

APHIDS

Integrated Pest Management for Home Gardeners and Landscape Professionals

Aphids are small, soft-bodied insects with long slender mouthparts that they use to pierce stems, leaves, and other tender plant parts and suck out fluids. Almost every plant has one or more aphid species that occasionally feed on it. Many aphid species are difficult to distinguish from one another; however, management of most aphid species is similar.

IDENTIFICATION

Aphids have soft pear-shaped bodies with long legs and antennae and 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. Most species have a pair of tubelike structures called cornicles projecting backward out of the hind end of their body. 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 don't move rapidly when disturbed.

LIFE CYCLE

Aphids have many generations a year. Most aphids in California's



Figure 1. Wingless adults and nymphs of the potato aphid.



Figure 2. Woolly apple aphid adults showing waxy coating.

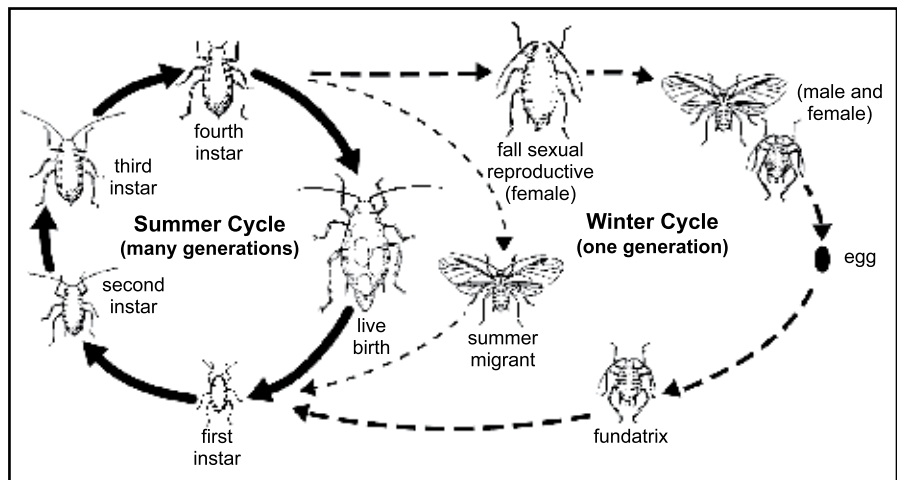


Figure 3. General life cycle of aphids. Asexual reproduction occurs during most of the year (summer cycle). Some aphid species produce a generation of sexual individuals that produce overwintering eggs as shown in the winter cycle.

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 skin about four times before becoming adults. There is no pupal stage. Some species produce sexual forms that mate and produce eggs in fall or winter, providing a more hardy stage to survive harsh weather and the absence of foliage on deciduous plants. In some cases, aphids lay these eggs on an alterna-

tive 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 seven to eight 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 aren't usually damag-

ing in gardens or on trees. However, large populations can turn leaves yellow and stunt shoots; aphids 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 causes leaves to curl and further distorts growth. A few species cause gall formations.

Aphids may transmit viruses from plant to plant on certain vegetable and ornamental plants. Squash, cucumber, pumpkin, melon, bean, potato, lettuce, beet, chard, and bok choy are crops that often have aphid-transmitted viruses associated with them. The viruses mottle, yellow, or curl leaves and stunt plant growth. Although losses can be great, they are difficult to prevent by controlling aphids, because infection occurs even when aphid numbers are very low; it takes only 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 in spring and summer, causing lettuce plants to wilt and occasionally die. In fall, this species often moves to poplar trees, where it overwinters in the egg stage and produces leaf galls in spring. 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. Heavy infestations of crown and root aphids on carrots may weaken tops, causing them to tear off when carrots are harvested.

