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FOREST Pest LEAFLET

Pacific Forestry Centre

Common pine needle casts and blights in the Pacific Region

By R. S. Hunt

Introduction

Discolored current or 1-year-old needles on pine trees are so prevalent that the condition is often considered natural; however, this symptom is generally the result of diseases or insects. The destruction of foliage may result from non-infectious or infectious disease agents. Non-infectious disease agents, such as early or late frosts, winter drying, drought, or air pollution are adverse elements of the environment. Infectious foliage diseases are caused by fungi. Some of the more common fungi that cause premature defoliation of pines in the Pacific Region are the subject of this leaflet. Additionally two commonly observed fungi, *Lophodermium pinastri* and *L. nitens*, which are weakly virulent pathogens, are included.

For a more complete listing of pine needle pathogens in the Pacific Region the reader should consult the Canadian Forest Service book entitled *Foliar Fungi of Western Trees* (6).

Fig. 1. *Davisomycella ampla* black oval fruiting bodies on straw-colored needle segment which is bordered by a dark orange-brown band

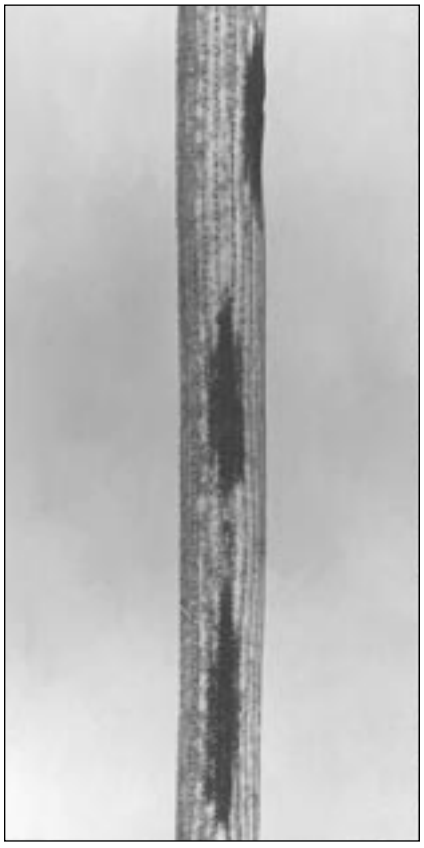

Fig. 2. *Elytroderma deformans*, elongated black fruiting bodies of various lengths forming ridges

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Hosts and distribution

Needle casts and blights of pines are common throughout British Columbia (B.C.) and the Yukon. The more common are native throughout the Pacific Northwest and *Scirrhia pini* (=*Mycosphaerella pini* Rostr. in Munk) has gained world-wide distribution due to the planting of contaminated exotic pines and the accidental introduction in portions of the world formerly free of the problem (7,8).

In B.C., the distribution of some needle casts coincides with host distribution. *Lophodermella concolor* samples from *Pinus contorta* Loud. are common over the southern half of the province, particularly in the Kootenays, and they are occasionally important as far north as the Yukon. In the past several years (1992-94) this disease has been prevalent and severe throughout the whole Pacific Region. *Lophodermella montivaga*, also from *P. contorta* var. *latifolia* Engelm. (lodgepole pine), seems to be more prevalent in the Yukon and northern areas of B.C. and only occasionally occurs in southern areas. Most *Davisomycella ampla* collections have come from southern Vancouver Island or the lower B.C. mainland, all from shore pine (*P. contorta* var. *contorta*). *Scirrhia pini* has been found on shore, lodgepole, white (*P. monticola* D. Don), ponderosa (*P. ponderosa* Laws.) and numerous exotic pines, north to Prince George and Hazelton. *Leptomelanconium pinicola* has caused epidemics on ponderosa pine in the East Kootenay and on lodgepole pine in the Prince Rupert area.

