

APHIDS

Integrated Pest Management for Home Gardeners and Landscape Professionals

Aphids are small, soft-bodied insects with long, slender mouth parts that they use to pierce stems, leaves, and other tender plant parts and suck out plant fluids. Almost every plant has one or more aphid species that occasionally feeds on it. Many aphid species are difficult to distinguish; however, identification to species is not necessary to control them in most situations.

IDENTIFICATION

Aphids may be green, yellow, brown, red, or black depending on the species and the plants they feed on. A few species appear waxy or woolly due to the secretion of a waxy white or gray substance over their body surface. All are small, pear-shaped insects with long legs and antennae (Fig. 1). Most species have a pair of tubelike structures called cornicles projecting backwards out of the hind end of their bodies. The presence of cornicles distinguishes aphids from all other insects.

Generally adult aphids are wingless, but most species also occur in winged forms, especially when populations are high or during spring and fall. The ability to produce winged individuals provides the pest with a way to disperse to other plants when the quality of the food source deteriorates.

Although they may be found singly, aphids often feed in dense groups on leaves or stems. Unlike leafhoppers, plant bugs, and certain other insects that might be confused with them, most aphids do not move rapidly when disturbed.

LIFE CYCLE

Aphids have many generations a year (Fig. 2). Most aphids in California's

mild climate reproduce asexually throughout most or all of the year with adult females giving birth to live offspring (often as many as 12 per day) without mating. Young aphids are called nymphs. They molt, shedding their skins about four times before becoming adults. There is no pupal stage. Some species mate and produce eggs in fall or winter, which provides them a more hardy stage to survive harsh weather. In some cases, these eggs are laid on an alternative host, usually a perennial plant, for winter survival.

When the weather is warm, many species of aphids can develop from newborn nymph to reproducing adult in 7 to 8 days. Because each adult aphid can produce up to 80 offspring in a matter of a week, aphid populations can increase with great speed.

DAMAGE

Low to moderate numbers of leaf-feeding aphids are usually not damag-

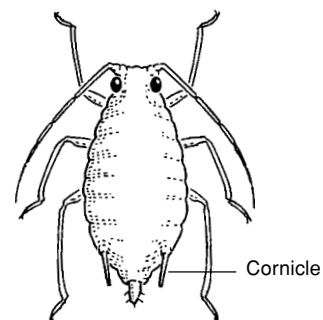


Figure 1. A wingless aphid.

ing in gardens or on trees. However, large populations cause curling, yellowing, and distortion of leaves and stunting of shoots; they can also produce large quantities of a sticky exudate known as honeydew, which often turns black with the growth of a sooty mold fungus. Some aphid species inject a toxin into plants, which further distorts growth. A few species cause gall formations.

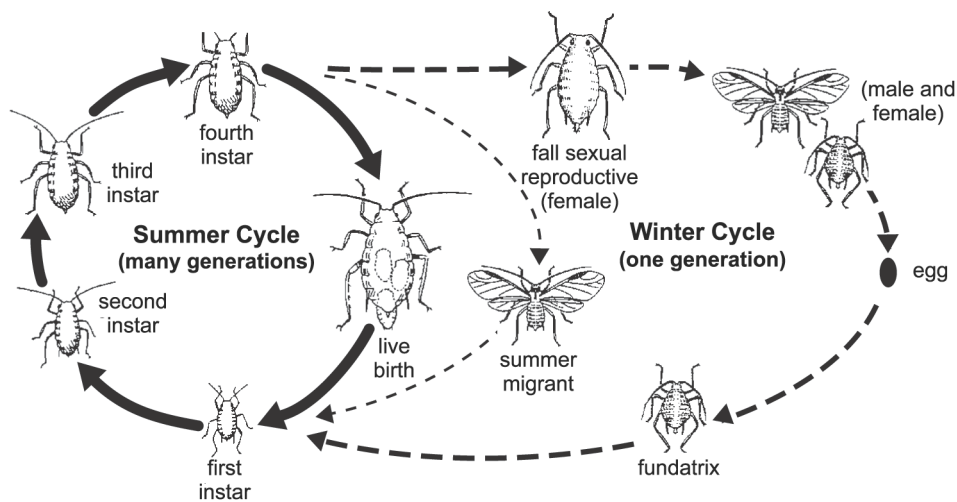


Figure 2. General life cycle of aphids. Asexual reproduction occurs during most of the year (summer cycle). Some aphid species produce a generation of sexual individuals that produce overwintering eggs as shown in the winter cycle.

