



Mistletoes

Integrated Pest Management for Home Gardeners and Landscape Professionals

Mistletoes are parasitic plants that grow on trees or large shrubs, where they can cause damage or simply look unsightly. All mistletoes in California belong to the sandalwood family Santalaceae, including both the broadleaf mistletoes, *Phoradendron* (Figure 1) and *Viscum* species, and the dwarf mistletoes, *Arceuthobium* species (Figure 2). While these genera are closely related, there are differences in their life cycles, damage they may cause to hosts, and to some degree, tactics used for their management.

Several native species of broadleaf mistletoes occur in California, infesting a wide range of hardwood tree hosts including common landscape species such as alder, flowering pear, ash, birch, box elder, cottonwood, locust, silver maple, walnut, and zelkova. An exotic species of broadleaf mistletoe, *Viscum album*, was intentionally introduced by Luther Burbank at the turn of the 20th century and can be found in Sonoma County parasitizing alder, apple, black locust, cottonwood, maple, and pear trees.

While conifers are less often attacked by broadleaf mistletoes, a few localized infestations in California warrant mentioning, including white fir (*Abies concolor*) in the southern Sierra

Nevada, incense cedar in Northern California, and cypress and junipers in the eastern Sierra Nevada. Monterey cypress (*Hesperocyparis macrocarpa*), a widely planted landscape tree that typically grows best in coastal locations, is rarely infested.

Most conifers, however, are susceptible to infestation by dwarf mistletoes (*Arceuthobium* spp.), which commonly attack pines, junipers, firs, and other conifers in forests. Dwarf mistletoe infestation can be a problem in landscapes at the forest's edge, such as in the Sierra Nevada foothills.



Figure 1. Mature plant of broadleaf mistletoe, *Phoradendron* sp.

IDENTIFICATION AND LIFE CYCLE

Broadleaf Mistletoes

Broadleaf mistletoes, also called leafy mistletoes, have green stems with thick nearly oval leaves (Figure 3). Mistletoe plants often develop into rounded shrublike clusters which can be up to 2 feet or more in diameter. Evergreen clumps of mistletoe are readily observed on deciduous trees in winter (Figure 4). It is not necessary to distinguish among species of leafy mistletoes for management purposes. *Viscum album*, found only in Sonoma County, can be easily distinguished by its completely smooth leaves, whereas



Figure 2. Closeup of dwarf mistletoe, *Arceuthobium* sp.

Authors:

Igor Laćan, UC Cooperative Extension, San Mateo and San Francisco Counties;

Steven Swain, UC Cooperative Extension, Marin County;

Edward J. Perry, UC Cooperative Extension Advisor (retired), Stanislaus County.

leaves of most common *Phoradendron* mistletoe species are somewhat hairy.

Broadleaf mistletoes are distinguished from other plants by their lifestyle and form: they are shrubby, arboreal hemiparasites. This means that mistletoes can perform their own photosynthesis (although they sometimes sequester photosynthates from their hosts) but rely on hosts for water and nutrients. This lifestyle contrasts with that of parasitic fungi, which must derive all their energy from their host plants. Mistletoes are also characterized by regularly branching structures (in contrast to parasitic vines, like dodder), and they occur exclusively in the crowns of trees and shrubs (in contrast to root parasites). About 1,500 mistletoe species are recognized worldwide, ranging in size from plantlets of a few inches to 36-foot-tall trees, such as the West Australian Christmas Tree mistletoe (*Nuytsia floribunda*).

In California, mistletoe plants are either female (producing berries) or male (producing only pollen). The berries of the female plant are small, sticky, and whitish, and are normally produced from October to December. The berries of leafy mistletoes are very attractive to birds such as cedar waxwings, robins, and other species (Figure 5). Birds feed on the berries and defecate the living seeds, which stick tightly to any branch on which they may land. In most cases, infestations initially occur on large or mature trees because birds prefer the high perches of taller trees.

A severe infestation of broadleaf mistletoe may occur on an individual tree because when birds spend significant time feeding on berries, they will subsequently spread seeds and new mistletoe plants throughout the canopy. Also, seeds may fall from mistletoe plants in the upper part of the tree, creating new infestations on the lower branches. The rapidity with which mistletoe spreads appears to be related to the proximity and severity

of established infestations. Newly planted trees can become quickly infested if they are growing near older, heavily infested trees.

After seeds germinate, mistletoe plants grow through the tree's bark and into water-conducting tissues, where rootlike structures called haustoria develop. In some mistletoe species, the haustoria gradually extend up and down within infested branches as the mistletoe plants grow. Mistletoe plants grow slowly and may take years before blooming and producing seed.

Broadleaf mistletoes have succulent stems that become woody at their bases. On some host species, large swollen areas develop on infested branches where the mistletoe haustorium has integrated into the tree's water-conducting system. If visible portions of mistletoe are removed, new mistletoe plants usually resprout from the haustoria.