Life history

A needle cast typical for the Pacific Region, and one that has caused severe damage on lodgepole pine, is *Lophodermella concolor*. This virulent pathogen completes its life cycle in 1 year, which is typical of many needle casts, especially the more damaging ones (4). Spores from previously infected year-old needles are released in July during periods of high humidity and they germinate and penetrate only young elongating needles. There is little external evidence of attack during the year of infection as the fungus undergoes a period of vegetative growth within the host tissue. In May or June of the following year, infected needles turn red-brown and by July they change to the color of straw. Fruit bodies appear as shallow depressions in straw-colored needles and are the same color as the needle surface. All needle cast fungi attack only current year's needles and produce ripe fruit bodies only on one annual increment of foliage. During periods of high humidity, mature fruiting bodies release spores, which are disseminated by wind, usually for short distances, to complete the life cycle. The dead discolored needles start falling (casting) at about this time.

Fig. 3. *Lophodermella concolor*, fruiting bodies forming oval depressions that are the same color as the infected parts of needles

In contrast, needle blights attack and fruit on any age of foliage and therefore are active not only in the spring, but any time there is a coincidence of high relative humidity and spores. Spores of needle blights are usually wind-borne for greater distances than spores of needle casts; therefore, needle blights are usually more serious than needle casts. Needle-blighted foliage is also cast from the tree after the spores are released.

Recognition

Generally, it is not difficult to distinguish between foliage killed by non-infectious and infectious disease agents. Damage caused by adverse environmental conditions is usually quite distinctive: tips of needles, whole

Key to common needle casts and blights

1. Needle blight (all ages of needles attacked); a small flap of epidermis lifts to release spores 2
1. Needle cast (a particular increment of foliage is attacked); usually with prominent fruit bodies 3

2. Red bands on brown needles . . . . . *Scirrhia pini*
2. Straw or brown needles, bandless . . . . . *Leptomelanconium pinicola*

3. Fruit bodies circular to oval, concolourous with needle . . . . . *Lophodermella concolor*
3. Fruit bodies oval and grey to black 4
3. Fruit bodies elongate and brown to black 7

4. Fruit bodies on straw-coloured segment of green needle . . . . . *Davisomycella ampla*
4. Fruit bodies on dead needles 5

5. Transverse lines absent, or diffuse brown . . . . . *Lophodermium seditosum*
5. Transverse lines frequent and black 6

6. Fruit body blackish, outlined with a black line . . . . . *Lophodermium pinastri*
6. Fruit body shiny black, outline lacking . . . . . *Lophodermium nitens*

7. Entire fruit body shiny black . . . . . *Elytroderma deformans*
7. Blackish fruit body with central light-coloured slit . . . . . *Lophodermella montivaga*

needles, or whole stands become uniformly affected, often in well-defined elevation strata or exposures. Sometimes a secondary fungus, *Sclerophoma pithyophila* (Corda) Höhn., is particularly aggressive on frost-killed tissue.

Damage to foliage which has been discolored or killed by insect chewing or mining is easily distinguished from that caused by disease action, especially when the insects are still present. Sawflies chew needles and leave the epidermis broken. Needle miners hollow out needles and leave the epidermis intact, with obvious small, round exit holes. Identifying aphid attack is more difficult if the feeding population has left the foliage, although some evidence usually remains, such as wool, body parts, eggs and feeding punctures. Occasionally, mites may make foliage blotchy or chlorotic (15).

Where pathogens are involved, sometimes only portions of needles are killed, and the resulting discoloration may be blotchy. Often, healthy needles are intermingled with diseased needles. Some trees may suffer heavy infection while adjacent ones of the same species have less or no disease. Frequently only the lower part of the trees are attacked. Eventually the diseased needles develop dark, sometimes black fruiting bodies, which are often submerged, and sometimes difficult to see, in the discolored needles. Fruiting bodies may cover the entire length of the needle or be almost microscopic in size.

By referring to the table and the illustrations in this leaflet, the more common pine needle diseases in the Pacific Region may be distinguished. For a more complete list and the distinguishing microscopic features, the reader is referred to the publication *Foliar Fungi of Western Trees* (6).

Frequently, the fruit bodies are rapidly invaded by opportunistic secondary fungi, which may confuse the identification of the primary agent. For instance, *Hendersonia pinicola* Wehmeyer is frequently found with *Lophodermella concolor*.

