits and distorts California pepper tree foliage.

DAMAGE

Psyllids suck plant juices. Some secrete a white wax and all produce honeydew, sometimes in pelletized or crystallized form, on which blackish sooty mold grows. High psyllid populations reduce plant growth or cause terminals to distort, discolor, or die back. High populations of certain species, such as eugenia psyllid, can cause defoliation. A few species cause galls on leaves or buds, for example when psyllid feeding causes the plant to form a pit around where each nymph settles (Fig. 2). Early damage typically occurs on young foliage where most eggs are laid.

Many native California trees and shrubs such as lemonade berry and sugar bush (*Rhus* species), manzanita (*Arctostaphylos*), and willow *(Salix*) that are planted as ornamentals can host native psyllid species. These are hardly ever problems and even if psyllids are abundant, most plants tolerate extensive psyllid feeding. Several gall-making *Pachypsylla* species infesting hackberry (*Celtis*) and the boxwood psyllid (*Psylla buxi*), which occurs only on boxwood (*Buxus*) and causes terminal leaves to become cupped, are pests primarily in the eastern United States. Pear psylla (*Cacopsylla pyricola*), which infests pear fruit trees throughout the United States, is one of the few psyllids that is an agricultural pest (see *Integrated Pest Management for Apples and Pears* or *UC IPM Pest Management Guidelines: Pear*, listed in "References"). In the home landscape, however, it is introduced species of psyllids that are mainly a problem on introduced species of plants.

MANAGEMENT

Most native species of psyllids require no management; even when populations are abundant, plants can tolerate substantial feeding and psyllid populations will decline naturally. The bluegum psyllid, and in many situations the peppertree psyllid, are under effective biological control and require no management except to conserve natural enemies. Parasites are being introduced for the redgum lerp psyllid, but this species and psyllids that infest acacia and eugenia may warrant a more comprehensive management program than just reliance on biological control. If control is necessary, use an integrated program incorporating appropriate plant care, conservation of natural enemies, and where feasible the use of least-toxic insecticides. No treatment restores damaged foliage; it remains distorted until trimmed or replaced by new growth.

Because psyllid damage is primarily aesthetic, tolerance varies among people and with the species and location of plants. Determine the level of damage you are willing to tolerate. Monitor adult psyllids before damage becomes evident and record the numbers of adults present on a weekly basis. During subsequent seasons take control action, if necessary, when populations or damage approach the levels that you previously found to be intolerable. Keep in mind that foliar damage is primarily caused by nymphs, but sprays are aimed at killing eggs or newly hatched nymphs before the damage occurs, which is why the adults are monitored. Therefore, a decision to spray should be based on the numbers of adults infesting the plants several weeks before damage from nymphs becomes intolerable.

Monitoring

Yellow sticky traps are the best way to monitor psyllids infesting eucalyptus and eugenia. Yellow sticky traps are available from most well-stocked garden supply stores or they can be homemade by painting clear plastic disks, such as 4-inch-diameter cottage cheese

container lids, with fluorescent or bright yellow paint (e.g., Rustoleum Yellow No. 659). Coat the bright yellow surface of homemade traps with a thin film of STP motor oil additive, which is viscous enough to snare adult psyllids but generally allows larger, stronger insects to escape. Other coatings include clear polybutene sticky material (e.g., Stikem, Tanglefoot) or an adhesive that can be made from one part petroleum jelly (e.g., Vaseline) or mineral oil mixed with one part household detergent. In hot weather, however, the adhesive made from petroleum jelly may drip off the traps unless it is applied thinly. As an alternative to directly coating the yellow surface, place sticky material on separate removable layers of clear plastic sandwiched over the yellow surface.

Adult psyllids and psyllid parasites are attracted to the yellow color and become stuck to the surface. (Consult the online version of this publication at www.ipm.ucdavis.edu for color photographs of the parasites.) Inspect the traps once each week and count (or estimate) and record the number of adult psyllids and their parasites. Following each count, remove the trapped insects from the trap by scrapping them off. Periodic cleaning or replacement of traps is essential to maintain the sticky surface.

