PITCH CANKER

Integrated Pest Management for Home Gardeners and Landscape Professionals

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Pitch canker is a disease of pine trees that is caused by the fungus *Fusarium circinatum*. Douglas fir can also be infected, but this is rare and infected trees are not severely damaged. The disease was first observed in California in Santa Cruz County in 1986. Since then it has spread rapidly and now occurs in 18 coastal counties. Most pines native to California are susceptible to pitch canker, but Monterey pine (*Pinus radiata*) is the most widely affected host. Pitch canker has also been reported in Mexico, southeastern United States, Japan, Spain, Chile, and South Africa. Genetic analyses of *F. circinatum* populations from around the world indicate that the pathogen originated in Mexico, and its recent introduction into California came by way of the southeastern United States.

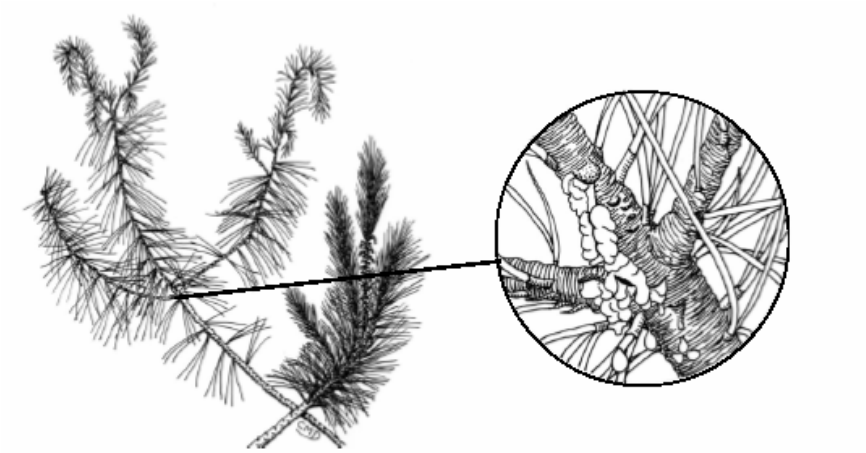

Figure 1. Tips of girdled branches wilt; needles begin to discolor and fall. *Inset:* Branch canker with oozing pitch.

IDENTIFICATION

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 as a result of obstructed water flow, causing the needles to turn yellow, and then red (Fig. 1). 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. The tree produces copious amounts of resin (pitch) in response to an infection. Flattened or slightly sunken cankers (large infection sites) on the main stem of the tree usually appear after the tree already has multiple branch infections. The fungus is not known to move within the tree; therefore, each canker or lesion is a separate and distinct infection. The flow of resin from main stem infections can coat the bark up to several feet below the infection site (Fig. 2). Honey-colored, resin-soaked wood is also a characteristic symptom of the disease and can be observed by peeling back the bark near a lesion. Infected trees are often attacked by engraver beetles, which cause the death of additional branches, tree tops, and the entire tree.

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

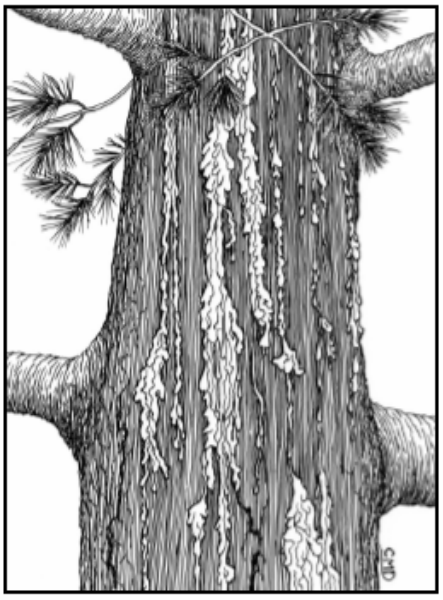

Figure 2. Pitch on trunk of infected tree.

