True Mistletoes

True mistletoes are parasitic flowering plants with characteristic clumps of aerial shoots that are easily visible on the host plant. Most have leaves, even though they may be greatly reduced in some species. Shoots vary in length from several inches to several feet. True mistletoes are dioecious, and female plants have flowers and produce one-seeded berries while male plants have small inconspicuous flowers that produce pollen. Seeds are disseminated by birds that eat or transport berries and deposit the seeds on host plants.

When a seed germinates on its host plant, the mistletoe penetrates the host directly. The parasitic mistletoe plant develops inside its host for about two years before producing aerial shoots on the outside of the plant. True mistletoe shoots contain chlorophyll and carry on photosynthesis but depend on their host plant for carbohydrates as well as water and mineral nutrients. They typically cause a slow decline in the host plant over many years.

True mistletoes differ from dwarf mistletoes in that they are generally less damaging to their host; they are larger and more conspicuous; and the seeds are disseminated by birds, making them more difficult to control. True mistletoes vary in their host specificity, some infecting only one or few host species and others infecting a wide range of host plants, unlike dwarf mistletoes that are very specific to their hosts and infect only conifers.

Pathogen – True mistletoe, *Phoradendron* species

Hosts – *True mistletoes infect many different trees and shrubs at different elevations in Arizona:*

- *Phoradendron juniperum* occurs on all juniper species including alligator juniper, one-seeded juniper, Utah juniper, and Rocky Mountain juniper; clumps have a rounded appearance; leaves are reduced and inconspicuous.

- *Phoradendron capitellatum* occurs on alligator juniper and Utah juniper in central Arizona and southward. It has small hairy leaves. Both juniper mistletoes may occur in the same locality and even in the same tree.
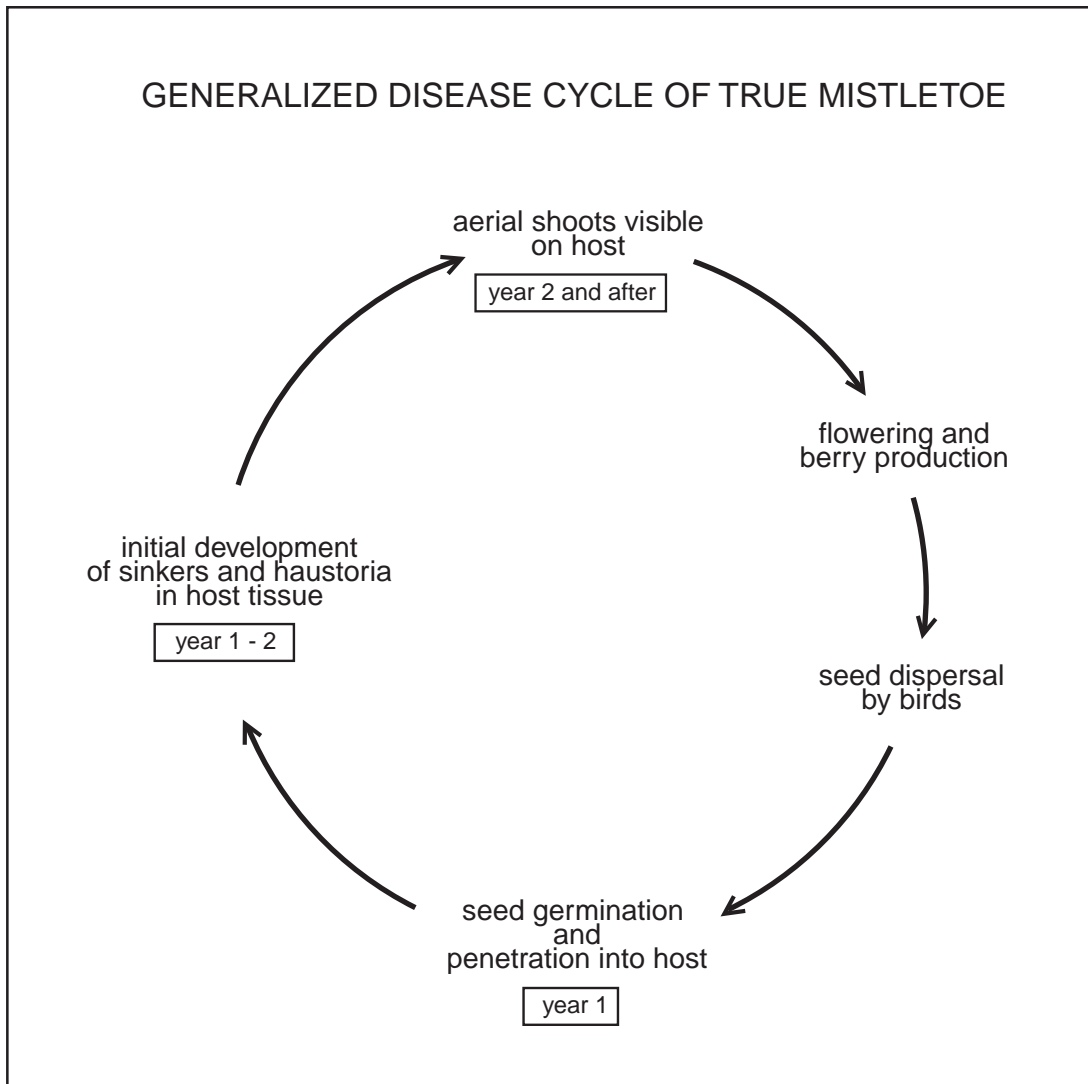

True mistletoe aerial shoots with berries.