MANAGEMENT

Although aphids seldom kill a mature plant, the damage they do and unsightly honeydew they generate sometimes warrant control. Consider the nonchemical controls discussed below, as most insecticides will destroy beneficial insects along with the pest. On mature trees, such as in cit-

rus 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 a week when plants are growing rapidly—in order to catch infestations early, so you can knock or hose them off or prune them out. Many species of aphids cause the greatest damage in late spring when temperatures are warm but not hot (65°-80°F). For aphids that cause leaves to curl, once aphid numbers are high and they have begun to distort leaves, it's often difficult to control these pests, because the curled leaves shelter aphids from insecticides and natural enemies.

Aphids tend to be most prevalent along the upwind edge of the garden and close to other infested plants of the same species, so make a special effort to check these areas. Many aphid species prefer the underside of leaves, so turn leaves over when checking for aphids. On trees, clip off leaves from several areas of the tree. 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, flattened, or fuzzy. Substantial numbers of any of these natural control factors can mean 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 frequently are a clue that an aphid infestation is present. If you see large numbers of ants climbing your tree trunks, check higher up the tree for aphids or other honeydew-producing insects that might be on limbs and leaves. To protect their food source, ants ward off many predators and parasites of aphids. Managing ants is a key component of aphid management. (See Cultural Control.)

In landscape settings, you can monitor aphids by using water-sensitive paper to measure honeydew dripping



Figure 4. Some aphids overwinter as eggs such as the mealy plum aphid on plums.



Figure 5. Honeydew produced by the hackberry woolly aphid.



Figure 6. Leaf curling caused by rosy apple aphid.

from a 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 Pests of Landscape Trees and Shrubs in References for more details.)

Biological Control

Natural enemies can be very important for controlling aphids, especially in gardens not sprayed with broad-spectrum pesticides (e.g., organophosphates, carbamates, and pyrethroids) that kill natural enemy species as well as pests. Usually natural enemy populations don't 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. The skin of the parasitized 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, soldier beetles, and syrphid fly larvae. Naturally occurring predators work best, especially in garden and landscape situations. For photos and more information about aphid natural enemies, see the Natural Enemies Gallery.

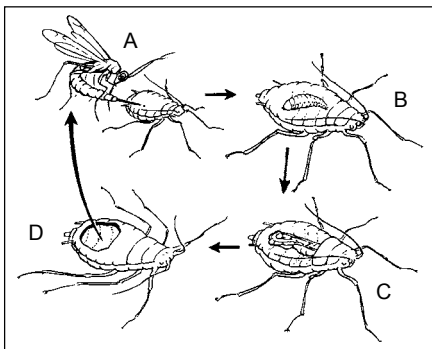







Figure 7. Life cycle of an aphid parasite. A: An adult parasite lays an egg inside a live aphid. B: The egg hatches into a parasite larva that grows as it feeds on the aphid's insides. C: After killing the aphid, the parasite pupates. D: An adult wasp emerges from the dead aphid then flies off to find and parasitize other aphids.



Figure 8. Mummified aphid bodies indicate that they have been parasitized. The parasitic wasp (center) has emerged from the circular hole in the top left mummy.

Table 1. Common Aphids on Vegetables and Flowers.

Common name	Scientific name	Common hosts
bean aphid 	<i>Aphis fabae</i>	legumes, various woody ornamentals, and flowers
cabbage aphid 	<i>Brevicoryne brassicae</i>	cole crops and other mustard family plants
green peach aphid 	<i>Myzus persicae</i>	peppers, spinach, tomato, cucurbits, carrot, lettuce, legumes, corn, flowers, flowering plum, and stone fruit
melon (cotton) aphid 	<i>Aphis gossypii</i>	cucurbits, carrot, citrus, many flowers, and various woody landscape ornamentals
potato aphid 	<i>Macrosiphum euphorbiae</i>	potato, spinach, lettuce, tomato, and many others

Photos by J. K. Clark

Lady Beetle Releases

Applying commercially available lady beetles (the convergent lady beetle, *Hippodamia convergens*) may give some temporary control when properly handled, although most of them will disperse from your yard within a few days.