Aphids may transmit viruses from plant to plant on certain vegetable and ornamental plants. Squashes, cucumbers, pumpkins, melons, beans, potatoes, lettuces, beets, chards, and bok choy are crops that often have aphid-transmitted viruses associated with them. The viruses cause mottling, yellowing, or curling of leaves and stunting of plant growth. Although losses can be great, they are difficult to prevent through the control of aphids because infection occurs even when aphid numbers are very low: it only takes a few minutes for the aphid to transmit the virus while it takes a much longer time to kill the aphid with an insecticide.

A few aphid species attack parts of plants other than leaves and shoots. The lettuce root aphid is a soil dweller that attacks lettuce roots during most of its cycle, causing lettuce plants to wilt and occasionally die if populations are high. The lettuce root aphid overwinters as eggs on poplar trees, where it produces leaf galls in spring and summer. The woolly apple aphid infests woody parts of apple roots and limbs, often near pruning wounds, and can cause overall tree decline if roots are infested for several years.

MANAGEMENT

Although aphids seldom kill a mature plant, the damage and unsightly honeydew they generate sometimes warrant control. Consider the nonchemical controls discussed below; most insecticides, if used, will destroy beneficial insects along with the pest. On mature trees, such as in citrus orchards, aphids and the honeydew they produce can provide a valuable food source for beneficial insects.

Monitoring

Check your plants regularly for aphids—at least twice weekly when plants are growing rapidly. Many species of aphids cause the greatest damage when temperatures are warm but not hot (65° to 80°F). Catch infestations early. Once aphid numbers are high and they have begun to distort and curl leaves, it is often hard to control them because the curled leaves shelter

aphids from insecticides or natural enemies.

Aphids tend to be most prevalent along the upwind edge of the garden and close to other sources of aphids, so make a special effort to check these areas. Many aphid species prefer the undersides of leaves, so turn them over to check them. On trees, clip off leaves from several areas of the tree to check for aphids. Also check for evidence of natural enemies such as lady beetles, lacewings, syrphid fly larvae, and the mummified skins of parasitized aphids. Look for disease-killed aphids as well: they may appear off-color, bloated, or flattened. Substantial numbers of any of these natural control factors can mean that the aphid population may be reduced rapidly without the need for treatment.

Ants are often associated with aphid populations, especially on trees and shrubs, and often are a tip-off that an aphid infestation is present. If you see large numbers of ants climbing up your tree trunks, check for aphids (or other honeydew-producing insects) on limbs and leaves above. To protect their food source, ants ward off many predators and parasites of aphids. Management

of ants is a key component of aphid management and is discussed under cultural controls.

In landscape settings, aphids can be monitored by using water-sensitive paper to measure honeydew dripping from the tree. This type of monitoring is of particular interest where there is a low tolerance for dripping honeydew, such as in groups of trees along city streets or in parks and for tall trees where aphid colonies may be located too high to detect. See Dreistadt et al. (1994) in "Suggested Reading" for more details on honeydew monitoring.

Biological Control

Natural enemies can be very important in the control of aphids, especially in gardens not sprayed with broad-spectrum pesticides (organophosphates, carbamates, and pyrethroids) that kill natural enemy species as well as pests. Usually natural enemy populations do not appear in significant numbers until aphids begin to be numerous.

Among the most important natural enemies are various species of parasitic wasps that lay their eggs inside aphids (Fig. 3). The skin of the parasitized

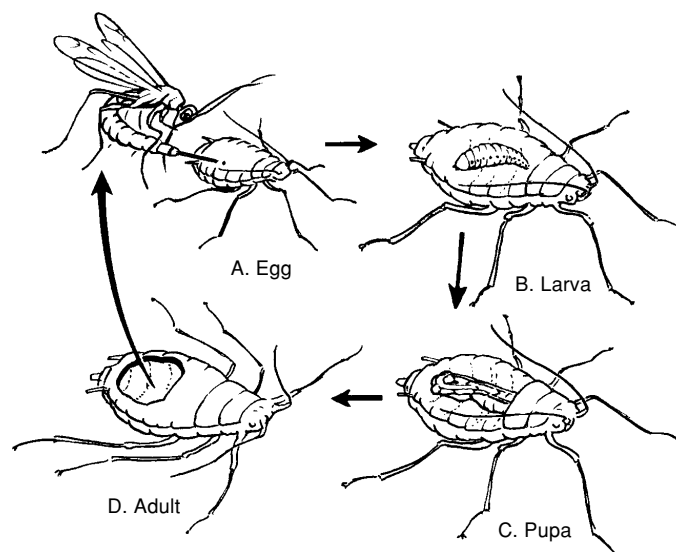


Figure 3. Life cycle of an aphid parasite. A: An adult parasite lays an egg inside a live aphid. B: The egg hatches into a parasite larva that grows as it feeds on the aphid's insides. C: After killing the aphid, the parasite pupates. D: An adult wasp emerges from the dead aphid, then flies off to find and parasitize other aphids.

aphid turns crusty and golden brown, a form called a mummy. The generation time of most parasites is quite short when the weather is warm, so once you begin to see mummies on your plants, the aphid population is likely to be reduced substantially within a week or two.

