

Mistletoes in Colorado Conifers

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Gardening Series | Diseases

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Dwarf mistletoes (*Arceuthobium* species) are leafless parasitic plants that infect several species of conifers (evergreen trees) in Colorado forests. Dwarf mistletoes produce rootlike structures that grow in the living tissue just under the bark (phloem) and in the wood (xylem), where they extract both nutrients and water from their host plants. Germinating seeds of mistletoes produce specialized structures called holdfasts that allow newly emerged parasitic plants to penetrate the tissues of host plants, thus infecting the host plant.

There are five species of dwarf mistletoes that infect conifers in Colorado (Table 1). While some dwarf mistletoes are relatively host-specific and generally do not infect other tree species, other species infect a wide range of coniferous tree species (Table 1). In addition, juniper mistletoe (*Phoradendron juniperinum*) is also present in Colorado and is a different type of mistletoe that is less damaging compared to dwarf mistletoes, in that it primarily acquires only water from the host tree. Juniper mistletoe is found in western Colorado and can infect several juniper species (*Juniperus* species) in many western states (Table 1).

The dwarf mistletoes and juniper mistletoe are dioecious plants with male flowers and female flowers produced on separate plants. The flowers produced by these mistletoes are small and inconspicuous.

Symptoms and Signs

When viewed from a distance, coniferous trees infected with dwarf mistletoes may appear to have yellow foliage, reduced foliage, abnormally dense green and distorted foliage or witches' brooms, and mortality of the



Figure 1: Lodgepole pine infected with dwarf mistletoe display witches' brooms and dead branches.

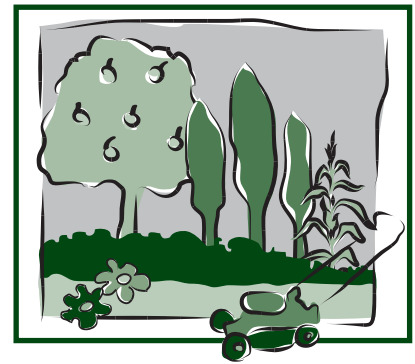


Figure 2: Witches' brooms – dense, multiple branches on lodgepole pine infected with dwarf mistletoe.

upper portion of the affected tree (Figures 1, 2, and 3).

Closer examination of branches of affected trees will reveal the yellowish green, olive green, or reddish brown segmented shoots of the parasitic plant (Figures 4 and 5).

The first symptom of dwarf mistletoe infection is a slight swelling of the bark at the infection site. The parasite is identifiable when shoots protrude two to three years after infection. Dwarf mistletoe shoots are 1/2 to 6 inches long and 1/8 to 1/4 inch in diameter (Figures 4 and 5). Douglas-fir dwarf mistletoe shoots are hard to see because they are only about 1/2 inch long. When shoots



Quick Facts

- Mistletoes are parasitic flowering plants that can infect and damage many species of trees.
- Dwarf mistletoes are leafless parasitic plants that infect several coniferous or evergreen tree species in many western states.
- Ponderosa, lodgepole, limber, and pinyon pines and Douglas-fir are the most common trees affected by dwarf mistletoes in Colorado.
- Juniper mistletoe is another type of mistletoe that can infect several juniper species in many western states.
- Damage caused by mistletoes includes growth reduction, loss of wood quality, poor tree form, predisposition to insect infestation and diseases, premature death, and reduction in seed crops.

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Table 1. Mistletoes of Colorado conifers.