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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, needle drop	Cones or conelets abort	Swelling on branches	Silk webbing on tips
pitch canker	**		**	**	**	**		
Diplodia canker and blight	*		**	*	**	*		
blight, Aleppo pine	*		**	*	**			
western gall rust	*			**	*	*	**	
dwarf mistletoe	2			*	*		**	
pine scales			*	**	**			
pitch moths	*	**	*		*		*	
tip moths				**	*			
weevils				*	**			
red turpentine beetle		**						
Ips bark beetles		*	*	**	**	*		
cone beetles		**				**		
twig beetles			*	**	**	*		
injuries, pruning wounds	**	*						
salt, wind, or drought dieback				**	**			
shade-suppressed branches			*	**	*			
caterpillars					**			**

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

KEY

* Symptom occasionally occurs

** Symptom usually occurs

Adapted from: Adams, D. Unpublished. *Pitch Canker: An Introduced Disease.* Davis, CA: Calif. Dept. For. Fire Protection; Dallara, P. L., A. J. Storer, T. R. Gordon, and D. L. Wood. 1995. *Tree Notes* 20. Sacramento, CA: Calif. Dept. For. Fire Protection.

VECTORS OF PITCH CANKER

Insects are believed to transmit the pitch canker fungus during exploratory feeding on trees. The fungus has been isolated from a number of insects, and the following insects are capable of vectoring the pitch canker pathogen: engraver beetles (*Ips* spp.), twig beetles (*Pityophthorus* spp.), cone beetles (*Conophthorus radiata*), and deathwatch beetles (*Ernobius punctulatus*). Adult spittlebugs (*Aphrophora canadensis*) have not 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.

DISEASE PROGRESS IN NATIVE AND URBAN FORESTS

Based on the distribution of pitch canker in California (Fig. 3), it can be concluded that the mild climate of the central and southern coast 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. The difference in disease development between inland and coastal locations was especially striking because the inland plots are all within a few miles of the coast.

