

Epidemiology and Control of Pitch Canker in Pines in California

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Pitch canker of pines was identified as a serious disease affecting Monterey pines (*Pinus radiata*) in Santa Cruz County in 1986. Since then the disease has been found in nine additional counties. More than a thousand dead or dying Monterey pines have been removed as a result of the disease. Pitch canker is endemic in the southeastern United States and very recently was reported from Mexico. The disease, which results from infection by the fungus *Fusarium subglutinans* f. sp. *pini*, is recognized by the death of shoots and branches which often are killed by girdling infections associated with cones. Bole cankers with copious production of pitch are a less common symptom. Infected tissues beneath the bark are resin-soaked and honey-colored.

The pitch canker fungus requires a wound before it can infect a tree. In the southeastern United States, injuries made by tree shaking equipment used in harvesting cones, cone removal and storms are implicated in disease incidence in seed orchards. Insects, particularly the deodar weevil and the subtropical pine tip moth have been found contaminated with the fungus and have been able to inoculate pines in laboratory tests. The fungus is commonly seed-borne, both externally and internally. A wide range of pines including loblolly, shortleaf, slash, pitch and Virginia are infected in the Southeast. In California the principal host is Monterey pine, but aleppo, bishop, and Italian stone pines also have become infected in the landscape.

Host Range

Twenty-six *Pinus* species, including important California natives, were inoculated in greenhouse trials. All but Brutia pine were susceptible. Redwood, sequoia, incense cedar, Norfolk Island pine, and Monterey and Arizona cypress were immune. Douglas fir, White fir, Atlas cedar, and deodar cedar became infected but recovered completely. All of the non-pine species would make satisfactory replacement trees for pines in areas where the disease occurs. Brutia pine is being evaluated as a replacement tree in Santa Cruz County.



Resin production (above) is a common symptom of pitch canker infection.

Branch dieback on Monterey pine resulting from pitch canker (left).



Disease Resistance in Monterey Pine

Although Monterey pine is the species most severely damaged by pitch canker in California, not all trees are equally affected. In several locations in Santa Cruz County, we have observed Monterey pines with little or no disease even though they were adjacent to several heavily infected trees. Inoculations of these trees in the field showed that cankers developed much more slowly on the disease-free trees than on comparable trees which already were infected. Experiments conducted under greenhouse conditions revealed that some Monterey pines may be genetically resistant to pitch canker. For example, tests of native populations showed that trees originating in Año Nuevo were less susceptible to pitch canker than trees from the Monterey peninsula. Thus, it may be possible to make selections from native populations of Monterey pines which will be more resistant to pitch canker in landscape plantings.

Epidemiology

Pitch canker is a relatively new disease in California. This is borne out by genetic studies of the pathogen. There are one predominant strain and four minor strains present in California. In contrast, collections of the fungus from

Florida are found to be made up of many different strains, even within a limited area, suggesting that the fungus has been in Florida for some time.

The fungus can be detected throughout the year in the air in areas where the disease is prevalent but not in nearby areas where the disease is absent. The source of the air-borne inoculum is likely to be pulverized infected needles and infected cones. Artificial wounds made on shoots and branches did not become infected, although observations suggest that wounds do serve as entry courts for the fungus in some situations. A wound dressing using a solvent based paint containing 1-percent benomyl was effective in protecting inoculated wounds from infection.

Insect Relationships

Many different kinds of insects collected on sticky traps were found to be contaminated with the pitch canker

pathogen. Up to 20 percent of the bark beetles (*Ips* spp. and *Pityophthorus* spp.) caught in pheromone traps were contaminated, and *Ips* spp. were shown to be capable of moving the fungus into healthy Monterey pine branches. A dry cone and twig beetle (*Ernobius punctulatus*) was caught in high numbers at sticky traps on new shoots, and 16 percent of them were contaminated with the pitch canker pathogen. Evidence continues to accumulate that insects play a major role in the spread of pitch canker.

Cultural control

In many parts of Santa Cruz County, Monterey pines are heavily infected with pitch canker and must eventually be removed. In outlying areas where the disease is less intense, it may be possible to eliminate pitch canker, or at least slow its development, by removal of the infected branches. However, because symptoms are not visible for at least several weeks after an infection takes place, it may not be possible to remove all infected branches at one time. For example, in a stand of Monterey pines in southern Santa Cruz County, we removed all visible infections from 14 trees in August of 1989. In April, 1990, we removed 100 infected branches which had not shown symptoms when trees were pruned eight months earlier. Some of these branches probably were infected just prior to the time of the first pruning and were not yet symptomatic. Also, because this location was within 3 miles of heavily diseased trees, new infections may have occurred during the interval between prunings. However, even in a more isolated location in Monterey county, nine trees pruned in August, 1989, had to be pruned again in April, 1990, when 23 new infections were identified.

Because of the frequency with which insects associated with Monterey pine carry the pitch canker pathogen, disease control can probably not be achieved only by removal of infected branches but may also require appropriate measures to control insect populations. Control measures are most likely to be effective if applied soon after the disease is first recognized.

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