8. Needle Cast Diseases of Pines

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Hosts

Nearly all pine species are susceptible to infection by one or more of the fungi that cause needle cast diseases. Most of the needle cast fungi are weak pathogens and have specific host preferences. However, some host-pathogen combinations can result in significant outbreaks of disease when weather and site conditions are favorable. Nonnative species such as Scots, Austrian, and Japanese black pine are especially susceptible to needle cast diseases and can suffer severe damage in the nursery. With the exception of red pine, seedlings of native pine species are normally not seriously affected in the nursery. Three species of fungi, *Cyclaneusma minus*, *Lophodermium seditiosum*, and *Ploioderma lethale*, are the most common cause of severe needle cast disease outbreaks in nurseries that grow pines. These pathogens and their host species are listed in table 8.1.

Distribution

The fungi that cause pine needle cast diseases are widely distributed throughout North America and can usually be found wherever their hosts are present.

Damage

The cohort of needles affected depends on which fungus is involved. *L. seditiosum* primarily infects newly elongated needles on the current season's shoots. *P. lethale* mainly infects 2-year-old needles. *C. minus* infects all needles except those of the current year. Damage usually becomes evident the year following infection when the affected needles die and fall prematurely. Needle cast diseases seldom result in mortality, but extensive needle loss may result in reduced growth and loss of vigor. Severely discolored or defoliated seedlings may lose their sale value because of poor appearance. If infected, outplanted seedlings may perform poorly and may serve as a source of inoculum for infection of other nearby pines. For these reasons, diseased seedlings should be culled.

Diagnosis

Lophodermium and *Ploioderma* needle cast symptoms become visible on current-year needles between late autumn and the next spring. Initially, yellow to reddish-brown spots develop on infected needles (fig. 8.1). These spots can be confused with damage caused by sucking insects. As the spots enlarge, needles infected by *L. seditiosum* take on a mottled appearance. By summer, they turn brown and fall from the tree. Needles infected by *P. lethale* turn grayish-brown but remain green near the base. Seedlings severely affected by either disease may appear scorched (fig. 8.2). Fruiting bodies (apothecia) of *L. seditiosum* and *P. lethale* appear beginning in late spring on dead portions of infected needles and on fallen needles. The fruiting bodies of *L. seditiosum* are small, black football-shaped structures visible with the naked eye (fig. 8.3). Fruiting bodies of *P. lethale* appear as elongated black lines (fig. 8.4).

Cyclaneusma needle cast symptoms appear on 2-year-old needles in late summer or autumn the year after the needles were infected. Spots on infected needles are initially light green. The spots enlarge into yellow bands, and eventually the entire needle becomes yellow, often with transverse brown bands. Fruiting bodies of *C. minus* initially develop in the brown areas, and later on the entire lower surface of the infected needles. These fruiting bodies are initially small and inconspicuous, gradually elongating.

Table 8.1—*Needle cast fungi causing disease on pine seedlings and their hosts.*

Species	Pines highly susceptible to damage in nurseries	Other recorded pine hosts, not commonly damaged in nurseries
Cyclaneusma minus	Scots, Austrian, and Monterey	Cuban, gray, Jeffrey, limber, lodgepole, mugo, ponderosa, Virginia, eastern white, and others
Lophodermium seditiosum	Austrian, red, Scots[1], and Monterey[2]	Aleppo, rough-barked Mexican, and Virginia
Ploioderma lethale	Austrian, red, and Japanese black	Austrian, Japanese black, Cuban, loblolly, pitch, pond, red, sand, shortleaf, slash, spruce, Table Mountain, and Virginia

[1] Particularly short-needle strains originating in France and Spain.

[2] When grown outside its native range.

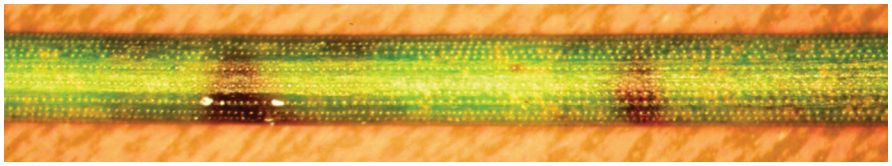

Figure 8.1—*Typical needle spots on red pine caused by* Lophodermium *species.* Photo by USDA Forest Service, North Central Research Station Archive, at http://www.bugwood.org.

Figure 8.2—*From a distance, diseased pine foliage appears scorched.* Photo by Joseph O'Brien, USDA Forest Service, at http://www.bugwood.org.

The fungal tissue erupts through the epidermis, which typically splits in two thin flaps to expose the fungal tissue. The fungal tissue is yellow to orange, later becoming white or tan as the spore-producing surface is exposed (fig. 8.5).

Identifying the species causing needle cast diseases often requires microscopic examination by a specialist. Many saprophytic or weakly pathogenic fungi that grow on dead or dying needles but do not cause disease have fruiting bodies that may appear very similar to the pathogenic species. Accurate identification is necessary to determine if the symptoms are due to a needle cast disease and the species involved. Accurate identification is also necessary to time chemical treatments for effective control.