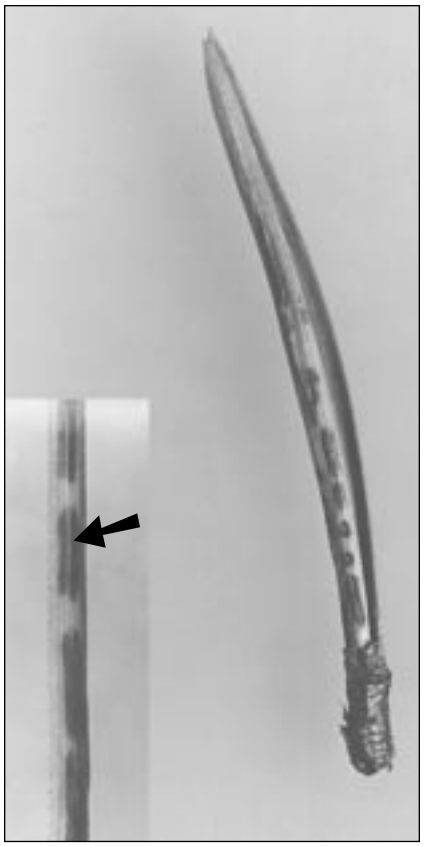


Fig. 4. *Lophodermella montivaga*, fruiting bodies with central light-colored slits

Damage

Damage caused by foliage diseases has not been investigated in detail in the Pacific Region. It is likely that increment loss is substantial when climatic conditions make it possible for these fungi to become epidemic (11, 12). If climatic conditions favourable to these diseases persist, some young trees are reduced to a single annual increment of foliage and are sometimes killed as a result. Conditions optimal for fungus sporulation and infection are quite critical, and high humidity is the major requirement. Epidemics can be widespread and severe following a year in which the spring was wet. For instance, in 1993 and 1994 *Lophodermella concolor* was at epidemic proportions following a series of years with wet spring weather (17). Because of the critical requirements for maximum spore production, dissemination and infection, plus the fact that needles are only

Fig. 5. *Lophodermium pinastri*, greyish black oval fruit bodies; they are often outlined in black, and may be accompanied by black, transverse lines.

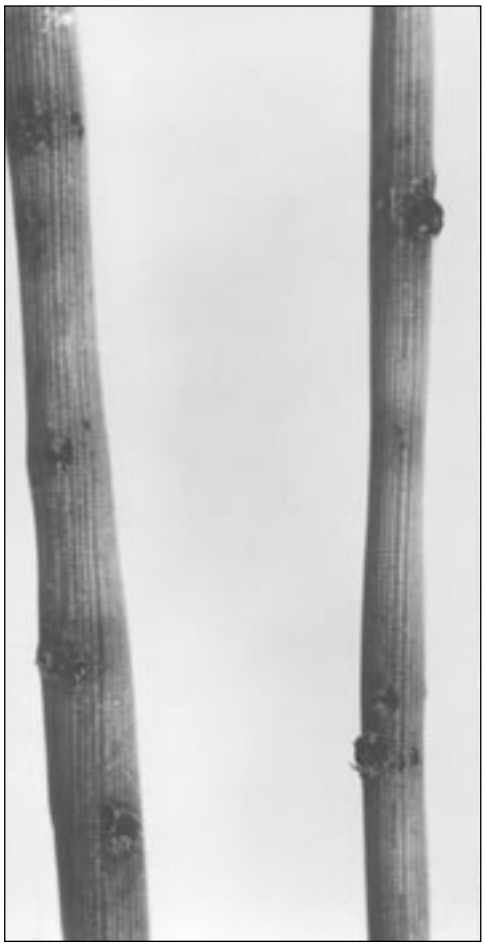


Fig. 6.*Scirrhia pini*, minute, round black fruiting bodies on red bands

susceptible to infection by needle casts from bud break until maturity, serious outbreaks over large areas occur only sporadically. Exceptions occur: in the Kootenays there seem to be more years with epidemics than without. Epidemics of needle blights last 1 to 3 years, and then they collapse for unknown causes. Only small and weak native trees succumb during the epidemic.

