

Introduction to Foliage Diseases

Spots, blights, and casts

Diseases of tree foliage can be broken roughly into three groups: hardwood foliage diseases, needle casts, and needle blights (figs. 1-4). Hardwood foliage diseases are diverse.

General Features—General features of foliage diseases:

- Foliage pathogens penetrate either directly through the cuticle and epidermis or enter through stomates. Wounds are not normally involved.
- Hardwood foliage diseases usually have minor impact unless they cause repeated defoliation.
- Conifer foliage diseases (table 1) can significantly affect growth. Conifers cannot refoliate like hardwoods; conifers depend on several years of foliage. A defoliated hardwood will have a full complement of leaves the next year if not the same year.
- Foliage pathogens are usually damaging only under certain circumstances such as in trees that are off-site or out of native range; pure, dense stands; small trees, usually seedling to pole size; and particular weather patterns.
- Most overwinter in foliage, either on the tree (conifers) or on the ground (mostly hardwoods). Some hardwood foliage pathogens also grow into the twig, causing twig cankers, and can overwinter there.
- Although leaf wetness is required for spore production, germination, and infection, the required duration is only a few days or less. So foliage diseases can be successful even during dry years if sufficient moisture occurs at the right time. Some (e.g., *Davisiomyces* needle cast) are even more damaging during hot, dry conditions, if infection occurred earlier in a wet period.



Figure 1. Example of a foliage disease: early stage of inkspot of aspen. Photo: Jim Worrall, USDA Forest Service.



Figure 2. Marssonina blight of aspen. Photo: Jim Worrall, USDA Forest Service.



Figure 3. Discoloration and reduced needle retention due to needle cast of ponderosa pine. Photo: Jim Worrall, USDA Forest Service.



Figure 4. Unusually severe damage and mortality due to red band needle blight of lodgepole pine in British Columbia. Photo: Jim Worrall, USDA Forest Service.

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Table 1. Conifer foliage pathogens (other than rusts) and their hosts documented in Region 2 and nearby areas. Most diseases do not have well-established names, so they are not provided. Alternate names are provided where confusion is likely. DF = Douglas-fir, F = true firs, LP = limber pine, LPP = lodgepole pine, P = pine, PiP = pinyon, PP = ponderosa pine, S = spruces, SAF = subalpine fir, WF = white fir, WP = white pines.

Pathogen	Host
<i>Bifusella linearis</i>	LP
<i>Bifusella pini</i>	PiP
<i>Bifusella saccata</i>	PiP, LP
<i>Cyclaneusma niveum</i>	LPP, PP
<i>Davisomycella medusa</i>	LPP, PP
<i>Davisomycella ponderosae</i>	PP
<i>Dothistroma pini</i>	P
<i>Dothistroma septosporum</i> (<i>Mycosphaerella pini</i>)	P
<i>Elytroderma deformans</i>	PiP, PP
<i>Hemiphacidium planum</i>	LP, PP
<i>Herpotrichia juniperi</i> (<i>H. nigra</i>)	P, S, F
<i>Isthmiella</i> (<i>Bifusella</i>) <i>abietis</i>	SAF
<i>Isthmiella</i> (<i>Bifusella</i>) <i>crepidiformis</i>	F, S
<i>Lecanosticta</i> (<i>Coryneum</i>) <i>cinerea</i>	LPP, PP
<i>Lirula abietis-concoloris</i>	F
<i>Lirula macrospora</i> (<i>Lophodermium filiforme</i>)	S
<i>Lophodermella</i> (<i>Hypodermella</i>) <i>arcuata</i>	LP
<i>Lophodermella cerina</i>	PP
<i>Lophodermella concolor</i>	LPP
<i>Lophodermella montivaga</i>	LPP
<i>Lophomerum</i> (<i>Lophodermium</i>) <i>autumnale</i>	WF
<i>Lophodermium decorum</i>	WF
<i>Lophodermium juniperinum</i>	Rocky Mountain juniper
<i>Lophodermium nitens</i>	WP
<i>Lophodermium piceae</i>	S
<i>Neopectia coulteri</i>	P, S
<i>Phaeocryptopus gaeumannii</i>	DF
<i>Phaeocryptopus nudus</i> (<i>Adelopus balsamicola</i>)	SAF
<i>Rhabdocline pseudotsugae</i>	DF
<i>Rhizosphaera kalkhoffii</i>	S
<i>Virgella</i> (<i>Hypoderma</i>) <i>robusta</i>	WF

Hardwood Diseases—Hardwood foliage diseases typically overwinter in foliage on the ground. The primary inoculum in spring is ascospores that are shot into the air from the foliage. Some produce secondary inoculum from lesions on current-year leaves for further infections during the year. Others grow down the petiole, invade twigs, and cause cankers there in which they can overwinter.

Needle Casts—Characteristics of needle casts:

- Needles are often lost, or cast, prematurely. However, there are some needle casts (for instance, on larch) where the needles are kept longer than normal.
- Needle casts have only one infection period per year.
- Most infections are caused by a group of fungi in the family Rhytismataceae, order Rhytismales, but some pathogens are in other groups of the phylum Ascomycota.
- Needle-cast pathogens in the family Rhytismataceae usually have specialized fruiting structures called hysterothecia. Hysterothecia may be elongated and have a covering that develops a longitudinal slit in the middle. Special cells at the outer edges absorb water under wet conditions and force the slit open to expose the spore-producing surface. When the weather is dry, they close again, functioning as automatic doors.

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- Ascospores are forcibly shot into the air. They are usually long and narrow, which may increase the likelihood of hitting a needle. They have a sticky sheath that helps them stick to needles.
- Most needle casts infect young, current-year needles, and their sporulation is synchronized with needle elongation. Some infect mostly older needles, but they are less serious diseases and verge on the saprobic species.
- Symptoms usually do not appear during the year of infection. If they do, it is not until autumn.

Needle Blights—The term “blight” is used various ways, and needle blights vary considerably. In general, however, they can infect multiple times during the year, whenever temperature and moisture are favorable. They usually have two kinds of spores: sexual spores that cause the initial infection and asexual spores that can propagate the epidemic during suitable weather. Dead needles may remain attached to twigs instead of being prematurely cast.

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 4. Staley, J.M. 1976. Notes and a key, by host species, to the common foliar fungi and pathogens of conifers in the northern, central and southern Rocky Mountains, Great Basin, and Arizona and New Mexico. Unpublished document on file at U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO.