

Conifer Foliage Diseases

Needle Casts

Hosts: Conifers.

Diagnosis and Damage: Identification of needle cast diseases is based on the appearance of fruiting bodies on discolored needles and premature death and shedding of needles. Identification is difficult without looking at fruiting bodies and spore shape and size with a compound microscope. What is most important is to determine if the tree has a needle disease, insect damage such as needle miner, or abiotic damage so the correct management action can be taken. Premature needle cast

should not be confused with annual fall needle drop. Every year, usually in the fall, conifers shed some of their oldest needles. Prior to this annual needle drop, these older needles will often turn yellow or brown. Insect needle miners hollow out needles, and needle scale insects can be seen as small appressed bodies on needles or twigs. Abiotic damages that are often confused with needle casts include salt, drought, frost-winter

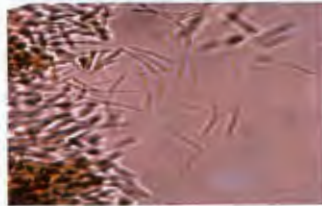
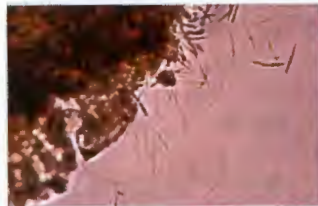
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FUNGAL ORGANISM	HOST	IDENTIFICATION
<i>Bifusella saccata</i> *	Limber, pinyon pine	Large, long, shiny, black fruiting bodies on the dead tips of green needles.
<i>Bifusella linearis</i>	Limber pine	Shiny black, elongated fruiting bodies on two- to three-year old needles. Black crust-like fungal growths, irregular in shape and size, are frequently associated with the fruiting bodies.
<i>Davisonmycella</i> spp. *	Ponderosa, lodgepole pines	Long, dark brown or black, shiny, raised fruiting bodies bordered by orange-brown bands on brown, faded needles.
<i>Dothistroma</i> sp. *	Ponderosa, lodgepole, Austrian	Infections in lower crowns, red bands; needles turn light green-yellow, tan, and brown. Needles are not normally cast and may droop. Conidia have cross walls and are clear.
<i>Elytroderma deformans</i> *	Ponderosa, pinyon pines	One-year-old needles turn red in the spring following infection and develop dull black, elongated fruiting bodies that are scattered on all needle surfaces. Red-brown necrotic flecks in the bark of older infected twigs are diagnostic. Causes small, tufted brooms of twigs and branches.
<i>Lirula abietis-concoloria</i>	True firs	Forms dark brown to black, elongated fruiting bodies extending down the center of the lower surface of two-year or older, straw-colored needles. On the upper surface of the infected needle, a single brown line is evident along the midrib. Infection is usually limited to one year's set of needles.
<i>Lirula macrospora</i>	Spruces	Fruiting bodies are long, black lines that often traverse the entire length of the needle. Needles remain on the branch after death.
<i>Lophodermella arcuata</i> *	Limber pine	Newly developing needles are infected and remain green until the following spring when they die back from the tip and turn brown prior to bud break. Black to brown, elongate to elliptical fruiting bodies appear in early summer on all surfaces of the dead needles.
<i>Lophodermella cerina</i>	Ponderosa pine	Infected needles die back from the tip, turning bright red-brown. Short, oval, light brown to buff fruiting bodies are formed, are often the same color as the infected needle, and develop in groups on waxy spots on green and dead needles.
<i>Lophodermella concolor</i> *	Lodgepole pine	New needles are infected and remain green until the following spring when they turn red. Fruiting bodies appear on dead and dying needles as shallow oval depressions the same color as the needle surface.
<i>Lophodermella montivaga</i> *	Lodgepole pine	Elongate, dark brown fruiting bodies with prominent central slits.
<i>Lophodermium</i> sp. *	Lodgepole, ponderosa, limber, spruce,	Fruiting bodies usually are shiny black and separated from each other and are usually on older needles. Depending on the species, needles are usually cast in one year, or some do not normally fall for several years after fruiting bodies are formed.
<i>Rhabdocline pseudotsugae</i> *	Douglas-fir	Infection occurs on new needles, which develop chlorotic spots in the fall following infection. In late spring on one-year-old needles, red-brown spots and long, brown pustules form on either side of the midrib on the underside of needles. Needles are cast in summer.
<i>Rhizosphaera</i>	Spruces	Pycnidia in rows of stomates with smooth, small spores that makes sporodochia look fuzzy.
<i>Scirrhia acicola</i> *	Ponderosa, lodgepole, Austrian	The disease is normally called brown spot since it produces spots but can form bands. Last year's infected needles do not normally drop. Conidia are cross walls and are usually greenish brown.
<i>Stigmia lautii</i>	Spruces	Sporodochia fill stomatal pits that make large, multicelled spores.
<i>Virgella robusta</i>	True firs	Forms dark brown to black, elongated fruiting bodies extending down the center of the lower surface of two year or older, straw-colored needles. Two distinct brown lines are formed on the upper surface of the infected needle on either side of the midrib. Infection is usually limited to one year's needles.

