

WHITEFLIES

Integrated Pest Management for Home Gardeners and Professional Landscapers

Whiteflies are tiny, sap-sucking insects that are frequently abundant in vegetable and ornamental plantings. They excrete sticky honeydew and cause yellowing or death of leaves. Outbreaks often occur when the natural biological control is disrupted. Management is difficult.

IDENTIFICATION AND LIFE CYCLE

Whiteflies usually occur in groups on the undersides of leaves. They derive their name from the mealy, white wax covering the adult's wings and body. Adults are tiny insects with yellowish bodies and whitish wings. Although adults of some species have distinctive wing markings, many species are most readily distinguished in the last nymphal (immature) stage, which is wingless (Table 1).

Whiteflies develop rapidly in warm weather, and populations can build up quickly in situations where natural enemies are destroyed and weather is favorable. Most whiteflies, especially the most common pest species—greenhouse whitefly (*Trialeurodes vaporariorum*) and silverleaf or sweetpotato whiteflies (*Bemisia* species)—have a wide host range that includes many weeds and crops. In many parts of California, they breed all year, moving from one host to another as plants are harvested or dry up.

Whiteflies normally lay their tiny, oblong eggs on the undersides of leaves. The eggs hatch, and the young whiteflies gradually increase in size through four nymphal stages called instars (Fig. 1). The first nymphal stage (crawler) is

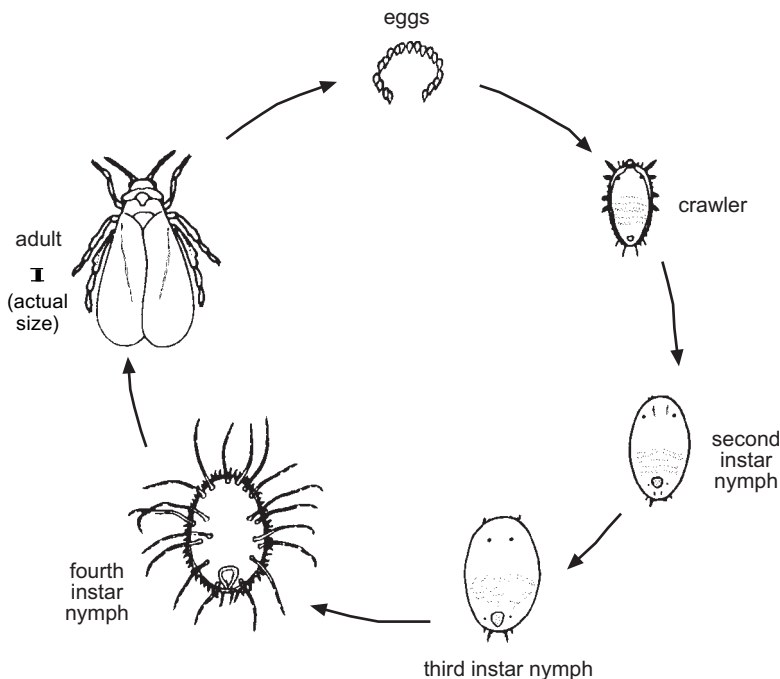


Figure 1. Greenhouse whitefly life cycle.

barely visible even with a hand lens. The crawlers move around for several hours, then settle and remain immobile. Later nymphal stages are oval and flattened like small scale insects. The legs and antennae are greatly reduced, and older nymphs do not move. The winged adult emerges from the last nymphal stage (for convenience sometimes called a pupa). All stages feed by sucking plant juices from leaves and excreting excess liquid as drops of honeydew as they feed.

Table 1 lists common whiteflies in California gardens and landscapes.

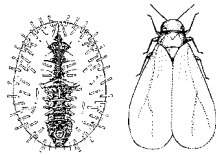
DAMAGE

Whiteflies suck phloem sap. Large populations can cause leaves to turn yellow, appear dry, or fall off plants. Like aphids, whiteflies excrete honeydew, so leaves may be sticky or covered with black sooty mold. The honeydew attracts ants, which interfere with the activities of natural enemies that may control whiteflies and other pests.