Many predators also feed on aphids. The most well known are lady beetle adults and larvae, lacewing larvae, and syrphid fly larvae. Naturally occurring predators work best, especially in a small backyard situation. Commercially available lady beetles may give some temporary control when properly handled, although most of them will disperse away from your yard within a few days.

Aphids are very susceptible to fungal diseases when it is humid. Whole colonies of aphids can be killed by these pathogens when conditions are right. Look for dead aphids that have turned reddish or brown; they have a fuzzy, shriveled texture unlike the shiny, bloated, tan-colored mummies that form when aphids are parasitized.

Weather can also impact aphids. Populations of many species are reduced by summer heat in the Central Valley and desert areas, and aphid activity is also limited during the coldest part of the year. However, some aphids may be active year round, especially in the milder, central coastal areas of California.

Cultural Control

Before planting vegetables, check surrounding areas for sources of aphids and remove them. Aphids often build up on weeds such as sowthistle and mustards, moving onto crop seedlings after they emerge. Check transplants for aphids and remove them before planting.

Where aphid populations are localized on a few curled leaves or new shoots, the best control may be to prune these areas out and dispose of them. In large trees, some aphids thrive in the dense inner canopy; pruning these areas out can make the habitat less suitable.

In some situations ants tend aphids and feed on the honeydew aphids excrete. At the same time, they protect the aphids from natural enemies. If you see ants crawling up aphid-infested trees or woody plants, put a band of sticky material (Tanglefoot, etc.) around the trunk to prevent ants from getting up. Teflon products, which are too slippery for ants to climb up, have also been used. (Note: Do not apply sticky material directly to the bark of young or thin-barked trees or to trees that have been severely pruned; the material may have phytotoxic effects. Wrap the trunk with fabric tree wrap or duct tape and apply sticky material to the wrap.) Alternatively, ant stakes or baits may be used on the ground to control the ants without affecting the aphids or their natural enemies. Prune out other ant routes such as branches touching buildings, the ground, or other trees.

High levels of nitrogen fertilizer favor aphid reproduction. Never use more nitrogen than necessary. Use less soluble forms of nitrogen and apply it in small portions throughout the season rather than all at once. Or better yet, use a urea-based, time-release formulation (most organic fertilizers can be classified as time-release products as compared to synthetically manufactured fertilizers).

Because many vegetables are primarily susceptible to serious aphid damage during the seedling stage, losses can be reduced by growing seedlings under protective covers in the garden, in a greenhouse, or inside and then transplanting them when they are older and more tolerant of aphid feeding. Protective covers will also prevent transmission of aphid-borne viruses.

Aluminum foil mulches have been successfully used to reduce transmission of aphid-borne viruses in summer squashes, melons, and other susceptible vegetables. They repel invading aphid populations, reducing numbers on seedlings and small plants. Another benefit is that yields of vegetables grown on aluminum foil mulches are usually increased by the greater

amount of solar energy reflecting on leaves.

To put an aluminum mulch in your garden, remove all weeds and cover beds with aluminum-coated construction paper, which is available in rolls from Reynolds Aluminum Company. Bury the edges of the paper with soil to hold them down. After the mulch is in place, cut or burn 3- to 4-inch diameter holes and plant several seeds or single transplants in each one. You may furrow irrigate or sprinkle your beds; the mulch is sturdy enough to tolerate sprinkling. In addition to repelling aphids, leafhoppers, and some other insects, the mulch will enhance crop growth and control weeds. When summertime temperatures get high, however, remove mulches to prevent overheating plants. An alternative to aluminum-coated construction paper is to spray clear plastic mulch with silver paint. Reflective plastic mulches are also available in many garden stores.

Another way to reduce aphid populations on sturdy plants is to knock them off with a strong spray of water. Most dislodged aphids will not be able to return to the plant, and their honeydew will be washed off as well. Using water sprays early in the day allows plants to dry off rapidly in the sun and be less susceptible to fungal diseases.