Mistletoe species	Common name	Host plant species	Common name of host	Description
<i>Arceuthobium americanum</i>	Lodgepole pine dwarf mistletoe	Primary Host: <i>Pinus contorta</i> var. <i>latifolia</i> Occasional hosts: <i>Pinus ponderosa</i> var. <i>scopulorum</i> , <i>Pinus albicaulis</i> , <i>Pinus aristata</i> , <i>Pinus flexilis</i> , <i>Pinus mugo</i> , <i>Pinus sylvestris</i> , <i>Picea engelmannii</i> , <i>Picea pungens</i> , <i>Abies lasiocarpa</i>	Lodgepole pine ponderosa pine, whitebark pine, bristlecone pine, limber pine, mugo or mountain pine, scots or scotch pine, Engelmann spruce, blue spruce, subalpine fir	Shoots are yellowish to olive green, mean shoot height 5-9 cm, with whorl-like branching; fruit is an ovoid berry, olive green and 3.5-4.5 mm long and 1.5-2.5 mm wide
<i>Arceuthobium cyanocarpum</i>	Limber pine dwarf mistletoe	Primary Host: <i>Pinus flexilis</i> Occasional hosts: <i>Pinus albicaulis</i> , <i>Pinus aristata</i> , <i>Pinus contorta</i> var. <i>latifolia</i> , <i>Pinus ponderosa</i> , <i>Pinus strobiformis</i>	Limber pine whitebark pine, bristlecone pine, lodgepole pine, ponderosa pine, southwestern white pine	Shoots are yellowish green, mean shoot height 3 cm, with fan-like branching; fruit is a bluish (cyan)-ovoid berry and 3.5 mm long and 2.0 mm wide
<i>Arceuthobium divaricatum</i>	Pinyon dwarf mistletoe	Primary Host: <i>Pinus edulis</i>	Pinyon pine	Shoots are olive green to brown, mean shoot height 8 cm, with fan-like branching; fruit is an ovoid berry, green/white and 3.5 mm long and 2.0 mm wide
<i>Arceuthobium douglasii</i>	Douglas-fir dwarf mistletoe	Primary Host: <i>Pseudotsuga menziesii</i> Occasional Hosts: <i>Abies concolor</i> , <i>Abies lasiocarpa</i> , <i>Picea engelmannii</i> , <i>Picea pungens</i>	Douglas-fir white fir, subalpine fir, Engelmann spruce, blue spruce	Shoots are olive green, mean shoot height 2 cm, with fan-like branching, fruit is an ovoid berry, olive green/white, and 3.5-4.5 mm long and 1.5-2.0 mm wide
<i>Arceuthobium vaginatum</i> subsp. <i>cryptopodium</i>	Southwest dwarf mistletoe	Primary Host: <i>Pinus ponderosa</i> Occasional Host: <i>Pinus aristata</i> , <i>Pinus contorta</i> var. <i>latifolia</i> , <i>Pinus flexilis</i> , <i>Pinus strobiformis</i> , <i>Pinus sylvestris</i>	Ponderosa pine	Shoots are orange to reddish brown (sometimes very dark brown), mean shoot height 10 cm, with extensive branching; fruit is an ovoid berry, bi-colored, and 4.5-5.5 mm long and 2.0-3.0 mm wide
<i>Phoradendron juniperinum</i>	Juniper mistletoe	Primary Hosts: <i>Juniperus scopulorum</i> , <i>Juniperus osteosperma</i> , <i>Juniperus monosperma</i>	Rocky Mountain juniper , Utah juniper, oneseed juniper	Shoots are green to yellow green, leafless, mean shoot height 20-40 cm; plants globose, with extensive branching; fruit is an ovoid berry, pinkish-white, and 4 mm in diameter

have fallen off, look for the remnants of basal cups on branches.

After initial infection, mistletoes can cause distorted branching or witches' brooms in the host tree (Figure 2). When dwarf mistletoes infect occasional hosts – hosts other than the primary host – different and unique symptoms may occur. For example, lodgepole pine dwarf mistletoe causes very large and dense witches' brooms when it infects ponderosa pine (Figure 7). Lodgepole pine dwarf mistletoe also induces on limber pine large elongate galls with rarely any shoots present.

Juniper mistletoe plants are usually seen as large yellowish-green round masses of small branches in the crown of junipers (Figure 6). Juniper mistletoe does not induce the juniper to make witches' brooms.

Damage to Host Trees

Dwarf mistletoe witches' brooms extract nutrients from uninfected parts of the tree, gradually reducing host tree vigor and eventually causing premature death.

