TREE NOTES

CALIFORNIA DEPARTMENT OF FORESTRY AND FIRE PROTECTION

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Pitch Canker Disease in California

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What Is Pitch Canker?

Pitch canker is a disease of pine trees (*Pinus spp.*) caused by the fungus *Fusarium subglutinans*. The fungus infects branch tips, causing them to wilt and die. It also infects the bole (trunk), limbs, and wounded roots, causing cankers which can produce large quantities of pitch. Tree mortality may result from secondary attacks by bark beetles.

Beetles known to feed on woody tree tissue are strongly implicated in disease transmission. Small twig beetles (*Pityophthorus spp.*) and cone beetles (*Conophthorus spp.*) transmit the disease to the tips of branches and developing cones, and Ips bark beetles (*Ips spp.*) transmit the disease to the main bole and large limbs. The extent to which the disease can spread, within a tree and between trees, without the assistance of insects is unclear.

Monterey pine (*Pinus radiata*) is the primary tree infected in California, although the fungus has been isolated from other tree species. Widespread severe infections in ornamental plantings of Monterey pine have occurred in Santa Cruz and Alameda counties, with severe localized infections in other areas. Pitch canker can also be a serious problem in Monterey pine Christmas tree plantations.

Which Trees Are Affected By Pitch Canker?

Pitch canker has been found naturally infecting ten species of trees in the landscape. Thirteen species of trees have been inoculated in the laboratory. Some of these have developed symptoms of the disease while others have shown resistance. Trees in these categories are shown in Table 1.

		Native to California ?
Naturally infected species:		
Monterey pine	*Pinus radiata*	✔
Monterey x knobcone pine	*Pinus radiata x attenuata*	✔
Bishop pine	*Pinus muricata*	✔
Coulter pine	*Pinus coulteri*	✔
Ponderosa pine	*Pinus ponderosa*	✔
Torrey pine	*Pinus torreyana*	✔
Shore pine	*Pinus contorta contorta*	✔
Aleppo pine	*Pinus halepensis*	
Italian stone pine	*Pinus pinea*	
Canary Island pine	*Pinus canariensis*	
Other species susceptible in laboratory tests:		
Knobcone pine	*Pinus attenuata*	✔
Jeffrey pine	*Pinus jeffreyi*	✔
Sugar pine	*Pinus lambertiana*	✔
Digger pine	*Pinus sabiniana*	✔
Scots pine	*Pinus sylvestris*	
Eldarica pine	*Pinus eldarica*	
Douglas-fir	*Psuedotsuga menziesii*	✔
Species resistant in laboratory tests:		
White fir	*Abies concolor*	✔
Incense-cedar	*Libocedrus decurrens*	✔
Coast redwood	*Sequoia sempervirens*	✔
Giant sequoia	*Sequoiadendron giganteum*	✔
Brutia pine	*Pinus brutia*	
Norfolk Island pine	*Araucaria heterophylla*	

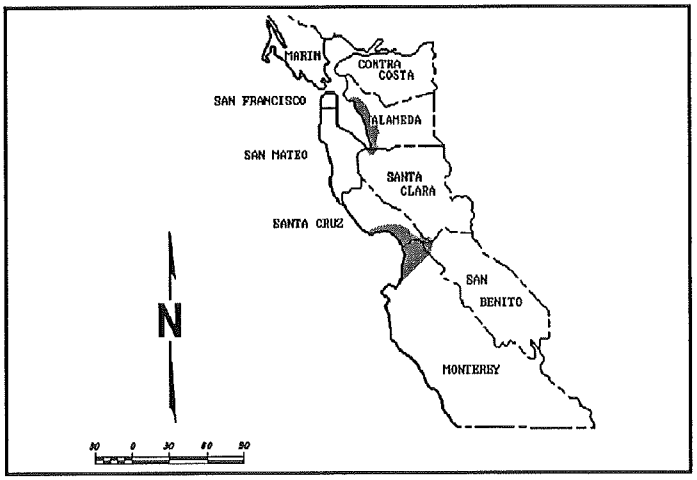
Table 1. Tree species infected with pitch canker fungus in the field, and species resistant or susceptible in laboratory tests.

It should be noted that the list of susceptible and naturally infected trees includes trees of commercial value, such as Douglas-fir and ponderosa pine, as well as native Californian species with restricted ranges.

Current research including periodic monitoring of susceptible trees in native stands and landscape plantings will allow the location and rate of disease spread to be followed through time.

Where in California is Pitch Canker found?

Trees with pitch canker have been found in ten counties in California. The largest infestations of pitch canker fungus are currently in Santa Cruz and Alameda counties, as shown in Map 1. Localized infections have also been found at Morro Bay, Los Osos and Baywood Park in San Louis Obispo county, and in the city of Santa Barbara. Christmas tree plantations have been found to be infected with the disease at Torrance and Rosemead in Los Angeles county, and at Escondido in San Diego county.



Map 1. Locations of widespread infection.

What Are The Symptoms Of Pitch Canker?

There are a number of symptoms of the disease, which may not all be present on an infected tree. Pitch canker is characterized by a resinous oozing on the surface of branches, shoots, boles, or previously wounded roots of infected trees. Removal of bark from an infected area, or canker, reveals slightly sunken, honey-colored wood that is soaked with resin. Needles on the tips of infected branches fade to yellow, then to red, and usually fall from the tree. Previously vigorous, unshaded branches often lose all needles beyond the most recent cone whorls, producing a noticeable dieback in the tree crown. Cones abort before or after reaching full size, and remain closed on infected whorls. Bole cankers produce a large amount of resin that often coats the bark several feet below the infection site; lower limbs and understory vegetation are also sometimes covered with fallen pitch. Bole cankers are flat or slightly sunken, up to several inches in diameter, and usually appear after branch dieback has occurred. Root

cankers are characterized by the presence of white, crystalline pitch at the wound site.