Dwarf Mistletoes

As their name implies, dwarf mistletoes are smaller plants than broadleaf mistletoes, with mature stems that are non-woody and less than 6 to 8 inches long. All species of dwarf mistletoes in California grow exclusively in the above-ground portions of their hosts. They only parasitize members of the pine family (Pinaceae), including firs, hemlocks, larches, and spruces. They differ from broadleaf mistletoes in several ways; most importantly, they are true parasites rather than hemiparasites, deriving virtually all their nutrients from host plants. Furthermore, dwarf mistletoe differs from broadleaf mistletoe in appearance, with small scale-like leaves and shoot coloration varying from pale yellowish-green to tan, occasionally reddish-brown (Figure 6). Their small size and inconspicuous coloration can make them difficult to spot. Often, the only visible parts of a dwarf mistletoe plant are its flowering and fruiting branches.



Figure 3. Broadleaf mistletoe, *Phoradendron* sp.



Figure 4. Broadleaf mistletoes are evergreen as seen in this deciduous tree.

The first symptom of infection by dwarf mistletoe is usually a swelling of the host branch at the point of infection. Much of the biomass of the dwarf mistletoe is hidden within the tissues of the host.

While broadleaf mistletoe seeds are dispersed by birds, dwarf mistletoe seeds are spread mostly by forcible discharge from fruit, which can propel the sticky seeds onto trees up to 40 feet away. Seeds typically land on the needles of nearby trees and stick to the tree. During the next rain event, seed coatings become slick, and the



Figure 5. Foliage and fruit of broadleaf mistletoe.



Figure 6. Dwarf mistletoe stems and seeds growing from a pine branch.

seeds slide down the needles onto the twigs, where infection occurs. After infection, dwarf mistletoe grows slowly beneath the host bark, usually taking between 2 to 6 years before producing a shoot, and often requiring another year or two more before flowering. The exact amount of time until first shoot production varies tremendously by mistletoe species and host, with some species on some hosts requiring up to 12 years.

DAMAGE

Mistletoes are easily recognized and are especially prominent in the bare canopies of deciduous trees in winter, when the mistletoes retain their green foliage. Broadleaf mistletoe absorbs both water and mineral nutrients from its host trees. As a result, the infested branch often develops a swelling (hypertrophy) at the mistletoe attachment point, but may exhibit reduced growth overall, or the branch portions distal to the mistletoe may completely wither and fall off, leaving a branch with the mistletoe at its end. Also, a “witches’ broom” (a dense mass of small branches, often misshapen and visibly different from the rest of the tree’s crown) may grow at the mistletoe attachment point.

Overall, healthy trees are often able to tolerate a few mistletoes (at the cost of individual branches weakened or sometimes killed), but heavily infested

trees may be reduced in vigor (and thus become pre-disposed to insect or pathogen attack), exhibit stunted growth, and experience premature mortality, especially if they are stressed by other problems such as drought or disease.

Dwarf mistletoes are uncommon in landscaped settings for the simple reason that infestation of a new host tree requires it to be within about 40 feet of an already infested tree. Infestation of a tree by dwarf mistletoe makes trees grow more slowly, often stunting them. The most obvious symptoms of infestation are “witches’ brooms.” Infested host branches often exhibit swelling at the infection site. Infested branches often die further away from the infection site, and the host trees are often stunted, perform poorly, and will eventually be killed by the parasite. Other factors can cause witches’ brooms, however, including genetic mutations, mites, viruses, and fungi. Therefore, the presence of witches’ brooms is not necessarily diagnostic. Infestation by dwarf mistletoe must be confirmed by inspection of the branch, and positive identification of shoots, flowers, or fruits.

MANAGEMENT

In newly developed areas or in older established areas where trees are being replaced, the most effective

method of managing mistletoe is to plant tree species that are resistant or moderately resistant to mistletoe. Avoid trees like Modesto ash, known to be especially susceptible to mistletoe infestation. Where many new trees are being planted, control mistletoe in any surrounding infested trees to reduce the infestation of new trees.

For treatment of existing trees, it is important to remove mistletoe before it produces seed and spreads to other limbs or trees. Mechanical control through pruning tree branches is the most effective method for mistletoe removal. Synthetic chemical growth regulators provide a degree of temporary control, but repeated applications are required. It is probably useful to stay vigilant and remove new mistletoe clusters as they appear in the tree canopy, to lessen seed production and, thus, the spread through the tree and to other trees. Severely infested trees may be considered for removal and replacement with less susceptible species where concerns exist about the potential infestation of surrounding trees. Removal should be carefully considered, as such trees are often large, may be old, and may have substantial value for the ecosystem or the landscape.

Mechanical Control

The most effective way to control mistletoe and prevent its spread is to prune out infested branches as soon as possible. Using thinning-type pruning cuts, remove branches at their point of origin or back to large lateral branches. It is likely that infested branches will need to be cut at least one foot below the point of mistletoe attachment to completely remove embedded haustoria. Done properly, limb removal for mistletoe control can maintain or even improve tree structure. In contrast, severe heading (topping) that is often used to remove heavy mistletoe infestations weakens a tree's structure, and destroys its natural form, and should be avoided. In some cases, it may be best to remove severely infested trees in poor condition, because they can serve as a source of mistletoe seed.