* Photographs available on following pages.

Bifusella saccata

Right: Limber pine with *Bifusella* needle cast. Note black fruiting. Photograph by William Jacobi.



Davisomyces spp.

Top left: *Davisomyces* on ponderosa pine in southern Colorado.

Middle left: *Davisomyces* on ponderosa pine. Preceding photographs by William Jacobi.

Bottom left: *Davisomyces* immature fruiting body.

Right: *Davisomyces* fruiting bodies open. Preceding photographs by Jim Worrall.

Dothistroma sp.

Top left: *Dothistroma* on lodgepole pine in northern Rocky Mountains. Photograph by William Jacobi.

Top right: *Dothistroma* pattern on ponderosa needles. Photograph by Susan Hagle.

Middle right: *Dothistroma stromata* on needle. Photograph by Jim Walla.

Bottom left and right: *Dothistroma* Conidia. Photographs by Jim Walla.



Elytroderma deformans

Left: *Elytroderma* on ponderosa pine with small broom and needle death in fall. Photograph by William Jacobi.

Right: *Elytroderma* fruiting bodies on needles. Photograph by John Schwandt.



Lophodermella arcuata

Left: *Lophodermella* on limber pine. **Right:** Long, dark fruiting bodies on limber pine needles. Photographs by William Jacobi.

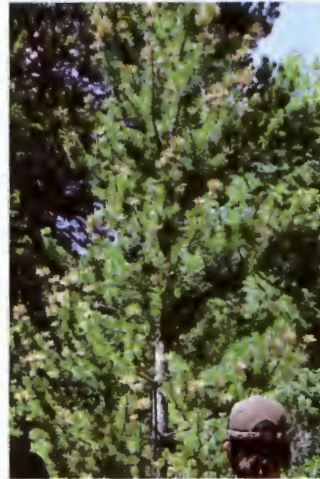
Rhabdocline pseudotsugae

Left and right: *Rhabdocline* on Douglas fir. Photographs by William Jacobi.



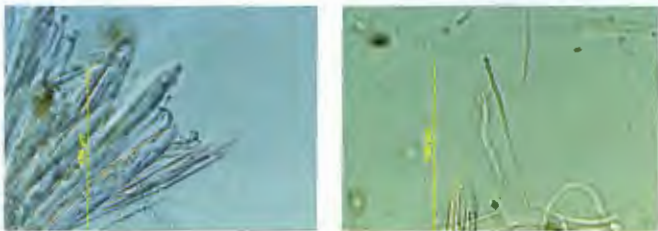
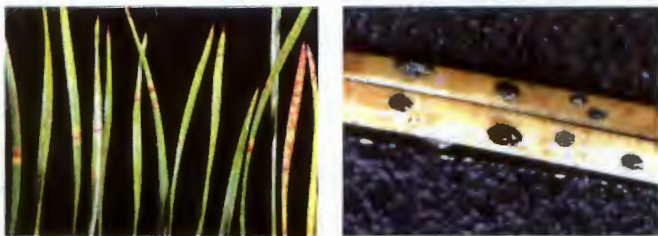
Lophodermella concolor

Top: Lophodermella on lodgepole pine. **Middle left:** Lophodermella fruiting bodies on needles. **Bottom left:** Asci with ascospores. Photograph by Ned Tieserat. **Bottom right:** Spring symptoms on lodgepole. Other photographs by William Jacobi.



Lophodermella montivaga

Top left: Lophodermella montivaga on lodgepole. **Top right and middle right:** Lophodermella montivaga on last year's needles. **Bottom:** Lophodermella montivaga fruiting bodies. Photographs by Jim Worrall.



Lophodermium sp.

Top left: Lophodermium banding. Photograph courtesy of USDA Forest Service. **Top right:** Lophodermium open hysterothecia. Photograph by Jim Walla. **Bottom left and right:** Lophodermium asci with ascospores. Photographs by Bruce Watt.