Adult psyllids can also be monitored by shaking or tapping plants over a collecting surface to knock them onto the collecting surface where they can be easily seen and counted. The collecting surface can be a special beating tray, sheet, or a clipboard with a white sheet of paper that is held beneath the beaten branch. Shake the plant or sharply tap foliage two or three times and count and record the number of live psyllid adults and their parasites that you see on the collection surface. Do this on two or three different portions of two or more representative plants. Sample about once each week during the season when psyllid adults or new growth are expected. Shaking or beat monitoring may be best for acacia psyllid because it also monitors important psyllid predators (described below).

In addition to the adult psyllids present, keep a close watch on the number of new growing tips on a plant and on their general rate of growth. You may discover an annual cycle to psyllid abundance; population increases are typically associated with the availability of tender new growth. Conversely, the presence of large numbers of psyllid adults may be no cause for concern when a growth flush is nearing its end; the same number of adults observed when a plant is weak or growing poorly might warrant closer attention.

Cultural Control

Avoid excess irrigation and do not fertilize established woody plants unless foliage appearance or plant growth is unsatisfactory because of a confirmed nutrient deficiency. Most nutrient deficiency symptoms are caused by poor root health (such as infection by fungal pathogens) or improper soil conditions (such as inappropriate soil pH, inadequate drainage, and excess irrigation). These adverse root conditions cause unhealthy looking foliage even when nutrient levels in soils are sufficient for plants; adding fertilizer will not remedy these problems. Irrigating appropriately and avoiding fertilization discourages the excessive succulent foliage that promotes increased populations of phloem-sucking insects such as psyllids.

Except as discussed below for eugenia psyllid, minimize shearing or pruning of terminals. Shearing to provide a smooth, dense canopy surface for ornamental purposes (such as formal hedging or topiary pruning) stimulates new growth, which is preferred by psyllids.

Avoid planting susceptible species and consider replacing problem-prone plants. Some people consider extensive planting of eucalyptus to be undesirable and recommend alternative plants (such as California natives), especially since the recent introduction of several eucalyptus pests (for example, see *Pest Notes* on eucalyptus longhorned borers and redgum lerp psyllid, listed in "References"). Consider planting acacia species that are rarely or lightly infested with acacia psyllid (Table 1). Australian willow myrtle or peppermint tree (*Agonis flexuosa*), desert willow (*Pittosporum phillyraeoides*), and Australian willow (*Geijera parviflora*) are relatively drought-tolerant and have a weeping appearance that resembles pepper tree but they are not affected by the peppertree psyllid.

Biological Control

Natural enemies, including lady beetles, lacewing larvae, small preda-

Table 1. Species of Acacia and Albizia that are Lightly or Rarely Infested by Acacia Psyllid.

***Acacia* species**
adansonii, albida, aneura, arabica, armata, aroma, aspera, baileyana[1]*, bonariensis, brachystachya, caffra, calamifolia, cambagii, congesta, crassiuscula, cyanophylla, dealbata, deanii, dentifera, diffusa, drummondii, flexifolia, giraffae, horrida, howittii, karroo, kempeana, latifolia, linearis, lineata, linophylla, nealii, nerifolia, oswaldii, oxycedrus, pennata, plumosa, podalyriifolia, salicina, spirocarpa, verticillata, vestita, visco, woodii*

***Albizia* species**
fastigiata, odoratissima, polyphylla

[1] Susceptible to the baileyana psyllid, *Acizzia acaciaebaileyanae*.
Sources: Koehler, C. 1973. *Albizia Psyllid on Acacia and Albizia.* Hayward, CA: Univ. Calf. Coop. Exten. Alameda Co.; Koehler, C. S., W. S. Moore, and B. Coate. 1983. Resistance of acacia to acacia psyllid, *Psylla uncatoides. J. Environ. Hort.* 1: 65-67.

ceous bugs, and parasitic wasps, which attack only certain psyllids, provide at least partial control of all the psyllids discussed here. Conserve psyllid natural enemies by using appropriate cultural practices and only low toxicity, short-persistence pesticides or, whenever possible, inject insecticides instead of spraying if direct control action is needed. The introduced species of natural enemies now occur naturally throughout California; they are not available commercially for purchase and release.