Dwarf mistletoe infested trees decline and die from the top down as witches' brooms on lower branches extract more nutrients and water (Figures 1 and 3). Death of the host tree occurs slowly in most cases and depends on the severity of infection and on the vigor and size of the tree.

A measure of dwarf mistletoe infection severity is based on a two-part rating system (Tables 2a and 2b). First, a tree's crown is divided into thirds, and each third is rated. If there are no visible infections, that third of the crown gets a 0; if 1 to 50 percent of the branches are infected in that third, the rating is 1; and if more than 50 percent of the branches are infected, the rating is 2 (Table 2a). Add the rating of each third to get a total dwarf mistletoe rating (Table 2b). Life expectancy information for trees afflicted with dwarf mistletoe is provided in Table 3.

Witches' brooms develop over many years. Dwarf mistletoe witches' brooms extract nutrients and water from uninfected parts of the tree, gradually reducing host tree vigor and eventually causing premature death. Junipers infested with juniper mistletoe will have clusters of the yellowish



Figure 3: Lodgepole pine with dead top and dense dwarf mistletoe-induced brooms on the lower stem.

Table 2a. Rating scale for dwarf mistletoe infection severity.

Percent of branches infected in each crown section ¹	Tree crown section rating
0	0
1-50	1
51-100	2
¹ top third, middle third, and bottom third of tree crown.	

Table 2b. Dwarf mistletoe rating system (DMR).

Sum of rating of each of the three crown sections	Infection severity
2-3	Light
4-5	Moderate
6	Heavy

Table 3: Approximate number of years needed to kill 50 percent of Ponderosa pine trees infected with dwarf mistletoe.¹

Tree diameter	Infection severity ²		
	Light	Moderate	Heavy
4-9 inches	30	17	7
Greater than 9 inches	60	25	10
¹ Based on ponderosa pine in open, multi-aged stands.			
² Infection severity based on the following: light = a rating of 2 or 3; moderate = a rating of 4 or 5; heavy = a rating of 6.			

green parasitic plant growing amongst the juniper foliage (Figure 6).

Juniper mistletoe witches' brooms extract only water from the host plant. On heavily infested trees, the parasite can cause death of portions of the tree during prolonged periods of below normal precipitation.

Spread

Dwarf mistletoes spread slowly from tree to tree. In closely spaced trees of about the same height, this spread is one to two feet per year. The spread from large to small trees can extend 60 feet, but the average usually is less than 30 feet.

The sticky seeds of *Arceuthobium* species are explosively discharged from the fruit at almost 60 miles per hour, adhering to any surface they strike. Seeds that adhere to young branches of susceptible trees germinate, and the mistletoe rootlet penetrates the bark. Dwarf mistletoe seeds generally are dispersed in August and early September. Birds can, but only occasionally, spread the seeds some distance to uninfected trees. Dwarf mistletoes have a relatively long life cycle between infection and seed production (six to eight years). This long life cycle allows for long-term disease management. Mistletoes are not common in nursery and

ornamental plantings, but the parasites can be introduced into an area by planting trees unknowingly infected with mistletoe.

The fruits and seeds of *Phoradendron juniperinum* are spread by birds and consequently can be spread great distance in a single season. A number of bird species feed on the juniper mistletoe fruits and disperse the seeds by excreting or regurgitating them. Seeds are deposited on the top side of branches of juniper hosts. Germinating seeds produce a holdfast that penetrates the host plant.

Management

Mistletoes cause a gradual decline of plant health and do not quickly cause serious injury, thus long-term management options are feasible. However, mistletoe-infected trees may become sufficiently stressed as to attract mountain pine bark beetle (MPBB), *Ips* bark beetles, and twig beetles that may breed and kill parts (twig and *Ips*) of or the whole tree (MPBB, *Ips*). Mistletoe management options include branch pruning, tree removal, and planting resistant tree species.

Branch Pruning and Tree Removal

Pruning out the witches' brooms and removing infected trees is the best management measure available to reduce



Figure 4: Ponderosa pine dwarf mistletoe plants.