Feeding by the immature silverleaf whitefly, *Bemisia argentifolii*, can cause plant distortion, discoloration, or silverying of leaves and may cause serious

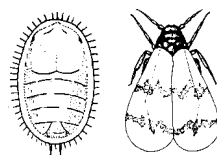
Table 1. Major Economic Hosts of Some Common Whiteflies.

Ash whitefly
(*Siphoninus phillyreae*)



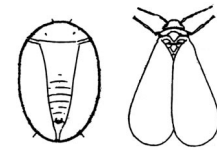
Host plants: many broadleaved trees and shrubs including ash, citrus, Bradford pear and other flowering fruit trees, pomegranate, redbud, toyon
Characteristics: Fourth-instar nymphs have a very thick band of wax down the back and a fringe of tiny tubes, each with a liquid droplet at the end. Adults are white.

Bandedwinged whitefly
(*Trialeurodes abutilonea*)



Host plants: very broad including cotton, cucurbits, other vegetables
Characteristics: Fourth-instar nymphs have short, waxy filaments around their edges. Adults have brownish bands across the wings, and their body is gray.

Citrus whitefly
(*Dialeurodes citri*)

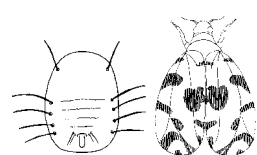


Host plants: citrus, gardenia, ash, ficus, pomegranate
Characteristics: Fourth-instar nymphs have no fringe around their edges but have a distinctive Y-shape on their backs. Adults are white.

Crown whitefly
(*Aleuroplatus coronata*)

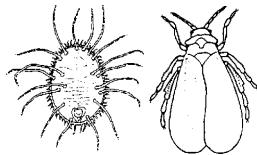
Host plants: oak, chestnut
Characteristics: Fourth-instar nymphs are black with large amounts of white wax arranged in a crownlike pattern. Adults are white.

Giant whitefly
(*Aleurodicus dugesii*)



Host plants: begonia, hibiscus, giant bird of paradise, orchid tree, banana, mulberry, vegetables, and many ornamentals; currently only in Southern California
Characteristics: Adults are up to 0.19 inch long. They leave spirals of wax on leaves. Nymphs have long filaments of wax that can be up to 2 inches long and give leaves a bearded appearance. For more information, see *Pest Notes: Giant Whitefly*, listed in References.

Greenhouse whitefly
(*Trialeurodes vaporariorum*)



Host plants: very broad including most vegetables and herbaceous ornamentals
Characteristics: Fourth-instar nymphs have very long waxy filaments and a marginal fringe. Adults have white wings and a yellow surface or substrate.

Iris whitefly
(*Aleyrodes spiraeoides*)

Host plants: iris, gladiolus, many vegetables, cotton and other herbaceous plants
Characteristics: Fourth-instar nymphs have no fringe or waxy filaments but are located near distinctive circles of wax where egg laying took place. Adults have a dot on each wing and are quite waxy.

losses in some vegetable crops. Some whiteflies transmit viruses to certain vegetable crops. With the notable exception of the citrus whitefly, whiteflies are not normally a problem in fruit trees, but several whiteflies can be problems on ornamental trees (see Table 1). Low levels of whiteflies are not usually damaging. Adults by themselves will not cause significant damage unless they are transmitting a plant pathogen. Generally, plant losses do not occur unless there is a significant population of whitefly nymphs.

