PITCH CANKER

Integrated Pest Management for Home Gardeners and Landscape Professionals

Pitch canker, a disease that affects many pine species, is caused by the fungus *Fusarium circinatum*. This fungus can also infect Douglas-fir, but symptoms are usually limited to tip dieback.

Most pines native to California are susceptible to pitch canker, but Monterey pine, *Pinus radiata*, is the most widely affected host. The most recent severe outbreak of this disease in California was in populations of native bishop pine, *P. muricata*, at the Point Reyes National Seashore.

Pitch canker was first observed in California in Santa Cruz County in 1986. Since then the disease has spread rapidly and now occurs in 18 coastal counties. Pitch canker also occurs in the southeastern United States and in Mexico, Chile, Japan, South Korea, Italy, France, Spain, Portugal, and South Africa. Evidence indicates the pathogen may have originated in Mexico, and its introduction into California came by way of the southeastern United States.

IDENTIFICATION AND DAMAGE

The fungus causes infections (lesions) that can encircle (or girdle) branches, exposed roots, and the main stems (trunks) of pine trees. The tips of girdled branches wilt (Figure 1) as a result of obstructed water flow, causing needles to turn yellow (Figure 2) and then brown (Figure 3). The fascicles (needle clusters) eventually fall off, leaving bare branch ends. Multiple branch infections can cause extensive dieback in the crown of the tree and may lead to tree mortality (Figures 4 and 5).

Figure 1. Infected Monterey pine branch tips showing initial wilting.

Figure 2. Monterey pine branch tips showing discolored needles at infection site.

Figure 3. Infected Monterey pine branch tips showing chlorotic and dead needles caused by a girdling lesion.

The fungus isn't known to move within the tree; therefore, each canker or lesion is a separate and distinct infection. Resin (pitch) accumulates

Figure 4. Dieback of branch tips of Monterey pine caused by pitch canker.

Figure 5. Mortality of Monterey pine caused by pitch canker.

on a branch at the site of infection (Figure 6), and removal of the bark reveals honey-colored resin-soaked wood (Figure 7). Flattened or slightly sunken cankers on the main stem of the tree usually appear after the tree already has multiple branch infections. The flow of resin from main stem infections can coat the bark up to several feet below the infection site

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(Figure 8). Infected trees are often attacked by engraver beetles, which may cause death of additional branches, treetops, or the entire tree.

Infections of Douglas-fir often induce no symptoms: consequently, infected seedlings or cuttings may serve as vehicles for dissemination of the pathogen.

Certain insects and other pathogens, often in combination, can cause wilting of branch tips or other damage resembling that caused by pitch canker (Table 1). Though the disease can usually be diagnosed based on symptoms, diseased tissue must be cultured in a laboratory for a definitive identification.

Fusarium circinatum can also be a cause of seedling mortality. Seedling infections can result from inoculum present on seed, in soil, or the litter layer. Emerging seedlings may die quickly and not develop symptoms that are distinctive enough to identify *F. circinatum* as the cause. On older seedlings, resin typically accumulates on the stem near the soil line, with honey-colored lesions beneath the bark.

Figure 6. Infected Monterey pine branch showing resin accumulation on the surface.

Figure 7. Infected Monterey pine branch showing a honey-colored lesion beneath the surface.

VECTORS OF PITCH CANKER

Insects can transmit the pitch canker fungus during exploratory feeding on trees. The fungus has been isolated from a number of insects, and those capable of vectoring the pitch canker pathogen include engraver beetles (*Ips* species), twig beetles (*Pityophthorus*

Table 1. Comparison of Pine Tree Maladies with Some Similar Symptoms.[1]

Malady	Oozing or streaming pitch	Lumpy, protruding, or tubular masses	Yellow to red wilted tip needles	Yellow to red unwilted tip needles	Dead tips and needle drop	Cones or conelets abort	Swelling on branches	Silk webbing on tips
blight, Aleppo pine	*		**	*	**			
caterpillars					**			**
cone beetles		**				**		
Diplodia canker and blight	*		**	*	**	*		
dwarf mistletoe	[2]			*	*		**	
injuries or pruning wounds	**	*						
Ips bark beetles		*	*	**	**	*		
pine scales			*	**	**			
pitch canker	**		**	**	**	**		
pitch moths	*	**	*		*		*	
red turpentine beetle		**						
salt, wind, or drought dieback				**	**			
shade-suppressed branches			*	**	*			
tip moths			*	**	*			
twig beetles			*	**	**	*		
weevils				*	**			
western gall rust	*			**	*	*	**	

KEY:
*Symptom occasionally occurs **Symptom usually occurs

[1]Other abiotic disorders such as poor growing conditions and inappropriate cultural practices can also cause many of these symptoms.
[2]Extensive branch swelling and distortion caused by dwarf mistletoe might cause resin flow.

