

18. Snow Molds of Conifers

Jill D. Pokorny

Hosts

Snow molds are a select group of fungi that grow and attack dormant plants at low temperatures under snow cover. They are fungal pathogens of forage crops, winter cereals, and conifers. These fungi have adapted different survival strategies to enable them to grow at subzero temperatures under snow. The freezing resistance of mycelia and spores is considered a key to their survival.

Two types of snow molds affect conifers: snow blights and brown felt blights. Snow blight fungi produce annual mycelium that disappears from plant surfaces soon after snowmelt, and brown felt blight fungi produce brown mycelium that grows perennially on plant surfaces and persists long after snowmelt.

Two fungi account for most of the snow blight records in North America: *Phacidium abietis* and *Lophophacidium hyperboreum*. Other snow blight fungi, most notably, *Phacidium infestans* and *Sarcotrichila*, have been cited to occur in North America; however, these reports are considered unconfirmed due to changes in taxonomic nomenclature and questions regarding pathogenicity.

Two fungi commonly cause brown felt blight in North America: *Herpotrichia juniperi* and *Neopeckia coulteri*. *Herpotrichia juniperi* occurs on fir and spruce and *Neopeckia coulteri* occurs only on pines.

Snow blights affect many conifer hosts including Engelmann, Norway, black, Colorado blue, red, and white spruces; balsam, grand, white, Pacific silver, and subalpine firs; Douglas-fir; eastern and western white pine; and eastern hemlock.

Brown felt blights also affect many conifer hosts including Engelmann, Norway, Sitka, and white spruces; alpine, balsam, grand, noble, red, European silver, Pacific silver, and white firs; bristlecone, foxtail, Jeffrey, limber, lodgepole, mugo, ponderosa, sugar, western white, and whitebark pines; mountain and western hemlocks; western redcedar; common, creeping, alligator, and Rocky Mountain junipers; and Pacific yew.

Distribution

Snow blights occur in the boreal and alpine regions of the United States, especially in areas of higher elevations and with deep snow accumulation. Brown felt blights occur only in the mountains of the West.

Damage

Significant losses can occur to seedlings in northern nurseries when snow cover persists in the spring. Small trees, in natural and planted forests, can also be affected, resulting in severe damage to

lower branches that are below the snow line. Small trees beyond the seedling stage will often retain some foliage and survive.

Diagnosis

Look for severe browning or mortality of seedlings in the early spring, just after snowmelt (fig. 18.1).

Because snow mold fungi can grow under snow, seedlings that appear healthy in the fall may show severe damage the next spring. In nursery beds, infection frequently occurs in patches and is usually most severe in areas where snowmelt is delayed. Needles, twigs, and branches become covered with a mass of mycelium (mycelial mats) that become visible as the snow melts. The mycelial mat color and persistence are diagnostic features that help to distinguish between brown felt blights and snow blights.

Brown felt blights are readily identifiable by the brown mycelial mats that cover twigs, branches, and needles (fig. 18.2). Fungal growth is prolific on



Figure 18.1—White spruce seedlings in a nursery bed showing symptoms of snow blight. Photo by Gaston Laflamme, Canadian Forest Service, Laurentian Forestry Centre, as published in *Diseases of Trees and Shrubs*, 2nd edition, Cornell University Press, 2005.



Figure 18.2—Alpine fir showing the diagnostic dark mycelial mats of brown felt blight. Photo by Cornell University Department of Plant Pathology and Plant-Microbe Biology, as published in *Diseases of Trees and Shrubs*, 1st edition, Cornell University Press, 1987.

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branches and foliage that are buried under snow (fig. 18.3). As the snow melts, and mats are exposed, fungal development ceases. Freshly exposed mats are dark brownish-black, weathering to grayish-brown. They are resistant to summer desiccation, persist on infected needles, and resume growth during the winter and the next spring as a perennial blight. The needles and twigs under the mats die but remain attached for 1 year or more. Spherical black fruiting bodies form on and in the mats the second winter after infection.

In the case of snow blights, affected needles become covered with mycelial mats that are white and cobweb-like in appearance (fig. 18.4). Unlike the brown mycelial mats of felt blights, the white mats of snow blights are ephemeral and do not persist after the snow melts. Affected needles first appear yellow, gradually turn red to reddish-brown,

and finally to gray, and remain attached for 1 to 2 years. In late summer, black fruiting bodies appear on the underside of discolored needles. Morphology of these fruiting bodies varies with the fungus species involved. Fruiting bodies may appear as small black dots, aligned in rows on each side of the midrib (fig. 18.5) or as elongated black lines that extend along one-half or more of the length of the needle.

Biology

The biology of snow mold fungi is unique. Although most plant pathogenic fungi overwinter in a dormant state, the snow molds actively grow during the winter and infect conifer needles that are buried under the snow.

Black fruiting structures develop on blighted needles and release spores during moist weather in the fall. The spores are



Figure 18.4—Snow blight mycelium and symptoms on white spruce needles recently under snow. Photo by Gaston Laflamme, Canadian Forest Service, Laurentian Forestry Centre, as published in *Diseases of Trees and Shrubs*, 2nd edition, Cornell University Press, 2005.



Figure 18.5—Fir needles showing snow blight fruiting bodies (small black dots), aligned in two lines on either side of the midrib. Photo by Susan K. Hagle, USDA Forest Service, at <http://www.bugwood.org>.



Figure 18.3—Prolific mat development on lower branches of white fir that were buried in snow. Photo by Duane Mallams.

windborne, land on healthy needles, and cause infection once the needles become covered in snow. As the snow melts in the spring, mycelium grows from the infected needles to healthy nearby needles, forming the characteristic mycelial mats. Fungal growth ceases during the summer and resumes again in the fall. The windborne spores are the most important source of new infections.

Control

Prevention

Snow molds may occur on the low branches of trees up to pole size and on spruces and firs that are larger than pole

size; therefore, inoculum sources within the nursery should be removed. Use northern seed sources, which are usually more resistant to these fungi than seed from southern areas. If possible, avoid nursery sites where snowmelt is delayed.

Cultural

Avoid growing susceptible tree species in nursery beds where snow accumulates in drifts. Remove infected seedlings and those adjacent, apparently healthy seedlings to reduce the spread of the disease from localized infections. Increase potassium fertilizer application when potassium is deficient because low potassium increases snow blight severity.

Chemical

No fungicides are specifically registered for snow blight or brown felt blight control.

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