Chemical Control

Insecticidal soap, neem oil, and narrow-range oil (e.g., supreme or superior parafin-type oil) provide temporary control if applied to thoroughly cover infested foliage. To get thorough coverage, spray these materials with a high volume of water and target the underside of leaves as well as the top. Soaps, neem oil, and narrow range oil only kill aphids present on the day they are sprayed, so applications may need to be repeated. Predators and parasites often become abundant only after aphids are numerous, so applying nonpersistent insecticides like soap or oil may provide more effective long-term control. Although these materials do kill natural enemies that are present on the plant and hit by the spray, because they leave no toxic residue, they

do not kill natural enemies that migrate in after the spray. These and other insecticides with only contact activity are generally ineffective in preventing damage from aphids such as the woolly apple aphid or the woolly ash aphid that are protected by galls or distorted foliage. Do not use soaps or oils on water-stressed plants or when the temperature exceeds 90°F. These materials may be phytotoxic to some plants, so check labels and test them out on a portion of the foliage several days before applying a full treatment.

Supreme- or superior-type oils will kill overwintering eggs of aphids on fruit trees if applied as a delayed dormant application just as eggs are beginning to hatch in early spring. These treatments will not give complete control of aphids and are probably not justified for aphid control alone. Earlier applications will not control aphids. Common aphid species controlled include the woolly apple aphid, green apple aphid, rosy apple aphid, mealy plum aphid, and black cherry aphid.

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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ILLUSTRATIONS: Figs. 1 and 2: *Pests of the Garden and Small Farm*, UC DANR Publ. 3332; Fig. 3: *Natural Enemies Handbook*, UC DANR Publ. 3386.

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To simplify information, trade names of products have been used. No endorsement of named products is intended, nor is criticism implied of similar products that are not mentioned.

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Many other insecticides are available to control aphids in the home garden and landscape, including foliar-applied formulations of malathion, permethrin and acephate (nonfood crops only). While these materials may kill higher numbers of aphids than soaps and oils, their use should be limited because they also kill the natural enemies that provide long-term control of aphids and other pests. Repeated applications of these materials may also result in the development of resistance to the material by the aphid. Insecticides such as oils and soaps are also safer to use when children and pets may be present. Formulations combining insecticidal soaps and pyrethrins may provide slightly more knockdown than soaps alone, yet have fewer negative impacts on natural enemies than malathion, permethrin, and acephate, because pyrethrins break down very quickly. Avoid the use of diazinon and chlorpyrifos; urban garden use of these materials has been identified as a source of pollution in California's creeks and rivers. Carbaryl is not recommended because it is not very effective against aphids. Acephate has systemic activity, which means it moves through leaves, thus it can be effective where aphids are hidden beneath curling foliage. Acephate is not registered for use on food crops in the garden because it can break down to a much more toxic material. The soil-applied systemic pesticide disulfoton is sometimes applied in roses for aphid

control, but it is a highly toxic material to people.

Professional applicators can make soil injections of the systemic insecticide imidacloprid, which is quite effective against aphids infesting large street trees and not very harmful to beneficial soil organisms. Because it takes a substantial time for the product to get from the soil to the growing points of trees, applications must be made up to 2 months before problems are expected.

When considering application of pesticides for aphid control, remember that moderate populations of many aphids attacking leaves of fruit trees or ornamental trees and shrubs do not cause long-term damage. Low populations can be tolerated in most situations and aphids will often disappear when natural enemies or hot temperatures arrive. Often a forceful spray of water or water-soap solution, even on large street trees, when applied with appropriate equipment, will provide sufficient control.

SUGGESTED READING

Dreistadt, S. H., J. K. Clark, and M. L. Flint. 1994. *Pests of Landscape Trees and Shrubs: An Integrated Pest Management Guide*. Oakland: Univ. Calif. Agric. Nat. Res. Publ. 3359.

Flint, M. L. 1999. *Pests of the Garden and Small Farm: A Grower's Guide to Using Less Pesticide*, 2nd ed. Oakland: Univ. Calif. Agric. Nat. Res. Publ. 3332.

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 and/or vegetables ready to be picked.

Dispose of empty containers carefully. Follow label instructions for disposal. Never reuse the containers. Make sure empty containers are not accessible to children or animals. Never dispose of containers where they may contaminate water supplies or natural waterways. Do not pour down sink or toilet. Consult your county agricultural commissioner for correct ways of disposing of excess pesticides. Never burn pesticide containers.

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