Biology

All three species release spores when mature fruiting bodies are moistened by rain or irrigation, although the seasonality of spore release differs. *C. minus* spores are released throughout the year when temperatures are above freezing, peaking 4 to 6 hours after rain begins. *L. seditiosum* spores are released in late summer and fall, and occasionally at other times of the year if conditions are favorable. *P. lethale* spores are released during late spring and early summer. These fungi also require moist conditions for spore germination and infection. *L. seditiosum* and *P. lethale* spores infect only current-year needles. *C. minus* spores infect current-year needles in late spring and older needles from spring through autumn. Year-to-year variations in weather and differences in climate among geographic areas will affect the exact timing of spore release and infection by these fungi.

Spores may be produced on infected trees in the vicinity of the nursery, on infected nursery stock, and on fallen needles. Infected seedlings transplanted from other facilities and pine needles used as mulch are potential sources of inoculum. *L. seditiosum* also fruits on cone scales and can be introduced into nurseries on cone fragments mixed with seeds. Severe outbreaks of needle cast diseases are most likely to occur after cool, moist weather in spring, summer, or early fall creates favorable conditions for buildup of abundant populations of spores and widespread infection of susceptible hosts.

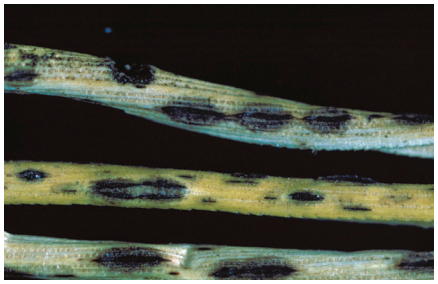

Figure 8.3—*Fruiting bodies of* Lophodermium *species on pine needles.* Photo by Robert L. Anderson, USDA Forest Service, at http://www.bugwood.org.

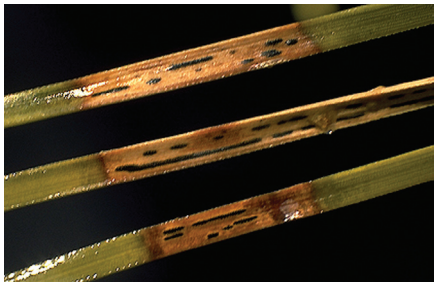

Figure 8.4—*Fruiting bodies of* Ploioderma lethale *on pine needles.* Photo by Department of Plant Pathology and Plant-Microbe Biology, Cornell University.

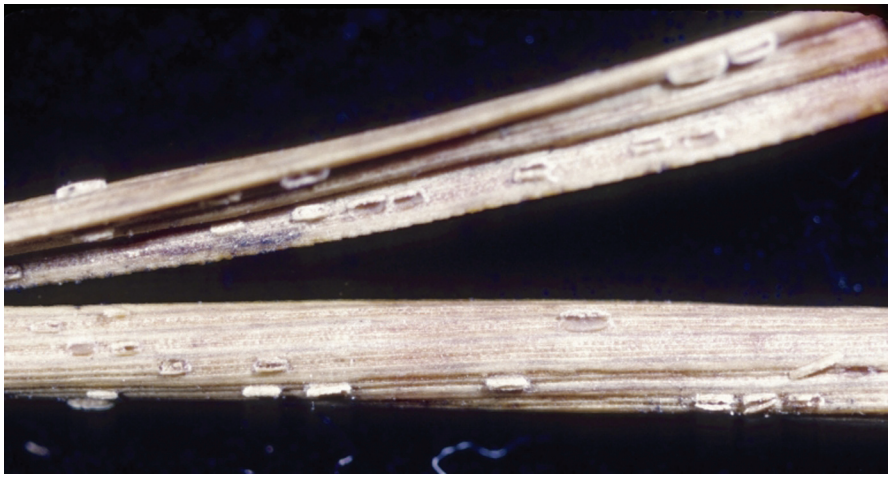

Figure 8.5—*Fruiting bodies of* Cyclaneusma minus *on Scots pine needles.* Photo by Joseph O'Brien, USDA Forest Service, at http://www.bugwood.org.

Control

Prevention

Ideally, nurseries that grow pines should be located as far as possible from pine forests. Pines in windbreaks and residential areas adjacent to nurseries can also be sources of inoculum. Seed should be inspected and thoroughly cleaned before sowing to remove cone scales that may harbor inoculum. Pine seedlings received from other nurseries should be inspected carefully before transplanting. Do not use pine needle mulch.

Cultural

Allow needles to remain wet for the shortest possible time. Low seedling density will encourage good air circulation, allowing seedlings to dry as rapidly as possible after rain and irrigation. Drip irrigation is ideal for keeping foliage dry. If overhead sprinklers are used, watering in the morning will help seedlings dry faster. After pine seedlings are lifted, fallen needles should be removed or tilled in if susceptible pines will be grown nearby the following year.

Chemical

Fungicides can be used to protect healthy foliage from infection. They must be applied just before and during spore release periods, and before infection occurs. To be effective, thorough coverage of the foliage is required. The timing of fungicide applications should be based on proper identification of the causal fungus, local weather conditions, and the product label recommendations. Wet years will require more frequent applications. High-density plantings and areas with a history of needle cast diseases may also require more frequent fungicide treatments.

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