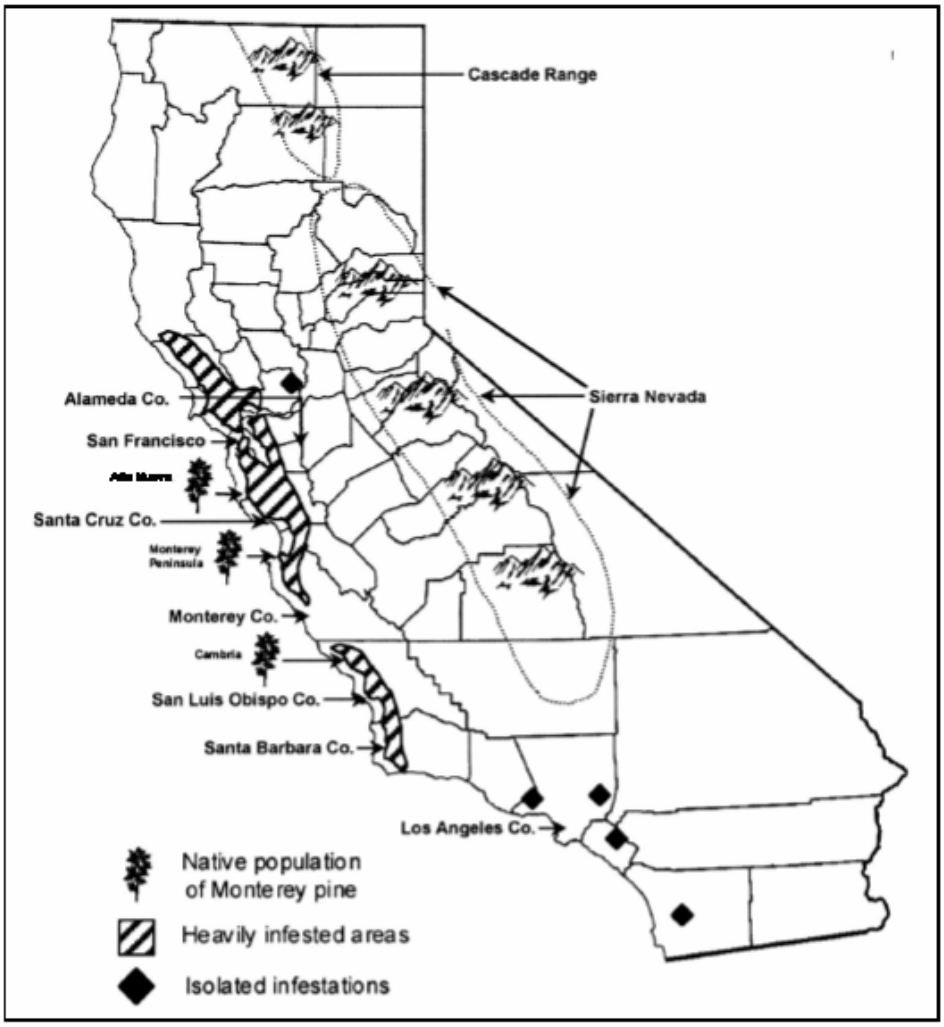

Figure 3. Distribution of pitch canker in California.

Results from that same survey also document 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.

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 trees repeatedly exposed to the pathogen may gain resistance over time. For example, trees deliberately inoculated four times with *F. circinatum* over a 2-year period developed progressively smaller lesions each time they were inoculated. Likewise, there have been numerous observations of severely infected trees recovering from infection after a period of 6 to 7 years. Therefore, landowners and land managers should take a conservative approach to removing diseased trees because there is a possibility they may go into remission or even recover.

Resistance to Pitch Canker. It is not uncommon to observe Monterey pines that are unaffected by pitch canker, even where they are surrounded by severely infected trees. Monterey pines have a wide range of susceptibility to pitch canker. 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, Christmas tree farms, and in commercial forestry. However, the genetic resistance may be adversely affected by 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 (as a result of sexual reproduction) or if new strains of the fungus are introduced from elsewhere in the world.

Though the fungus is primarily spreading by asexual propagation in California, laboratory studies indicate that strains within California have the ability to outcross (reproduce sexually). If outcrossing begins to occur naturally in California, new strains could develop. Furthermore, strains of the fungus isolated both in Mexico and in Florida are able to cause disease on a Monterey pine that is resistant to the eight predominant strains of the fungus in California. Thus, Monterey pines will always be at some risk of future damage from pitch canker, and the use of resistant stock for landscape plantings should be undertaken only if the use of nonsusceptible tree species is not an option.

Preventing Movement of the Pathogen. In order to minimize the damage caused by pitch canker, it is important to prevent movement of the pathogen to noninfested areas. With this in mind, the California Board of Forestry has designated a zone of infestation that includes most of coastal California (see the zone of infestation map on the Pitch Canker Task Force Web site listed in Online Resources). You can also contact the agricultural commissioner in your county to determine whether or not you are within this zone. Local regulations may apply to the movement of 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. The pathogen can also survive in soil, in seed, and can infect seedlings that show no symptoms. Consequently, avoid moving any of these materials into areas where the disease

Table 2. Susceptibility of Some Conifers Grown in California to Pitch Canker Caused by *Fusarium circinatum*.

Species	Common name	Status[1]	Susceptibility Greenhouse[2]	Susceptibility Field[3]
Pinus attenuata	knobcone pine	native	S	S
P. canariensis	Canary Island pine	exotic	R	R
P. contorta ssp. *contorta*	shore pine	native	S	S
P. contorta ssp. *murryana*	lodgepole pine	native	S	N
P. coulteri	Coulter pine	native	S	S-
P.eldarica	Eldarica pine	exotic	S	N
P. halepensis	Aleppo pine	exotic	S	S
P. jeffreyi	Jeffrey pine	native	S	N
P. lambertiana	sugar pine	native	S	N
P. monophylla	pinyon pine	native	S-	N
P. muricata	bishop pine	native	S	S
P. pinea	Italian stone pine	exotic	R	R
P. ponderosa	ponderosa pine	native	S	S-
P.radiata	Monterey pine	native	S	S
P. sabiniana	gray pine	native	S	S-
P.sylvestris	Scotch pine	exotic	S	N
P. thunbergii	Japanese black pine	exotic	R	N
P. torreyana	Torrey pine	native	NT	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 the results of 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. NT indicates a species that has not 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 and/or some trees have sustained severe damage from pitch canker. Species that have frequently been observed in otherwise infested areas and for which few or no trees are known to have sustained natural infections and none have 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.

does not already occur. For more information on management of pitch canker, consult the Web site of the Pitch Canker Task Force listed in Online Resources.

