



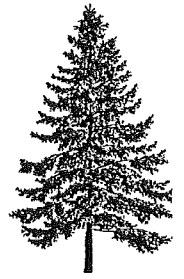
# TREE NOTES

CALIFORNIA DEPARTMENT OF FORESTRY AND FIRE PROTECTION

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## Madrone Canker In California

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### Introduction

A potentially lethal canker disease of Pacific madrone has been prevalent along the west coast of California for over twenty years. Disease severity and incidence have greatly increased during the last ten years. Environmental changes occurring during periods of drought may be a factor in predisposing trees to infection. Although madrones have low commercial value in the managed forest, this disease can have a significant impact on these native plants in a landscaped environment.

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### Disease Situation

Madrones are found growing in low to mid elevation mixed hardwood and conifer forest lands. Species found in association with it include: Douglas-fir *Pseudotsuga menziesii*, ponderosa pine *Pinus ponderosa*, black oak *Quercus kelloggii*, incense-cedar *Calocedrus decurrans*, and manzanita *Arctostaphylos spp.*

Madrone canker has been found throughout most of the natural range of Pacific madrone in California including the coast range from Del Norte County to Ventura County, and the western Sierra foothills from Nevada County to Tuolumne County. The disease has been found only rarely on coast redwood *Sequoia sempervirens* and Douglas-fir in California, and is common on Sierra redwood (giant sequoia) *Sequoiadendron giganteum* planted outside its native range. In addition, this disease has also been found on many of our native western plants, including ceanothus *Ceanothus spp.*, manzanita *Arctostaphylos spp.*, and other hardwoods.

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### Field Identification

The most notable identifying characteristic of madrone canker is the dead, blackened branches and dead tops of infected madrones. Infection begins at the tips of the youngest branches and progresses into larger diameter wood and eventually into the bole (trunk). Dieback of lateral twigs and small branches that stops at a node rather than continuing through the node, may be an early sign of disease, or could be caused by other environmental factors such as shading. With disease progression, the once beautiful trees become unsightly taking on a blackened, scorched appearance over the dead wood.

The surface of a diseased branch becomes dark red wine-colored, eventually turning black as the tissue dies. As the disease advances down the larger twigs and branches, and into the bole, a wedge-shaped discoloration of the bark becomes apparent. As the canker widens, the branch becomes girdled and dies. This "wedge effect" becomes more apparent as stem diameter increases. Dead branches are black, becoming cracked on the surface, dark brown internally, and very solid and dry; there is no rotting or soft decaying of affected wood.

The only visible external signs of this fungus are tiny, black spore-producing structures (pycnidia), which upon maturity erupt through the dead bark. Individual fruiting structures are barely visible to the unaided eye. In mass they appear as a black, roughened surface on the affected wood compared with the smooth, exfoliating (peeling) bark of healthy branches.

Disease symptoms on ceanothus and manzanita are similar to those of madrone: blackening of branches and limb dieback. Often entire shrubs turn black and die. Field and laboratory studies have demonstrated that isolates from madrone can infect manzanita and vice versa.

Madrone canker is a very common disease on ornamentally planted Sierra redwood throughout California. Under these conditions it is usually called botryosphaeria canker and is characterized by golden-colored resin droplets at the base of cankers on branches, and main stems. Sierra redwood is frequently attacked and severely disfigured, often resulting in tree death.

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### Life History

Like most fungal diseases of plants, madrone canker disease in all its life stages is microscopic in size. While it is very difficult to see the fungus itself, the effect of the infection becomes plainly visible within a few years. The infection process begins when air-borne spores land on, germinate, and infect young, tender branches and leaf petioles. Typically, an early infection appears as a darkened (necrotic) spot several millimeters in size.

Characteristic branch dieback (flagging) occurs as the infection grows into older branch and bole wood, killing the earlier colonized twigs and small branches. Branches become blackened and roughened as masses of pycnidia (small

spore-producing fruiting bodies) protrude through the dead and blackened bark. Dense canopy and understory vegetation provide the high humidity conditions that are ideal for disease initiation and spread. Continued disease progression often leads to tree mortality.

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## ***Disease Spread***

Little is known about disease spread and pathogenicity. The madrone canker fungus is probably spread by rain, wind, or insects. Pycnidia produced on recently killed wood can continue to fruit on dead wood for several years. In wet weather spores ooze out of the pycnidia where they may be splashed away by water drops, or carried off by insects. Spores produced under favorable weather conditions may be dispersed to establish new infection sites within the tree or nearby trees. Infection of host tissue probably occurs through spore germination in wounds caused by wind-whipping, sun scalding, freeze damage, and insect feeding. It is not known how important, if at all, insects may be in disease spread.

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## ***Other Diseases and Insects***

The only other disease that may be confused with madrone canker on madrone is one caused by the arbutus (or *Hendersonula*) canker fungus *Hendersonula toruloidea*. Presence of this disease is characterized by a slow growing, very gnarled canker that is easily distinguished from the relatively smooth surfaced madrone canker. Branch blackening does not occur with arbutus canker. Arbutus canker is usually not lethal, but does cause infected branches to become unsightly.

Foliar diseases caused by several microfungi (especially *Mycosphaerella* sp.) cause mature leaves to become blackened while the branches remain healthy. This leaf blackening is common in the spring in forest situations where trees are growing under conditions of high humidity. Nearby trees in open (less humid) sites will have healthier appearing green leaves.

The madrone psyllid, *Euphyllura arbuti*, which is commonly found around madrone flowers, has not been shown to be involved in infection or disease spread. This sucking insect produces copious quantities of an easily seen white wax-like material that covers their nymphs.

Two tiny, narrow-winged moths, the madrone shield bearer *Coptodisca arbutiella* and a casebearer moth *Coleophora* spp. can cause foliar leaf mining damage. However, these foliar diseases and insects do not damage the madrone buds and new foliage will appear in the spring.

Although Pacific madrone is an evergreen tree, it rarely retains more than the current years growth of leaves due to the many foliar diseases and insects that affect them.

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## ***Collection of Tree Material for Laboratory Diagnosis***

1. Collect portions (6-12 inches) of diseased branches that include both healthy and diseased or dead wood, (i.e., the margin of the canker), preferably collecting the entire branch section rather than removing a wedge or chip.
2. Collections can be made at any time of the year, although it appears that the fungus is more active during wet weather. Collections made in late fall to spring are preferred for

laboratory diagnosis. Enclose the sample in a plastic bag, avoid drying, keep it cool, and ship immediately to the laboratory. Contact your county Agricultural Commissioner for further information.

3. The time needed for laboratory diagnosis can vary from about one week to as much as three weeks. However, the symptoms are unique and diagnosis by visual symptoms is generally reliable.

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## ***Disease Control***

Control within a tree is done by removing infected wood from the tree. Remove the discolored wood using proper pruning techniques. On larger diameter wood external discoloration may lag behind internal disease advance. Examine the cut branch end to be sure that all discolored wood has been removed.

Avoid pruning in wet weather because the wound may become contaminated while making the cut. Disinfect pruning tools after each branch cut. To keep tree reinfection at a minimum, remove or prune all nearby infected plants. Bury or burn all wood residue. Reduce all competition to allow trees maximum light, air movement, reduced humidity and freedom from root competition. Do not irrigate trees as in a lawn situation. Avoid compacting soil over roots, such as in driveways or areas of heavy foot traffic. Maintain trees in a healthy, but not overly vigorous condition to lessen the opportunity for successful infection. No chemicals are registered for control of this disease.

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## ***Further Reading***

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