Acacia Psyllid. Acacia psyllid populations have been greatly reduced by a 1/16-inch-long black lady beetle (*Diomus pumilio*) introduced from Australia, a 1/7-inch-long purplish pirate bug (*Anthocoris nemoralis*) from Europe, and several native predators, including brown lacewings (*Hemerobius* species). Acacia psyllid populations in the San Francisco Bay area typically decline dramatically during June and July after predators become abundant. However, this biological control may not be effective until some lag time after weather warms in spring and psyllid populations have increased; in northern California this is typically during April and May. Tolerate psyllids for several weeks and conserve natural enemies until predators provide control. Alternatively, temporarily reduce high populations by thoroughly covering new outer and upper canopy acacia growth with low toxicity insecticides such as oil or soap as discussed below. To entirely eliminate the problem, consider replacing susceptible plants with other appropriate species, such as acacias or albizias, which are not preferred by acacia psyllid (Table 1).

Bluegum Psyllid. The bluegum psyllid is effectively controlled by a tiny parasitic wasp (*Psyllaephagus pilosus*) that attacks only bluegum psyllid. Most bluegum psyllids will develop into puffy, brownish mummies, each containing a parasite that killed the psyllid. When bluegum psyllids are observed, avoid spraying pesticides that can disrupt biological control. No control is needed other than conserving parasites.

Eugenia Psyllid. Eugenia psyllid is partially controlled by an introduced *Tamarixia* species of parasitic wasps. However, especially in cooler areas near the California coast, parasite populations often do not increase quickly enough in spring to provide satisfactory control. Regular shearing of new growth provides substantial control by removing psyllid eggs and nymphs. Well-timed pruning in combination with parasite conservation can be especially effective in managing psyllids infesting eugenia topiary plantings.

Where pruning or other control methods are planned, inspect plants regularly for new growth, beginning in spring. Also consider regular monitoring for adult psyllids, especially when managing many eugenias. Prune terminals after maximum spring growth appears or about 3 weeks after the first peak in adult psyllid density, which is determined by using sticky traps and counting and recording the number of adult psyllids on a weekly basis as discussed in "Monitoring." Leave eugenia clippings as mulch near the shrubs for at least 3 weeks to allow parasites within psyllid nymphs to complete their development and emerge (Fig. 3). Eugenia psyllid eggs and nymphs on the cut foliage will die. Consider shearing eugenia tips at about 3-week intervals (and leaving clippings on-site) throughout the period of new plant growth or as long as adult psyllids are abundant. In addition to providing direct control, shearing terminals is the only way of eliminating damaged foliage (aside from waiting for old leaves to drop). No pesticide or other treatment will restore pitted foliage to a healthy appearance.

Peppertree Psyllid. Peppertree psyllids are partially controlled, often satisfactorily, by an introduced *Tamarixia* species of parasitic wasp that is different from the one that was introduced for eugenia psyllid. No additional control is required in many situations. Moderate psyllid damage is often tolerable in part because peppertree psyllid produces relatively little honeydew. The pepper tree also has finely divided leaves, and foliage distortion by psyllids can easily be overlooked, especially on branches above eye-level. Improving soil conditions and cultural practices are usually much more important methods of improving pepper tree health than taking control measures for psyllids. Pepper trees are adapted to well-drained, sandy soil, and summer drought. Planting trees in heavy clay soils or in summer-watered landscapes, such as lawns, promotes root disease and causes trees to decline and die. Improve soil drainage and remove irrigated landscape from near

