



# TREE NOTES

CALIFORNIA DEPARTMENT OF FORESTRY AND FIRE PROTECTION

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## Current Status of Pitch Canker Disease in California

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### INTRODUCTION

Pitch canker is a disease of conifers caused by the fungus *Fusarium subglutinans* f. sp. *pini*. The fungus, which apparently was introduced into California, initially infects branch tips, causing needle wilt and tip death. Resinous cankers result from infection of the bole (trunk), limbs, cones, and roots. Death of the tree or its top may result from secondary attack by bark beetles. Bark, twig, and cone beetles are implicated as vectors (carriers) of this pathogen.

### TREE SPECIES AFFECTED BY PITCH CANKER

Monterey pine (*Pinus radiata*) and Bishop pine (*P. muricata*) are the tree species most commonly infected in California. The fungus has been isolated from other conifers in California, and seedlings of additional tree species have been tested for susceptibility under greenhouse conditions. (Table 1).

**Table 1. Tree species found infected with the pitch canker fungus in nature, and species resistant or susceptible in greenhouse tests.**

Naturally infected species:		Native to California
Aleppo pine	<i>Pinus halepensis</i>	
Bishop pine	<i>P. muricata</i>	x
Canary Island pine	<i>P. canariensis</i>	
Coulter pine	<i>P. coulteri</i>	x
Digger (gray) pine	<i>P. sabiniana</i>	x
Italian stone pine	<i>P. pinea</i>	
Knobcone pine	<i>P. attenuata</i>	x
Monterey pine	<i>P. radiata</i>	x
Monterey x knobcone pine	<i>P. radiata x attenuata</i>	x
Ponderosa pine	<i>P. ponderosa</i>	x
Shore pine	<i>P. contorta</i>	x
Torrey pine	<i>P. torreyana</i>	x
Douglas-fir	<i>Pseudotsuga menziesii</i>	x
<u>Species susceptible in greenhouse seedling tests</u>		
Eldarica pine	<i>Pinus eldarica</i>	
Jeffrey pine	<i>P. jeffreyi</i>	x
Mugo pine	<i>P. mugo</i>	
Scots pine	<i>P. sylvestris</i>	
Sugar pine	<i>P. lambertiana</i>	x
<u>Species resistant in greenhouse seedling tests</u>		
Brutia pine	<i>Pinus brutia</i>	
White fir	<i>Abies concolor</i>	x
Coast redwood	<i>Sequoia sempervirens</i>	x
Giant sequoia	<i>Sequoiadendron giganteum</i>	x
Incense-cedar	<i>Calocedrus decurrens</i>	x
Norfolk Island pine	<i>Araucaria excelsa</i>	

## ***DISTRIBUTION OF PITCH CANKER IN CALIFORNIA***

Pitch canker epidemics in ornamental plantings of Monterey pine occur in Alameda, Santa Cruz, and northern Monterey and San Luis Obispo counties (Map 1). Smaller numbers of infected trees have been found in Sonoma, Contra Costa, San Francisco, San Mateo, Santa Clara, Santa Barbara, and Los Angeles counties. Infected Christmas trees have been found in San Mateo, Los Angeles, Orange, and San Diego counties.

Pitch canker infections in the native populations of Monterey pine at Point Año Nuevo and the Monterey Peninsula were initially found in 1992. At both locations, the number of diseased trees has increased rapidly. The disease was reported in a native Monterey pine stand at Cambria in 1994. The two Mexican island native populations have not been assessed for pitch canker. A small number of infected trees has been found in native Bishop pine stands in southern Mendocino County.

Map 1: Areas of localized and widespread pitch canker infection in California.



## ***SYMPTOMS OF PITCH CANKER DISEASE***

Infected trees may exhibit a number of disease symptoms, but not all symptoms will necessarily be present on an individual tree. The first indication of infection on pines is usually the wilting and fading of needles on previously vigorous, unshaded branch tips, with resin exudation from the infection site. Foliage becomes yellow, then red, and falls from the branch. This produces dieback that is often striking, with loss of all needles between the branch tips and the most recent branch and cone whorls. Pine cones abort before or after reaching full size, and typically remain closed on infected whorls. Removal of bark from infected areas, or cankers, reveals honey-colored wood that is soaked with resin. Bole cankers are slightly sunken, up to approximately eight inches in diameter, and usually appear after branch dieback has occurred. Crystallized, white resin produced by bole cankers often coats lower limbs and several feet of bark below the infection.

Infections of Douglas-fir are characterized by tip dieback without copious resin exudation; callous tissue may form at infection sites.

In Monterey pine Christmas trees, resinous cankers are produced at the root crown; the entire tree subsequently wilts and dies. Christmas tree branch infections will occasionally occur in the absence of root crown cankers. Tree death does not follow as rapidly in these cases.

Pitch canker symptoms may appear at any time of year, but initial symptoms in mature trees are most commonly observed in spring and summer. Symptoms have been observed in all age classes of trees. Bark beetle galleries are commonly associated with diseased plant tissues.

## ***CONDITIONS THAT CAN BE MISTAKEN FOR PITCH CANKER***

A number of insects, disease organisms, and environmental conditions cause symptoms that may be confused with pitch canker (Table 2). Positive diagnosis requires laboratory isolation and culture of the pitch canker fungus from symptomatic tree tissues.