Sources: Adapted from Adams, D. Unpublished. *Pitch Canker: An Introduced Disease.* Davis: Calif. Dept. of Forestry and Fire Protection; and Dallara, P. L., A. J. Storer, T. R. Gordon, and D. L. Wood. 1995. *Tree Notes No. 20.* Sacramento: Calif. Dept. of Forestry and Fire Protection.

species), cone beetles (*Conophthorus radiatae*), and deathwatch beetles (*Ernobius punctulatus*). Adult spittlebugs, *Aphrophora canadensis*, haven't been demonstrated to carry the fungus, but their nymphs do create wounds that may become infected if fungal spores are already present on the branch surface.

DISTRIBUTION OF THE DISEASE

The distribution of pitch canker in California (Figure 9) indicates that the mild climate of the central and southern coasts is conducive to disease development. In a survey of 39 plots on the Monterey Peninsula, strong trends were found with respect to disease severity and geographic location. On average, trees in plots located adjacent to the coast had significantly higher levels of disease than trees in plots located just a few miles inland. Furthermore, disease increased more rapidly in coastal plots than in inland plots. More severe disease near the coast reflects a greater frequency and longer duration of fog, which provides the moisture required for the pathogen to infect shallow wounds insects create.

The survey conducted on the Monterey Peninsula also documented significant differences in disease severity in the urban forest versus the natural forest. On average, trees in landscaped areas and small open spaces had higher levels of disease than trees in larger, less disturbed forests.

MANAGEMENT

Pitch canker can result in extensive damage and even death of infected trees. However, not all infected trees become severely diseased, and of those that do, some recover. Experiments under controlled conditions show that susceptible Monterey pine trees repeatedly exposed to the pathogen may gain resistance over time, and field studies have confirmed that trees in areas where pitch canker has been present for 10 or more years tend to be more resistant to the disease than trees in areas where the pathogen has only recently become established. Therefore, landowners and land managers should take a conservative approach to removing diseased trees, because there is a possibility they may recover completely.

Resistance to Pitch Canker

Although Monterey pine is a susceptible species, some individual trees are resistant to the disease. Resistant Monterey pines can be vegetatively propagated as rooted cuttings, and trees that develop from cuttings of resistant trees retain the resistance of the parent tree. Resistance may be a useful tool for managing the disease in landscape settings, on Christmas tree farms, and in commercial forestry.

Figure 8. Extensive resin flow caused by pitch canker on the main stem of bishop pine.

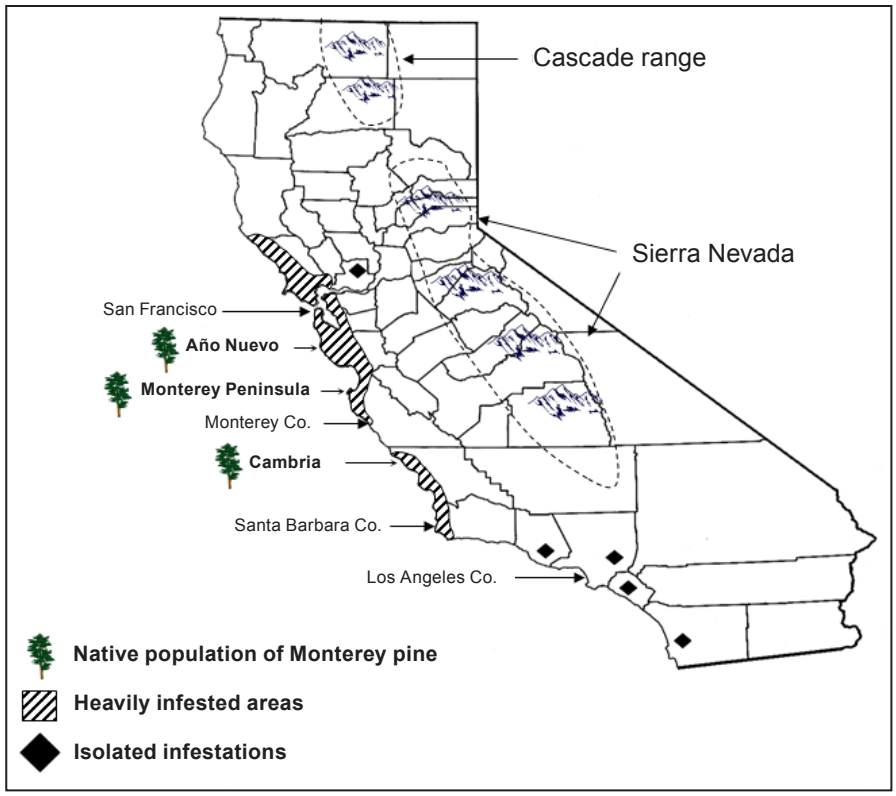

Figure 9. Distribution of pitch canker in California.