MANAGEMENT

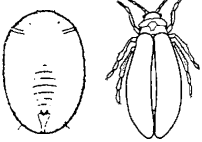
Management of heavy whitefly infestations is very difficult. Whiteflies are not well controlled with any available insecticides. The best strategy is to prevent problems from developing in your garden to the extent possible. In many situations, natural enemies will provide adequate control of whiteflies; outbreaks may occur if natural enemies that provide biological control of whiteflies are disrupted by insecticide applications, dusty conditions, or interference by ants. Avoid or remove plants that repeatedly host high populations of whiteflies. In gardens, whitefly populations in the early stages of population development can be held down by a vigilant program of removing infested leaves, vacuuming adults, or hosing down (syringing) with water sprays. Aluminum foil or reflective mulches can repel whiteflies from vegetable gardens and sticky traps can be used to monitor or, at high levels, reduce whitefly numbers. If you choose to use insecticides, insecticidal soaps or oils such as neem oil may reduce but not eliminate populations.

Biological Control

Whiteflies have many natural enemies, and outbreaks frequently occur when these natural enemies have been disturbed or destroyed by pesticides, dust buildup, or other factors. General predators include lacewings, bigeyed bugs, and minute pirate bugs. Several small lady beetles including *Clitostethus arcuatus* (on ash whitefly) and scale predators such as *Scymnus* or *Chilocorus* species, and the Asian multi-

Continued on next page

Table 1, continued. Major Economic Hosts of Some Common Whiteflies.

<p>Mulberry whitefly (<i>Tetraleurodes mori</i>)</p>	<p>Host plants: citrus, other trees Characteristics: Nymphs have blackish, oval bodies with white, waxy fringe.</p>
<p>Silverleaf and sweetpotato whiteflies (<i>Bemisia argentifolii</i> and <i>B. tabaci</i>)</p>	<p>Host plants: very broad including many herbaceous and some woody plants such as cotton, cucurbits, tomatoes, peppers, lantana, cole crops, and hibiscus Characteristics: Fourth-instar nymphs have no waxy filaments or marginal fringe. Adults have white wings and yellow body; they hold their wings slightly tilted to surface or substrate.</p>
	
<p>Woolly whitefly (<i>Aleurothrixus floccosus</i>)</p>	<p>Host plants: citrus, eugenia Characteristics: Nymphs are covered with fluffy, waxy filaments.</p>

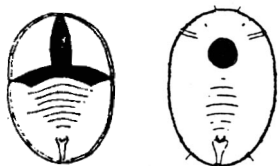


Figure 2. Look at empty nymphal cases to detect parasitism: a healthy adult whitefly emerged from the T-shaped hole in the mature nymph on the left, whereas an adult parasite emerged from the round hole on the right.

colored lady beetle, *Harmonia axyridis*, feed on whiteflies. Whiteflies have a number of naturally occurring parasites that can be very important in controlling some species. *Encarsia* spp. parasites are commercially available for release in greenhouse situations; however, they are not generally recommended for outdoor use because they are not well adapted for survival in temperate zones. An exception is the use of parasite releases for bayberry whitefly in citrus in southern California. You can evaluate the degree of natural parasitization in your plants by checking empty whitefly pupal cases. Those that were parasitized will have round or oval exit holes and those from which a healthy adult whitefly emerged will have a T-shaped exit hole (Fig. 2). Whitefly nymphs can sometimes be checked for parasitization before emergence by noting a darkening in their color. However, some

whitefly parasites do not turn hosts black and many whitefly nymphs that occur on ornamentals are black in their unparasitized state.

Avoiding the use of insecticides that kill natural enemies is a very important aspect of whitefly management. Products containing carbaryl, pyrethroids, diazinon or foliar sprays of imidacloprid can be particularly disruptive. Control of dust and ants, which protect whiteflies from their natural enemies, can also be important, especially in citrus or other trees.

Removal

Hand-removal of leaves heavily infested with the nonmobile nymphal and pupal stages may reduce populations to levels that natural enemies can contain. Water sprays (syringing) may also be useful in dislodging adults.

A small, hand-held, battery-operated vacuum cleaner has also been recommended for vacuuming adults off leaves. Vacuum in the early morning or other times when it is cool and whiteflies are sluggish. Kill vacuumed insects by placing the vacuum bag in a plastic bag and freezing it overnight. Contents may be disposed of the next day.