## ***PITCH CANKER FUNGUS TRANSMISSION***

Insect-caused wounds appear to be required as infection courts for the pitch canker fungus. Many insects are capable of causing wounds and some have been shown to transmit the pitch canker fungus. Insect vector studies continue to focus on bark and cone inhabiting

**Table 2. Comparison of pitch canker symptoms with other conditions of Monterey pine.**

**Key :**

**X:** symptom usually occurs

**O:** symptom occasionally occurs

	Streaming pitch	Yellow to red wilted tip needles	Yellow to red unwilted tip needles	Dead tips, needles fallen	Cone or conelet abortion	Lumpy or tubular pitch masses	Swelling on branch	Silk webbing on tips
Pitch canker fungus	X	X	O	X	X			
Western gall rust			X	O	O		X	
Dwarf mistletoe			O	O			X	
Monterey pine scale		X		X				
Pitch moth	O					X		
Monterey pine tip moth			X					
Weevils				X				
Red turpentine beetle						X		
Ips bark beetles		O	O	O				
Cone beetles					X	X		
Twig beetles		O	X	X	O			
Tree pruning or wounding	X					O		
Salt and wind dieback			X	X				
Shade suppressed branches		O	X	O				
Silver-spotted tiger moth				X				X

beetles that are known to carry this pathogen. (Table 3.)

Adult twig (*Pityophthorus* spp.) and cone (*Conophthorus radiatae*) beetles may inoculate trees when they excavate feeding and egg galleries in twig bark and cone tissues. *Lasconotus pertenuis* and *Ernobius punctulatus* adults enter these existing galleries and may transfer fungal inoculum (e.g. spores) to cone or twig beetles or infect tree tissues directly. Engraver beetles (*Ips* species) have been shown to cause infections on tree boles by their tunneling activities. Most of these beetle species commonly inhabit recently fallen tree material as well as live trees. Many utilize more than one host tree species and have wide geographic ranges; dispersal of inoculum-carrying insects may result in the appearance of pitch canker disease in new locations. We are investigating the host preferences, distribution, and vector biology of many of these insects.

Seeds coats of Monterey pine have been found to carry the pitch canker fungus. Germination of inoculum-carrying seeds has yielded infected seedlings.

**DISEASE MANAGEMENT**

No effective control of pitch canker, using either chemical or biological agents, is currently available.

**Table 3. Bark and cone beetle species from which pitch canker fungus has been isolated.**

Monterey pine engraver	<i>Ips mexicanus</i>
Four-spined engraver	<i>I. plastographus</i>
California five-spined ips	<i>I. paraconfusus</i>
Monterey pine cone beetle	<i>Conophthorus radiatae</i>
Twig beetles	<i>Pityophthorus carmeli</i> <i>P. pulchellus tuberculatus</i> <i>P. nitidulus</i> <i>P. setosus</i>
Cylindrical bark beetles	<i>Lasconotus pertenuis</i> <i>L. nucleatus</i>

Although a small proportion of landscape-planted Monterey pine appears to be resistant to the disease, no resistant varieties of seedlings are available for planting at the present time. Disease management is currently limited to control of inoculum, reduction of vector breeding material, and restricted planting of susceptible tree species.

Inoculum and vector control includes the removal and disposal of infected trees and restriction of movement of diseased firewood. Pruning to remove infected tips will usually not eliminate the disease. However, if a lightly infected tree is relatively isolated from other diseased trees, removal of infected tips may slow the development of a new disease center. Sterilization of pruning tools with Lysol<sup>tm</sup> or household bleach should be performed before and after pruning operations. Infected or uninfected prunings and cut branches, and infected trees may contain or become infested with insects (primarily bark-inhabiting beetles) that carry the pathogen. To reduce the risk of further infection, this material should be chipped and spread or burned in place; chips should be spread in a thin layer to allow rapid drying. It is not recommended that logs and firewood cut in infested areas be moved from the region of origin.

Seed collection is not recommended in areas where pitch canker is present. Nurseries should burn infected seedlings.

Planting of susceptible tree species in areas with current pitch canker infections is likely to result in new infections. Such plantings should especially be avoided in the vicinity of native populations of Monterey, Bishop, shore, and Torrey pines, as these species have very limited native geographic distributions. New plantings of Monterey pine risk development of pitch canker infection throughout California; consequently landscape plantings are not recommended at this time. Research is underway to find disease-resistant varieties of Monterey pine.

It is important that the occurrence of pitch canker in new areas be reported to county farm advisors or the California Department of Forestry and Fire Protection. Tree species, locations, numbers of symptomatic branches present on trees, and number of symptomatic trees in the area should be indicated.

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## ***FUTURE IMPLICATIONS***

The potential for the spread of the pitch canker fungus is significant considering the susceptibility of most pine species and the efficiency of the associated insects in finding suitable host material. Native Monterey pine and Bishop pine stands are now at risk, as are landscape plantings of these and numerous other conifers.

Insects that feed and breed on more than one tree species present the threat of infecting previously unaffected tree species. The appearance of pitch canker in ornamental plantings of Douglas-fir and ponderosa pine has raised concern that native and commercial stands of these species in nearby coastal forests and the Sierra Nevada may become impacted by this disease. Native and landscape stands of these and other conifers in central coastal California are being monitored for symptoms of pitch canker.

The restricted native ranges of Monterey pine, Torrey pine, and Bishop pine heightens concern for the effect of pitch canker on these populations. Monterey pine is the most widely planted timber species in the world, and California's native populations represent a global resource for breeding programs. Pitch canker has the potential to reduce the genetic diversity of these species and the integrity of their native stands.

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## ***FURTHER READING:***

Storer A. J., T. R. Gordon, D. L. Wood, and P. L. Dallara. 1995. Pitch Canker in California. California Department of Forestry and Fire Protection, *California Forestry Note* #110.

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