



Pinewood Nematode (Pine-Wilt Disease)

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The pinewood nematode (*Bursaphelenchus xylophilus*) is the most destructive pest of forest and landscape pines in Japan. This nematode invades the stems and branches of pines causing a sudden wilting and death of the tree irrespective of its age or size. In 1979, the pinewood nematode was discovered on dead pines in the United States (near Columbia, Missouri). To date, this nematode has been identified in thirty-three states and is likely distributed throughout most of the country. The pinewood nematode was thought first to be a recent introduction into the United States; however, plant pathologists now believe it is a native pest, which has gone undetected. The pinewood nematode does not appear to represent a severe threat to coniferous forests in the United States but may cause random death of pines in the landscape.

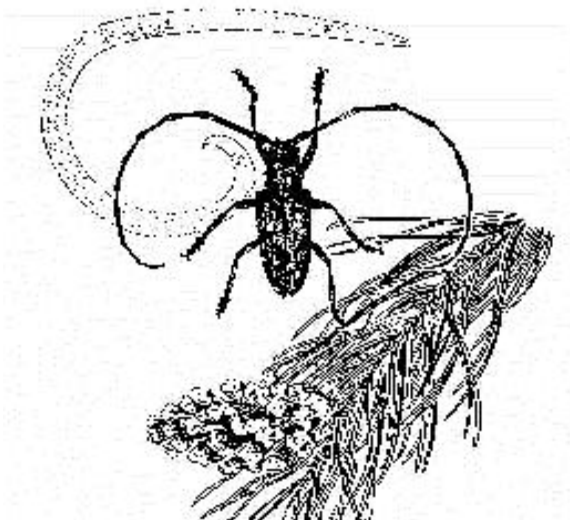
The pinewood nematode has been isolated from twenty pine species in this country. **Japanese black pine (*Pinus thunbergii*)**, **Japanese red pine (*P. densiflora*)** and **Scots pine (*P. sylvestris*)** are most susceptible. Most native pine species are somewhat resistant to the disease. In addition to pine, the nematode has been isolated from **larch, balsam fir, spruce and deodar and atlas cedar**.

SYMPTOMS

Symptoms of pine-wilt disease usually become evident in late spring or summer. The first observable symptom is a lack of resin exudation from bark wounds. The foliage then becomes pale green, then yellow and finally reddish brown when the tree succumbs to the disease. The wood in affected trees is dry and totally lacks resin. Symptoms usually become evident throughout the entire crown at once, but a slower, progressive decline may occur in resistant species.

DISEASE CYCLE

The pinewood nematode is vectored from diseased to healthy pines by certain wood boring beetles known as Cerambycids. These beetles breed in dead and recently killed pines. In diseased trees, developing beetles become contaminated with the pinewood nematode. When the beetles



complete development, adults emerge from the wood carrying the nematode and fly to healthy pines where they feed on succulent pine and introduce the nematode into feeding wounds. Following infection, the nemas migrate to resin ducts in the wood and feed on the cells lining the ducts.

Under summer temperatures, the nematode reproduces very quickly: each female lays approximately eighty eggs, and it can complete its life cycle (from egg-hatch to maturity) in four to five days. Huge populations of the nematode develop throughout the tree, which impedes water transport and causes the wilt symptoms. Highly susceptible pines usually die within three months of infection. If infection occurs late in the growing season, the tree probably will survive to the following spring or summer. Adult female Cerambycids lay eggs in trees weakened or killed by the pinewood nematode and the disease cycle is repeated.



**Egg laying niches of attaching
Cerambycid beetles**

On native pines, the pinewood nematode frequently is isolated from trees that were stressed or killed by another disease, insect, or an environmental adversity. Subsequently, the pinewood nematode may not be a primary pathogen in all declining trees in which it is found. The pinewood nematode and the Cerambycid

vectors also are associated frequently with blue stain fungi (*Ceratocystis* spp.), which also can cause wilting and death of pines. Clearly, more research is necessary to determine the role of the pinewood nematode in causing the death of native pines

DETECTION

Verification of the pinewood nematode can be accomplished by sending wood samples from symptomatic trees to the Bartlett Tree Research Laboratories or state plant diagnostic laboratory. Wood samples (not bark) should be obtained from trunk or branches preferably in the lower, middle, and upper portions of the crown. Wood cores obtained with an increment borer, or one to two-inch-thick cross-sections of the trunk or branch are suitable samples. Wrap samples in paper, not plastic, for shipment (enclosing the sample in plastic may kill the nematodes).

CONTROL

Immediate removal and destruction of pines killed by the pinewood nematode will help prevent spread of the pest to adjacent, healthy pines. Wood from the dead pines should be chipped, buried in a landfill or immediately burned. Maintaining the vigor of pines through periodic fertilization and irrigation during dry periods may help prevent disease development.