Mulches

Aluminum foil or reflective plastic mulches can repel whiteflies, especially

away from small plants. Aluminum-coated construction paper is available in rolls from Reynolds Aluminum Company. Alternatively, you can spray clear plastic mulch with silver paint. Reflective plastic mulches are also available in many garden stores.

To put a mulch in your garden, first remove all weeds. Place the mulch on the plant beds and bury the edges with soil to hold them down. After the mulch is in place, cut 3- to 4-inch diameter holes and plant several seeds or single transplants in each one. You may furrow irrigate or sprinkle your beds if you use aluminum-coated construction paper or other porous mulch; the mulch is sturdy enough to tolerate sprinkling. Plastic mulches will require drip irrigation. In addition to repelling whiteflies, aphids, and leafhoppers, the mulch will enhance crop growth and control weeds. Mulches have been shown to deter the transmission of viruses in commercial vegetable crops. When summertime temperatures get high, however, remove mulches to prevent overheating plants.

Traps

In vegetable gardens, yellow sticky traps can be posted around the garden to trap adults. Such traps won't eliminate damaging populations but may reduce them somewhat as a component of an integrated management program relying on multiple tactics. Whiteflies do not fly very far, so many traps may be needed. You may need as many as one trap for every two large plants, with the sticky yellow part of the trap level with the whitefly infestation. Place traps so the sticky side faces plants but is out of direct sunlight.

Commercial traps are commonly available, or you can make traps out of ¼-inch plywood or masonite board, painted bright yellow and mounted on pointed wooden stakes that can be driven into the soil close to the plants that are to be protected. Although commercially available sticky substrates such as Stickem or Tanglefoot are commonly used as coatings for the traps, you might want to try to make your

own adhesive from one-part petroleum jelly or mineral oil and one-part household detergent. This material can be cleaned off boards easily with soap and water, whereas a commercial solvent must be used to remove the other adhesives. Periodic cleaning is essential to remove insects and debris from the boards and maintain the sticky surface.

Insecticide Sprays

Insecticides have only a limited effect on whiteflies. Most kill only those whiteflies that come in direct contact with them. For particularly troublesome situations, try insecticidal soap or

an insecticidal oil such as neem oil or narrow-range oil. Because these products only kill whitefly nymphs that are directly sprayed, plants must be thoroughly covered with the spray solution. Be sure to cover undersides of all infested leaves; usually these are the lowest leaves and the most difficult to reach. Use soaps when plants are not drought-stressed and when temperatures are under 80°F to prevent possible damage to plants. Avoid using other pesticides to control whiteflies; not only do most of them kill natural enemies, whiteflies quickly build up resistance to them, and most are not very effective in garden situations.

REFERENCES

Bellows, T. S., J. N. Kabashima, and K. Robb. Jan. 2002. *Pest Notes: Giant Whitefly*. Oakland: Univ. Calif. Agric. Nat. Res. Publ. 7400. Also available online at <http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7400.html>

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For more information contact the University of California Cooperative Extension or agricultural commissioner's office in your county. See your phone book for addresses and phone numbers.

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WARNING ON THE USE OF CHEMICALS

Pesticides are poisonous. Always read and carefully follow all precautions and safety recommendations given on the container label. Store all chemicals in the original labeled containers in a locked cabinet or shed, away from food or feeds, and out of the reach of children, unauthorized persons, pets, and livestock.

Confine chemicals to the property being treated. Avoid drift onto neighboring properties, especially gardens containing fruits or vegetables ready to be picked.

Do not place containers containing pesticide in the trash nor pour pesticides down sink or toilet. Either use the pesticide according to the label or take unwanted pesticides to a Household Hazardous Waste Collection site. Contact your county agricultural commissioner for additional information on safe container disposal and for the location of the Household Hazardous Waste Collection site nearest you. Dispose of empty containers by following label directions. Never reuse or burn the containers or dispose of them in such a manner that they may contaminate water supplies or natural waterways.

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