If releasing lady beetles, keep them refrigerated until just before letting them go, doing so at dusk, as those released in broad daylight will fly away immediately. Mist the lady beetles with water just before release, and also mist the surface of the plant you are releasing them onto. Place the lady beetles at the base of infested plants or in the crotches of low branches. Lady beetles will crawl higher into the plant in search of aphids. University of California research indicates that high numbers of lady beetles are required to control aphids. One large, heavily infested rose bush required two applications, spaced a week apart, of about 1,500 lady beetles each. For more information about making lady beetle releases, see UC IPM's convergent lady beetle page in the Natural Enemies Gallery.






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

Weather can also impact aphids. Summer heat in the Central Valley and desert areas reduces the populations of many species, 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.

Ant Management

In some situations ants tend aphids and feed on the honeydew aphids excrete. At the same time, ants protect the aphids from natural enemies. If you see ants crawling up aphid-

Table 2. Common Aphids of Fruit Trees.

Common name	Scientific name	Common hosts	Comments
green apple aphid 	<i>Aphis pomi</i>	apple, pear, hawthorne, cotoneaster	
leaf curl plum aphid 	<i>Brachycaudus helichrysi</i>	plum, prune	curls leaves, goes to Asteraceae in summer
mealy plum aphid 	<i>Hyalopterus pruni</i>	plum, prune	curls and stunts leaves, goes to cattails and reeds in summer
rosy apple aphid 	<i>Dysaphis plantaginea</i>	apple	curls leaves, goes to plantain in summer
woolly apple aphid 	<i>Eriosoma lanigerum</i>	apple, pear, pyracantha, hawthorn	primarily found on wood or roots, creates galls in roots and waxy deposits

Photos by J. K. Clark

infested trees or woody plants, put a band of sticky material (e.g., Tangle-foot) around the trunk to prevent ants from climbing up. (Don't apply sticky material directly to the bark of young or thin-barked trees or to trees that have been severely pruned, as 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 containerized baits may be used on the ground to control ants without affecting aphids or their natural enemies. Prune out other ant routes such as branches touching buildings, the ground, or other trees.

Cultural Control






Before planting vegetables, check surrounding areas for sources of aphids and remove these sources. Some aphids build up on weeds such as sowthistle and mustards, moving onto related crop seedlings after they emerge. On the other hand, these aphid-infested weeds can sometimes provide an early source of aphid natural enemies. Always 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 out these areas and dispose of them. In large trees, some aphids thrive in the dense inner canopy; pruning out these areas can make the habitat less suitable.

High levels of nitrogen fertilizer favor aphid reproduction, so never use more nitrogen than necessary. Instead, use a less soluble form of nitrogen and apply it in small portions throughout the season rather than all at once. Slow-release fertilizers such as organic fertilizers or urea-based time-release formulations are best.

Because many vegetables are susceptible to serious aphid damage primarily during the seedling stage, reduce losses by growing seedlings under protective covers in the garden, in a greenhouse, or inside and then transplanting them when the seed-

Table 3. Some Problematic Aphids on Woody Ornamentals.*

Common name	Scientific name	Common hosts	Comments
ash leaf curl aphid 	<i>Prociphilus</i> species	ash (other Prociphilus species attack other trees)	causes leaves to curl, distort, and form pseudo-galls
crapemyrtle aphid 	<i>Sarucallis kahawaluokalani</i>	crapemyrtle	
giant conifer aphid 	<i>Cinara</i> species	fir, pine, spruce, cedar	may be mistaken for ticks
hackberry woolly aphid 	<i>Shivaphis celti</i>	hackberry	produces waxy tufts
oleander aphid 	<i>Aphis nerii</i>	oleander, milkweed	

* Green peach aphid, bean aphid, and melon aphid may also occur on many woody ornamentals. Photos by J. K. Clark, except crapemyrtle aphid, Jim Baker, North Carolina State University, Bugwood.org

lings are older and more tolerant of aphid feeding. Protective covers will also prevent transmission of aphid-borne viruses.