Infestations on trunks or major branches that cannot be removed may be controlled by cutting off the mistletoe flush with the limb or trunk and then wrapping the area with a few layers of wide, black polyethylene to exclude light (Figure 7). Use twine or tape to secure the plastic to the limb, but do not wrap it too tightly or the branch may be damaged. Broadleaf mistletoe requires light and, in theory, will die within a couple of years without it. Nevertheless, it may be necessary to repeat this treatment, especially if the wrapping becomes detached or if the mistletoe does not die.

Simply cutting mistletoe plants out of an infested tree each winter, even without wrapping, is better than doing nothing at all. Although the parasite will grow back, spread will be reduced because broadleaf mistletoe must be several years old before it can bloom and produce seed.

Dwarf mistletoe management in landscaped settings should primarily be handled by the removal of infested host branches. Trees with witches' brooms should be routinely inspected for dwarf mistletoe shoots, flowers, or



Figure 7. Wrap and tape limbs to exclude light.

fruits. If found, the infested branches should be pruned at the next closest node to the trunk, at least a foot away from the swelling, to be sure all haustoria are removed. In advanced cases, it may be more practical simply to remove the whole tree. Because latent infections can be easily missed, trees that have a history of infestation should be inspected for several years after the infestation was removed.

Resistant Species

Some tree species appear resistant to broadleaf mistletoe. Bradford flowering pear, Chinese pistache, crape myrtle, eucalyptus, ginkgo, golden rain tree, liquidambar, sycamore, peppertrees (*Schinus* spp.), bigleaf maple, and conifers, such as redwood and true cedars (*Cedrus* spp.), are rarely infested in California. These or other resistant species should be considered when planting in infested areas, or when replacing infested trees.

Community-based Mistletoe Management

An effective mistletoe control program in a community requires a combination of methods and the cooperation of developers, homeowners, businesses, and

public agencies. Property owners can substantially reduce mistletoe infestations in their own trees, but without community cooperation, infestations will likely reoccur. Public wooded areas, such as parks and stream banks adjacent to urban areas, can be a continual source of seed and, therefore, mistletoe infestation. Resistant tree species planting should be part of every city and park plan.

The most drastic and possibly the best control measure is to remove severely infested trees and replace them with less susceptible species. In some cases, and after consulting with the local government (city or county) to ensure compliance with any applicable tree ordinances, neighborhood residents may pool resources to hire a tree service to remove all mistletoe in their neighborhood.

Chemical Control

The plant growth regulator ethephon may be used as directed by the label to control mistletoe in dormant host trees. To be effective, the spray must thoroughly wet the mistletoe foliage. The ideal time to treat is in spring as temperatures begin to warm, but before the tree begins to grow new leaves. Daytime temperatures must

be above 65°F for best results. Spray only the individual mistletoe plants, not the entire tree. Treating trees during winter dormancy reduces the chance for the tree foliage to interfere with the treatment and ensures that the mistletoe is more visible. Spraying ethephon may cause some mistletoe plants to fall off but provides only temporary control, especially on well-established infestations. The mistletoe will soon regrow at the same point, requiring retreatment. Note that the chemical growth regulator, if used improperly, may damage the tree, and its application is best done by experienced professionals.

ECOLOGICAL BENEFITS OF BROADLEAF MISTLETOES

While every mistletoe is a plant parasite, and thus seldom an intended element in a landscape or garden, recent research has shown that broadleaf mistletoes have several important ecological functions: they provide food for wildlife as well as cover and nesting sites for birds and some small mammals, and they have been associated with increases in biodiversity in some natural settings. In addition, humans use leafy mistletoes for decoration in winter, and the European mistletoe *Viscum album* is being investigated

for possible uses in medicine. It is thus possible, under the right conditions, to regard mistletoes as desirable.

In situations where an infested tree does not appear stressed and there is little concern of spread to other trees (because they are already infested or because they are resistant), it may be an acceptable strategy to tolerate (or even enjoy) leafy mistletoes. Note that this “pacifist” approach may be considerably less appropriate in the case of dwarf mistletoes on conifers, since the damage they cause to trees can be substantial.



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Always read and carefully follow all precautions and directions provided on the container label. The label is the law and failure to follow label instructions is an illegal use of the pesticide. 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, and animals. Never place pesticides in food or drink containers. Consult the pesticide label to determine active ingredients, correct locations for use, signal words, and personal protective equipment you should wear to protect yourself from exposure when applying the material.

Pesticides applied in your garden and landscape can move through water or with soil away from where they were applied, resulting in contamination of creeks, lakes, rivers, and the ocean. Confine pesticides to the property being treated and never allow them to get into drains or creeks. Avoid getting pesticide onto neighboring properties (called drift), especially onto gardens containing fruits or vegetables ready to be picked.

Do not place containers with pesticide in the trash or pour pesticides down the sink, toilet, or outside drains. Either use all the pesticide according to the label until the container is empty or take unwanted pesticides to your local Household Hazardous Waste Collection site. Contact your county agricultural commissioner for additional information on safe container disposal and for the location of the Hazardous Waste Collection site nearest you. Follow label directions for disposal of empty containers. 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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