Scirrhia acicola

Top left: Brown spot symptoms on scots pine. Photograph by Jana Albers. **Top right:** Brown spot on longleaf pine. Photograph by Edward Barnard. **Bottom left:** Brown spot stromata forming on needle. Photograph by H.C. Evans. **Bottom right:** Brown spot conidia. Photograph by Albert Kais.

damage, and some herbicides. Conifer needle casts are fairly rare in the mountains and almost nonexistent in dry, low-elevation urban areas. We have listed needle diseases seen in wetter mountains and eastern plain states, but careful examination of specimens is needed to identify the cause.

The damage caused by needle cast diseases is usually limited to loss of one year's complement of needles. Crowns of infected trees will often appear thin and chlorotic. Consecutive years of infection may reduce growth and vigor to such an extent that the host is predisposed to other diseases or insect attack, although rarely will it result in tree mortality.

Biology and Disease Cycle: The fungi that cause needle casts are variable in their life cycles with some completing their life cycle in one year while others require two or more years. Needle cast diseases are spread by wind-dispersed ascospores and conidia, which are released from fruiting structures that develop on infected needles. Infection occurs in late spring or summer, and symptoms may develop as early as that fall, the next spring, or not for two or more seasons following infection. Infected needles turn red-brown to straw-colored. Fruiting bodies develop by midsummer and release spores during favorable moist and humid conditions. Diseased needles are typically cast in the late summer and fall.

Management: Control of needle cast fungi is typically neither practical nor necessary since the disease causes minimal damage to infected trees. Maintaining healthy and vigorous trees will encourage tree defense mechanisms. Mixed species compositions will prevent needle cast diseases from spreading to adjacent trees, as most are host-specific and may serve to reduce damage. If management is needed on high-value trees, nursery stock, or for visual reasons, fungicides need to be applied prior to infection periods each year.

Brown Felt Blight

Herpotrichia juniperi
Neopeckia coulteri

Hosts: These two fungi are usually found only at higher elevations (above 3,000 m), where enough snow falls to meet their unique requirements to thrive. *Neopeckia coulteri* is found on only pine species, whereas *H. juniperi* is found on conifers other than pine.

Diagnosis and Damage: The most conspicuous symptom of brown felt blight is the felt-like growth of brown mycelium spreading over affected twigs and branches. Fruiting bodies (perithecia) are immersed in the mycelium. Both *H. juniperi* and *N. coulteri* may appear on the same foliage. This disease may kill seedlings and can kill significant amounts of foliage on small trees, but it has little effect on larger trees if more than 50 percent of their crowns are above the snow depth.

Biology and Disease Cycle: The life cycles of *H. juniperi* and *N. coulteri* are quite similar, but little is actually known about infection process or timing. Under cover of snow, the fungus envelops the branch in a gray mycelium. After snowmelt and exposure, the fungus felt stops growing and turns a dark brown. The next summer, the mycelium remains inactive. The second winter, fruiting bodies (perithecia) develop on the felt under the snow.



Left: Brown felt blight on subalpine fir. **Upper right:** Brown felt blight on lower branches. **Lower right:** Mat of fungal mycelium. Photographs by William Jacobi.

Management: Conditions where branches of host trees are under snow cover for extended periods of time (as often occurs at higher elevations) encourages occurrence of disease. Management options are difficult to implement in a forest situation. Reducing the duration of snow cover by means of snowbreaks that cause snow to drop in a different location and removal of infected branches to reduce inoculum are possible options.

Juniper Tip Blights

Kabatina juniperi
Phomopsis juniperovora

Hosts: Eastern redcedar, creeping, Rocky Mountain, and Savin juniper.

Diagnosis and Damage: *Kabatina* and *Phomopsis* tip blight are rare in the region except in nurseries or on tightly spaced trees in eastern prairie windbreaks. These diseases result in foliar blighting and tip dieback. Damage to young nursery stock, transplants, and certain juniper varieties and species can be extensive, but established junipers in the landscape are seldom killed. Nevertheless, these tip blights may reduce the overall quality of the planting. Although *Phomopsis* and *Kabatina* blights cause almost identical symptoms, aspects of their development and control do differ.

Phomopsis tip blight damages new growth and succulent branch tips of junipers from mid-April through September. Older, mature foliage is resistant to infection, and therefore, most blighting occurs on the terminal 10 to 15 cm of the branches. Affected foliage first turns dull red or brown and finally ash gray. Small gray lesions often girdle branch tips and cause blighting of foliage beyond the diseased tissue. Small, black, spore-containing fungal fruit bodies develop in the lesions. Use a hand lens to more easily view these diagnostic fungal structures.

Kabatina tip blight symptoms appear in February and March and well before those of *Phomopsis* tip blight. The terminal 5 to 10 cm of diseased branches first turn dull green, then red or yellow. Small, ash gray to silver lesions dotted with small, black, fruit bodies of the fungus are visible at