The first symptoms of pitch canker may appear at any time of the year, and are often followed by the bark beetle-caused death of twigs, limbs, tree tops and entire trees. Positive identification of the disease requires laboratory isolation and culture of the fungus from symptomatic tissue.

What Other Tree Pests And Diseases Could Be Mistaken For Pitch Canker?

A number of other pests, diseases and tree conditions cause symptoms which may be confused with pitch canker. Table 2 shows other symptoms and their possible causes which may help to distinguish pitch canker from other tree conditions.

KEY:
● Symptom usually occurs
○ Symptom occasionally occurs

	Lumpy or tubular mass of discolored pitch	Streaming pitch	No pitch exudation	Swelling on branch	Tips red with wilting needles	Tips red, needles not wilting	Dead tips, barren of needles
Pitch moth	●	○					
Western gall rust			●	●		○	○
Dwarf mistletoe				●		○	○
Twig beetles			●		○	●	●
Red Turpentine beetle	●		○				
Ips bark beetle			●		○	○	○
Weevils			●				●
Tree wounding		●					○
Tree pruning		●					
Salt and windburn dieback			●				●
Pitch canker fungus		●			●	○	●
Monterey pine scale					●		●

Table 2. Symptoms and possible causes of Pitch Canker

How does Pitch Canker Spread?

Insects are strongly implicated in the transmission of the disease; potential agents are shown in Table 3. It is possible that other insect species feeding on Monterey pine may also contribute to the spread of the disease.

Common Name	Latin Name
Dry twig and cone beetle:	*Ernobius punctulatus*
Twig beetles:	*Pityophthorus nitidulus*
	Pityophthorus tuberculatus
	Pityophthorus carmeli
	Pityophthorus setosus
Cone beetle:	*Conophthorus radiatae*
Bark beetles:	
California fivespined ips	*Ips paraconfusus*
Monterey pine ips	*Ips mexicanus*
California fourspined ips	*Ips plastographus*
Red turpentine beetle	*Dendroctonus valens*

Table 3: Insect species from which the pitch canker fungus has been isolated.

The larvae of these beetles are whitish in color and grub-like. With the exception of the dry twig and cone beetle (*Ernobius punctulatus*), they have no legs, and adult beetles are cylindrical with small clubbed antennae. The dry twig and cone beetle is elongate, 4-5mm long, with thread like antennae. The twig beetles (*Pityophthorus spp.*) and cone (*Conophthorus sp.*) beetles are 2-3mm in length, and their presence is indicated by holes 1mm in diameter in twigs, cones and cone stalks. Removal of the bark reveals irregular galleries lightly engraving the woody tissue. Upon dissection, the galleries of the twig beetles can be found inside the twig, often traveling to the pith. Cones infested with these species are usually aborted by the tree, failing to develop to full size.

The Ips beetles are 4-7mm in length, and their presence is indicated by holes 2mm in diameter in the bark of the bole, and larger branches. Their boring often produces a reddish brown boring dust. Removal of the bark reveals gallery systems consisting of a long female egg gallery of uniform diameter, with smaller larval galleries radiating from it, increasing in diameter along their length. Staining of wood by natural associated fungal species may also be present. These wood staining fungi should not be confused with the pitch canker fungus.

Evidence of red turpentine beetle (*Dendroctonus valens*) attack includes: large light pink to reddish brown pitch tubes about 1 to 2 inches in diameter around the base of the tree, groups of larvae occupying excavated patches of inner bark, and pink or white granular material on the ground or lower bole.

How Can Pitch Canker Be Managed?

A number of management procedures are available to reduce the impact of the disease and include:

- **Pruning of infected tips**
- **Destruction of cut branches and trees**
- **Restricted movement of wood with the bark attached**

Pruning of infected branch tips is practical only if small numbers of tips are infected, and they are accessible. Pruning should be carried out one cone whorl behind the infected tip. This procedure should be done during the cooler months (November to February) when insect activity is lower. Pruning will have to be repeated as new infections develop. All pruning tools should be sterilized in household bleach or Lysol® before and after each cut, to reduce the risk of spores being introduced directly into pruning wounds. After pruning, the tree(s) should be monitored on a regular basis so new infections can be quickly removed.

Destruction of cut branches and trees reduces the availability of breeding material for beetles which may transmit the disease. Cut branches, prunings, and fallen trees should be chipped, debarked or burned to kill beetles breeding inside of them. Branches left on the ground can be used as breeding material by beetles which may result in the transmission of the disease to other trees in the area. Infected Christmas trees should be removed and burned.

The movement of logs or firewood is not recommended unless debarked, because this may introduce the fungus or fungus-carrying beetles to areas previously free of the disease.

What Are The Implications For The Future?

The potential for the spread of the pitch canker fungus is significant considering the susceptibility of most pine species and Douglas-fir in the laboratory, and the efficiency of the associated insects in finding suitable host material. Native Monterey pine stands may be at risk, as are all landscape plantings of Monterey pine.

Insects feeding on both Monterey pine and Douglas-fir could transmit the fungus to Douglas-fir in both native and commercial stands. Commercial stands of ponderosa pine in the Sierra Nevada may ultimately be threatened by the spread of the fungus.

It is important that the spread of pitch canker fungus be monitored. Trees suspected of having the fungus should be sampled by removing infected branch tips, cutting beyond the limit of the symptoms. These samples should be enclosed in paper bags and mailed to CDF Forest Pest Management Laboratory, 135 Ridgeway Ave., Santa Rosa, CA 95401.

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