- *Phoradendron densum* occurs on Arizona cypress in central Arizona. Its leaves have a smooth surface.

- *Phoradendron macrophyllum* occurs on many hardwoods including cottonwood, ash, black locust, hackberry, maple, walnut, sycamore and willow from west Texas to northern California. It does not infect oak. It

At a Glance

- True mistletoes are parasitic flowering plants with characteristic clumps of growth that are easily visible on the host plant.

- True mistletoe seeds are disseminated by birds that eat or transport the berries and deposit seeds on host plants.

- True mistletoes reduce the growth of infected hosts, but it usually takes many years for true mistletoe infections to kill a mature tree or shrub.

- True mistletoes are controlled by periodic manual removal of aerial shoots, by cutting off infected branches and by removal of heavily infested trees and shrubs.

GENERALIZED DISEASE CYCLE OF TRUE MISTLETOE

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                    aerial shoots visible
                          on host
                    ┌──────────────────┐
                    │ year 2 and after │
                    └──────────────────┘

                                              flowering and
                                              berry production

  initial development
 of sinkers and haustoria
     in host tissue
    ┌───────────┐
    │ year 1 - 2│                              seed dispersal
    └───────────┘                                 by birds


              seed germination
                     and
              penetration into host
                 ┌────────┐
                 │ year 1 │
                 └────────┘
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has well developed, slightly hairy leaves. It is conspicuous in winter when host trees loose their leaves and is harvested as Christmas mistletoe in Arizona.

- *Phoradendron coryae* occurs on oaks throughout Arizona. It has well developed leaves, and clumps often blend in well with the oak foliage.

- *Phoradendron californicum* occurs mainly on leguminous trees and shrubs such as Acacia, ironwood, mesquite and palo verde, and sometimes other desert plants, throughout the southwestern United States. Leaves are reduced to inconspicuous scales, stems are reddish, and clumps may be very large, especially in palo verde.

- *Phoradendron pauciflorum* occurs only on white fir in the Santa Catalina Mountains and is the only true mistletoe that infects a member of the pine family in Arizona.

Symptoms/signs – The first visible sign of infection is small aerial shoots coming out of the host plant. There are usually several or many shoots in a clump. Shoots become woody as they mature. All true mistletoes are dioecious, and female plants have flowers and small one-seeded berries while male plants have small inconspicuous flowers that produce pollen. Both male and female plants must exist in close proximity for pollination and fruit development. Each clump may develop into a large conspicuous growth. Swelling and branch distortions often occur at infection sites, and infected wood is weakened.

Disease – Mistletoes must have a living host plant on which to grow. Although true mistletoes are flowering plants and contain chlorophyll, they have no true roots and must obtain some carbohydrates as well as all their water and mineral nutrients from their hosts. Infections cause reduced host vigor because mistletoes compete with their hosts for nutrients and water.

Mistletoe seeds are disseminated by birds in several ways, depending on bird species. Seeds are disseminated as birds (1) wipe them off while preening, resulting primarily in dispersal in one host; (2) regurgitate them, resulting in dispersal to nearby hosts; or (3) excrete them after feeding on the berries, resulting in dispersal in a larger area.

The seeds germinate on host plants and penetrate directly by root-like structures that become progressively buried in the host wood. These structures (cortical haustoria in the phloem and sinkers in the wood) enable the mistletoe to acquire water and nutrients from host. True mistletoes develop inside the host for up to two years before sending out aerial shoots.

Multiple infections of true mistletoe.

Environmental conditions – Vigor of true mistletoe plants is usually related to that of the host, and it may decline in otherwise healthy trees during dry periods when host plants are water stressed. On the other hand, heavily infected trees are probably more susceptible to other stresses and insect infections. Seeds of most species require moisture for germination, so infections occur during rainy periods.

Prevention/control – Prevention of true mistletoe infections is very difficult since birds disseminate the seeds over large areas. True mistletoes are not aggressive pathogens, and it can take decades for mature, infested trees to die. Therefore, planting young trees, especially those that are not hosts, near older trees before they are removed or die is recommended. Young or small trees are seldom infected because birds prefer to perch in the tops of taller and/or more mature trees. Periodic recruitment of new young trees among older infested trees also allows some mistletoe to remain as part of the landscape. Since the berries of true mistletoes mature in winter, they are an important winter food source for many bird species. Clumps of mistletoe growth are also attractive nesting sites.

Area wide efforts to clean out trees in an entire neighborhood or development may be effective in preventing infections in new trees, but requires the cooperation of a large number of people including homeowners, businesses and public agencies. Without community cooperation, infestations will recur.

Control of true mistletoe depends on physical removal of the aerial shoots from the host plant by pruning infected branches or by periodic removal of the shoots. Breaking off shoots every two or three years will reduce competition between the mistletoe and the host. Repetitive pruning also will prevent spread since the mistletoe will not have a chance to produce seed, but aerial shoot removal does not eradicate the mistletoe. Shoots also may be removed by application of ethefon products (ethylene) that cause abscission of the shoots but do not kill the internal infection. Infested limbs can be cut out every year at least one foot below the infection site or preferably pruned at the nearest crotch. Periodic aerial shoot removal is the only control in trees with main stem or trunk infections. For trees and shrubs where a heavy infestation has persisted for several years, removal may be the only remedy.