MANAGEMENT

As mentioned above, some infected pines do recover, even if they are severely diseased. Pruning does not slow the spread of the disease in a highly infested area. However, pruning can be used strategically to enhance the aesthetic quality of a tree and thereby delay its removal from the landscape. Because trees may recover, their removal should be delayed as long as possible, and only trees that pose a hazard should be cut down. In areas where Monterey pine is not native (most of California outside of Año Nuevo, Cambria, and Monterey), select pines that are resistant to pitch canker (Table 2) or other nonsusceptible trees for replanting.

REFERENCES

Bonello, P., T. R. Gordon, and A. J. Storer. 2001. Systemic induced resistance in Monterey pine. *For. Pathol.* 31: 1-8.

Gordon T. R., A. J. Storer, and D. L. Wood. 2001. The pitch canker epidemic in California. *Plant Disease* 85: 1128–1139.

Gordon, T. R., K. R. Wikler, S. L. Clark, D. Okamoto, A. J. Storer, and P. Bonello. 1998. Resistance to pitch canker disease, caused by *Fusarium subglutinans* f.sp. *pini,* in Monterey pine (*Pinus radiata*). *Plant Pathol.* 47: 706–711.

McCain, A. H., C. S. Koehler, and S. A. Tjosvold. 1987. Pitch canker threatens California pines. *Calif. Agric*. 41: 22–23.

Storer, A. J., T. R. Gordon, and D. L. Wood. 2002. The epidemiology of pitch canker of Monterey pine in California. *For. Sci.* 48: 694–700.

Wikler, K. R., and T. R. Gordon. 2000. An initial assessment of genetic relationships among populations of *Fusarium circinatum* in different parts of the world. *Can. J. Bot.* 78: 709–717.

Wikler, K. R., T. R. Gordon, S. L. Clark, M. J. Wingfield, and H. Britz. 2000. Potential for outcrossing in an apparently asexual population of *Fusarium circinatum*, the causal agent of pitch canker. *Mycologia* 92: 1085–1090.

Wikler, K. R., A. J. Storer, W. Newman, W. Gordon, T. R. Gordon, and D. L. Wood. In press. The dynamics of an introduced pathogen in a native Monterey pine (*Pinus radiata*) forest. *Forest Ecology and Management.*

ONLINE RESOURCES

Pitch Canker Task Force Web site
http://frap.cdf.ca.gov/pitch_canker/index.htm

Center for Forestry Pitch Canker Extension Project Web site
http://nature.berkeley.edu/forestry/curr_proj/pitch/pitch.html

For more information contact the University of California Cooperative Extension or agricultural commissioner's office in your county. See your phone book for addresses and phone numbers.

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Pesticides are poisonous. Always read and carefully follow all precautions and safety recommendations given on the container label. Store all chemicals in the original labeled containers in a locked cabinet or shed, away from food or feeds, and out of the reach of children, unauthorized persons, pets, and livestock.

Confine chemicals to the property being treated. Avoid drift onto neighboring properties, especially gardens containing fruits and/or vegetables ready to be picked.

Do not place containers containing pesticide in the trash nor pour pesticides down sink or toilet. Either use the pesticide according to the label or take unwanted pesticides to a Household Hazardous Waste Collection site. Contact your county agricultural commissioner for additional information on safe container disposal and for the location of the Household Hazardous Waste Collection site nearest you. Dispose of empty containers by following label directions. Never reuse or burn the containers of dispose of them in such a manner that they may contaminate water supplies or natural waterways.