Figure 5: Lodgepole pine dwarf mistletoe plants. Note thin green-yellow shoots.

or eliminate dwarf mistletoe infestations in stands of high-value trees. First, remove severely infected trees (trees rated 5 and 6) or those with only a few live branches. Trees with high, unreachable mistletoe infections will continue to shower seeds on nearby trees if not cut down. However, it is not necessary to completely eradicate the mistletoe, as this may require removal of all trees. Pruning infected branches and removal of a few heavily infected trees can keep a green forest on the property.

Management Options:

1. Pruning and removing trees is the best management measure available to reduce or eliminate dwarf mistletoe infestations in ornamental trees or urban forests.
2. Plant resistant trees under infected trees to replace trees when infected ones are removed.
3. Use ethephon sprays in high-value areas where planting with the same species under infected trees is the only option.



Figure 6: Juniper mistletoe. Note the globose growth in this juniper.



Figure 7: Dense dark green brooms on ponderosa pine infected with lodgepole pine dwarf mistletoe.

Pruning off the lower and the largest witches' brooms from lightly to moderately infected trees (trees rated 1 to 4) can improve the health and allow these trees to survive for decades. When removing a witches' broom, prune the entire branch at the branch collar near the trunk. Examine trees every two or three years, and remove any newly infected branches. When pruning, keep 30 percent to 40 percent of the branches on the tree (from the top down), even if that means leaving some infected branches. Mistletoe shoots die as soon as the tree branch is cut, so no special disposal of pruning debris is needed. Trunk infections are not as detrimental as branch infections, so their removal is not necessary. If space allows, create 50-foot buffer zones between infected trees and healthy trees by cutting or by planting resistant trees. Contact a professional forester, the Colorado State Forest Service, or other professionals to obtain help in these decisions.

Planting Resistant Tree Species

Planting resistant or non-host tree species in areas with infected trees will ensure that trees will be in the area even after the infected trees are removed (Table 4).

NOTE: Scotch or Scots pine (*Pinus sylvestris*) is susceptible to both southwest and lodgepole pine dwarf mistletoes.

Deciduous trees and shrubs, such as birch, peashrub, ash, aspen, cottonwoods, and Gambel oak also can be planted in affected areas because dwarf and juniper mistletoe do not attack these plants. Keep in mind that site conditions and moisture availability will determine what trees and shrubs can be planted in a particular area.

Chemical Sprays

Ethephon (2-chloroethanephosphonic acid) is a growth regulating chemical that can be used to remove mistletoe shoots and reduce seed production. Ethephon is usually only used in high value areas where young trees should be protected until infected overstory trees are removed. This treatment does not kill the entire mistletoe plant, just the shoot. Retreatment is necessary until infected trees are removed, mistletoe infections are pruned from the tree, or new non-host trees are planted.

Additional Information

Colorado Master Gardener Garden Notes (available from the Colorado Master Gardener Program website, <http://cmg.colostate.edu/pubs.htm>)

- GardenNotes #618, Pruning Evergreens
- GardenNotes #633, The Science of Planting trees

Fact Sheets (available from the CSU Extension website, <http://www.ext.colostate.edu/pubs/pubs.html>)

- Fact Sheet 5.558, *Ips Beetles*
- Fact Sheet 5.528, *Mountain Pine Beetle*

Geils, B.W., Tovar, J.C., and Moody, B. 2002. Mistletoes of North American Conifers. Gen. Tech. Rep. RMRS-GTR-98. Ogden, UT: USDA, Forest Service, Rocky Mountain Research Station. 123p.

Table 4. Recommended species to replant in mistletoe affected areas.

Mistletoe-infected species	Recommended replacement species
ponderosa pine	white fir, blue spruce, bristlecone pine, pinyon pine, limber pine, Douglas-fir, and/or Rocky Mountain juniper
lodgepole pine	subalpine fir, Engelmann spruce, bristlecone pine, limber pine, and/or Douglas-fir
Douglas-fir	Engelmann spruce, lodgepole pine, and/or ponderosa pine
juniper	ponderosa pine and/or pinyon pine