Silver-colored reflective mulches have been successfully used to reduce transmission of aphid-borne viruses in summer squash, melon, and other susceptible vegetables. These mulches repel invading aphid populations, reducing their numbers on seedlings and small plants. Another benefit is that yields of vegetables grown on reflective mulches are usually increased by the greater amount of solar energy reflecting onto leaves.

To put a reflective mulch in your garden, remove all weeds and cover beds with mulch. Bury the edges 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 a single transplant in each one. 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.



Ready-to-use reflective mulch products include silver-colored plastic sold in rolls. You can also make your own by spray-painting construction paper, landscape fabric, or clear plastic. If you use plastic mulches, you will need to use drip irrigation underneath. Landscape fabric and most paper mulches will allow water to flow through.

Another way to reduce aphid populations on sturdy plants is to knock off the insects with a strong spray of water. Most dislodged aphids won't 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

When considering whether to apply insecticides for aphid control, remember that most larger plants can tolerate light to moderate levels of

Table 3. Some Problematic Aphids on Woody Ornamentals.* ... continued from previous page

Common name	Scientific name	Common hosts	Comments
rose aphid 	<i>Macrosiphum rosae</i>	rose	
tuliptree aphid 	<i>Illinoia lirioidendri</i>	tuliptree	

* Green peach aphid, bean aphid, and melon aphid may also occur on many woody ornamentals. Photos by J. K. Clark, except crapemyrtle aphid, Jim Baker, North Carolina State University, Bugwood.org

aphids with little damage. Larger aphid populations often rapidly decline due to biological control or when 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.

If insecticides are needed, insecticidal soaps and oils are the best choices for most situations. Oils may include petroleum-based horticultural oils or plant-derived oils such as neem or canola oil. These products kill primarily by smothering the aphid, so thorough coverage of infested foliage is required. Apply these materials with a high volume of water, usually a 1 to 2% oil solution in water, and target the underside of leaves as well as the top. Soaps, neem oil, and horticultural oil kill only aphids present on the day they are sprayed, so applications may need to be repeated. Although these materials can kill some natural enemies that are present on the plant and hit by the spray, they leave no toxic residue

so they don't kill natural enemies that migrate in after the spray.

These and other insecticides with contact-only activity are generally ineffective in preventing damage from aphids such as the leaf curl plum aphid or the woolly ash aphid, which are protected by galls or distorted foliage. Also, don't 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 the materials 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. (On plums dormant applications right after leaves have fallen in early November are preferred.) These treatments won't give complete control of aphids and probably aren't justified for aphid control alone but will also control soft scale insects if they are

a problem. Common aphid species controlled with these types of oils include the woolly apple aphid, green apple aphid, rosy apple aphid, mealy plum aphid, and black cherry aphid.

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, and they are associated with bee kills and environmental problems. Repeated applications of these materials may also result in resistance to the material.

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.

Systemic insecticides are also available for aphid management, primarily for woody ornamentals. These materials, including imidacloprid, are very effective and are especially useful for serious infestations of aphids such as the woolly hackberry aphid, which is often not effectively controlled by biological control or less toxic insecticides. Imidacloprid can have negative impacts on predators, parasitoids, and pollinators, so its use should be avoided where soaps and oils will provide adequate control. To protect pollinators, don't apply imidacloprid or other systemic insecticides to plants in bloom or prior to bloom.

Home-use soil-applied imidacloprid products are often diluted with water in a bucket and poured around the base of the tree or plant. Professional applicators can use soil injectors, which provide better control with less runoff potential. Applications are

usually made in spring when aphids first become apparent.

Adequate rain or irrigation is required to move the product through the soil to the roots and up into large trees, and it may take several weeks to see an effect on aphids feeding on leaves. One application on hackberry is enough to control hackberry woolly aphid for two to three years. See *Pest Notes: Hackberry Woolly Aphid* for more discussion about control methods using imidacloprid.

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This and other Pest Notes are available at www.ipm.ucdavis.edu.

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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.

Pesticides applied in your home and landscape can move and contaminate creeks, rivers, and oceans. 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 or pour pesticides down the 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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