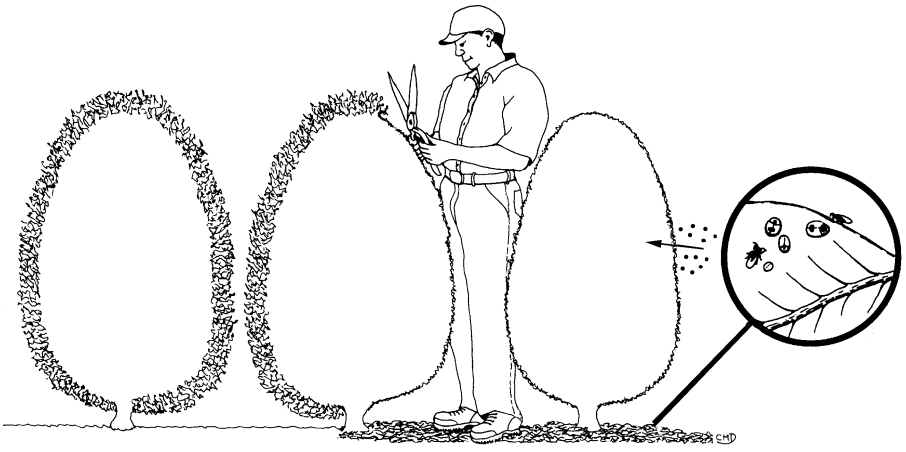

Figure 3. Leave clippings from eugenia bushes as mulch on the ground for at least 3 weeks to allow parasites to complete their development and return to the shrubs where they lay eggs that parasitize other psyllid nymphs.

trunks to improve pepper tree health and increase pepper trees' ability to tolerate psyllids.

Chemical Control

Because beneficials often do not become abundant until after psyllids are common and weather has warmed, supplemental control may be desired in certain situations. However, psyllids are difficult to control effectively with insecticides because they reproduce year-round in much of California and can infest large plants or those with dense canopies, which prevents good spray coverage. Limit use of insecticides to situations where psyllids and their damage cannot be tolerated. In the case of redgum lerp psyllid, pesticides believed to be the most effective against this pest (systemic insecticides) can be of limited and variable effectiveness, especially if trees are stressed or already heavily damaged.

Azadirachtin (Azatin, Neemazad), neem oil, insecticidal soap (potassium salts of fatty acids), and horticultural oil (an insecticide labeled narrow range, superior, or supreme oil) can provide temporary control of psyllids that are directly contacted by the spray. Infested new growth must be thoroughly covered with the insecticide spray. The low toxicity and short-persistence of these "organically acceptable" materials does not kill natural enemies that migrate in after the spray has dried, so application of these materials early in the season before natural enemies buildup on (and migrate from) nearby unsprayed plants is compatible with later-season biological control. However, an additional treatment may be necessary within several weeks if psyllid populations rebound and the plants produce a new growth flush.

Time an insecticide application to kill eggs and young nymphs before damage or psyllids become abundant. Monitor when susceptible new growth or adult psyllids or both become abundant as discussed in "Monitoring." Treat soon after a sharp increase in adult numbers is observed on sticky traps or in beat samples, or when significant numbers of eggs are observed on leaves and shoots. Continue monitoring after treatment. If natural enemies as well as psyllids become abundant, delay reapplication and monitor again later to determine if populations have declined and spraying can be avoided.

Systemic insecticides are the most practical, effective materials for controlling psyllids that infest large trees. Some are available only to licensed pesticide applicators, and generally only professionals have the equipment and experience to apply them effectively to large trees. Systemic insecticides for psyllid control include the organophosphate acephate (Orthene) and the chloronicotinyl insecticide imidacloprid (Marathon and Merit for licensed applicators and Bayer Advanced Garden Tree and Shrub Insect Control Concentrate for home gardeners). Imidacloprid has the advantage of being formulated into a product that can be applied to soil, thus avoiding the plant injury that occurs when trunks are injected or implanted with insecticide. Unlike spraying insecticides onto the plant foliage, soil applications avoid killing natural enemies. The microbial abamectin (Avid) can be injected into trees or sprayed on foliage by licensed applicators. Abamectin is effective against pear psylla, but its effectiveness against psyllid species that infest ornamentals is uncertain.

Carbamates (e.g., carbaryl), nonsystemic organophosphates (malathion), and pyrethroids (fluvalinate, permethrin) also can be applied, but these insecticides are not recommended. They generally are not as effective in controlling psyllids as the systemic materials discussed above, and spraying them kills many important natural enemies.

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