However, genetic resistance may cease to be effective due to changes in the pathogen population over time. Trees that now appear resistant could become susceptible if more virulent strains of the fungus arise through mutations or genetic recombination due to sexual reproduction, or if new strains of the fungus are introduced from elsewhere in the world. Thus, Monterey pines will

always be at some risk of future damage from pitch canker, and resistant Monterey pine stock should be used only where planting a nonsusceptible species isn't an option.

Preventing Movement of the Pathogen

In order to minimize damage caused by pitch canker, it is important to prevent movement of the pathogen to noninfested areas. With this in mind, the California State Board of Forestry designated a zone of infestation that includes most of coastal California as described on a site maintained by the Pitch Canker Task Force, http://ufei.calpoly.edu/pitch_canker/legislation.lasso#resolution. You can also contact the agricultural commissioner in your county to determine whether you are within this zone.

Local regulations may apply to moving potentially infested materials to areas outside the zone of infestation. Because the pathogen can survive in wood cut from infected trees, use or dispose of infected trees locally; see www.firewood.ca.gov. The pathogen can also survive in soil or seed and can infect seedlings that show no symptoms. Consequently, avoid moving any of these materials into areas where the disease doesn't already occur.

Table 2. Susceptibility to Pitch Canker of Some Conifers Grown in California.

Species	Common name	Status[1]	Susceptibility	
			Greenhouse[2]	Field[3]
Pinus attenuata	knobcone pine	native	S	S
Pinus canariensis	Canary Island pine	exotic	R	R
Pinus contorta subspecies contorta	shore pine	native	S	S
Pinus contorta subspecies murryana	lodgepole pine	native	S	N
Pinus coulteri	Coulter pine	native	S	S-
Pinus eldarica	Eldarica pine	exotic	S	N
Pinus halepensis	Aleppo pine	exotic	S	S
Pinus jeffreyi	Jeffrey pine	native	S	N
Pinus lambertiana	sugar pine	native	S	N
Pinus monophylla	pinyon pine	native	S-	N
Pinus muricata	bishop pine	native	S	S
Pinus pinea	Italian stone pine	exotic	R	R
Pinus ponderosa	ponderosa pine	native	S	S-
Pinus radiata	Monterey pine	native	S	S
Pinus sabiniana	gray pine	native	S	S-
Pinus sylvestris	Scotch pine	exotic	S	N
Pinus thunbergii	Japanese black pine	exotic	R	N
Pinus torreyana	Torrey pine	native	S	S-
Pseudotsuga menziesii	Douglas-fir	native	S-	S-

[1] Native species are found in native forests but may also be grown as timber species (e.g., ponderosa pine) or as landscape trees (e.g., Monterey pine); the exotic species are commonly planted in various parts of the state.

[2] Greenhouse tests of susceptibility were based on artificial inoculations. Species are rated as susceptible (S) if they sustained definite lesions at the site of inoculation or resistant (R) if there was little or no lesion development. For species rated as S-, most tested individuals were resistant, but a small percentage appeared moderately susceptible. N indicates a species that hasn't been tested.

[3] Field susceptibility is based on observations of natural infections. Species are rated as susceptible (S) if numerous trees are known to be infected, if some trees have sustained severe damage from pitch canker, or both. Species that have frequently been observed in otherwise infested areas, for which few or no trees are known to have sustained natural infections and none has been heavily damaged by pitch canker are rated as resistant (R); the level of resistance differs within this group. For species rated as S-, one or more infected trees have been observed, but the number of observations is too limited to provide a meaningful estimate of their relative susceptibility. For species rated as N, no infected trees have been observed, but the occurrence of this species in proximity to natural inoculum is too infrequent to conclude that the lack of disease is indicative of resistance.

Managing the Disease in Infected Trees

Where trees have sustained a limited number of infections, removing symptomatic branches can effectively eliminate the disease. Of course, new infections can occur, and studies have shown that pruning doesn't slow the development of pitch canker in stands where the disease is well established. However, pruning can be used strategically to enhance the aesthetic quality of a tree and thereby delay its removal from the landscape.

In areas where Monterey pine isn't native—most of California outside of Año Nuevo, Cambria, and Monterey—when replanting, select pines that are resistant to pitch canker (Table 2) or select other nonsusceptible trees.

Although insects often initiate infections, insecticides don't offer a practical way to control pitch canker. Likewise, fungicides with activity against the pitch canker pathogen are available, but no effective techniques for using them to control the disease have yet been demonstrated. For more information about managing pitch canker, consult the Web site of the Pitch Canker Task Force listed in Online Resources.

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ONLINE RESOURCES

Pitch Canker Task Force, http://ufei.calpoly.edu/pitch_canker/index.lasso.

California Firewood Task Force, http://www.firewood.ca.gov. ❖

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For more information, contact the University of California Cooperative Extension office in your county. See your telephone directory for addresses and phone numbers, or visit http://ucanr.org/ce.cfm.

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