Scirrhia pini, a native pathogen, produces a toxin (1) which our native pines seem to tolerate better than exotic species. When Monterey (*P. radiata* D. Don) and bishop (*P. muricata* D. Don) pines were planted in high rainfall areas of northern California (3) and Vancouver Island, some were killed within 3 years (13). Young native shore pine growing in small pockets are severely defoliated and some trees are killed in coastal areas. This pathogen has the potential to cause severe damage because of its ability to attack needles of all ages. Likewise, *Leptomelanconium pinicola* also is a severe defoliator (Fig. 7 and 8) and young trees may be killed of attacked for several consecutive years (10).

Rhizosphaera pini (Corda) Maubl. is an important blight fungus elsewhere in the world, and it has been reported from western white pine in B.C. As white pine plantations become established in B.C., this pathogen may gain more notice.

Control

Many fungi develop saprophytically in needle tissue damaged or killed by the more virulent primary pathogens without affecting the development of the primary fungi. Others gain entrance into previously damaged needles and compete so vigorously for food synthesized by the primary fungus that they inhibit or prevent the development of spores by the primary fungus and so constitute a natural control. *Hendersonia acicola* Tub. causes biological control of *Lophodermella sulcigena* (Rostr.) v. Höhn. in Europe (11). *Sarotrochila* species of fungi may exert this type of control of needle casts in the Pacific Region (6). Although *H. pinicola* aggressively

Distinguishing characteristics of the common needle diseases in the Pacific Region

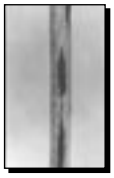
Needle disease	Pine hosts	Distinguishing characteristics (Key elements in **bold**)
Davisomycella ampla (J.J. Davis) Darker (Fig. 1) 	shore	Fruiting bodies are black oval pustules located on straw-colored **segments of green needles**. These segments may be separated from green portions of needles by an orange-brown band.
Elytroderma deformans (Weir) Darker (Fig. 2) 	lodgepole ponderosa	**Black elongated fruiting bodies** of various lengths forming ridges on freshly killed red-brown needles, which become straw-colored when fruiting bodies are mature. It also can cause witches brooms on infected branches.
Leptomelanconium pinicola (Berk. & Curtis) R.S. Hunt	lodgepole ponderosa	Similar to *S. pini*, but **lacking red bands** on brown or straw-colored needles.
Lophodermella concolor (Dearn.) Darker (Fig. 3) 	lodgepole shore	The **concolorous fruiting bodies** are very inconspicuous, forming small oval depressions in the early stage of development. Discoloration of needles is similar to that caused by *E. deformans*. Needles often secondarily infected by *Hendersonia pinicola*, which may release conspicuous masses of black spores.
Lophodermella montivaga Petr. (Fig. 4) 	lodgepole	**Brown elongated fruiting body** often showing a light-colored slit in the center, which differentiates it from *Elytroderma*.
Lophodermium nitens Darker	white, white bark (*P. albicaulis* Engel.)	Similar to *L. pinastri*. **Shining black oval fruiting body**, but outlining and lips lacking. Frequent shining black transverse lines.
Lophodermium pinastri (Schrad. ex Hook.) Chev. (Fig. 5) 	Jack (*P. banksiana* Lamb.), lodgepole, ponderosa, and exotics	**Grayish-black, oval fruiting body** often outlined with a black line, scattered over the dead needle, often separated by **shiny black, transverse lines**. Fresh specimens frequently with **"red lips"** on the fruiting body. Associated with other diseases or old needles.
Lophodermium seditiosum Minter, Staley & Millar	Scots, Austrian (*P. nigra* Arnold), and other exotics	Similar to *L. pinastri*. Greyish-black oval fruiting bodies, with or without a black outline and **"lips"** usually, **hyaline**. Rare diffuse **brown transverse lines**. A highly virulent pathogen.
Scirrhia pini Funk & Parker (Fig. 6) 	lodgepole, ponderosa, shore, white	Needles bearing **red bands** on brown needles, may produce fruit bodies. Minute flaps of host epidermis lift to expose spore masses.

Fig. 7. “Lion’s tailing” as a result of blighting to ponderosa pine

Fig. 8. Needle blight defoliation of ponderosa pine

follows *L. concolor* on lodgepole pine and may affect *L. concolor*, data supporting biological control are lacking (2, 5). Victoria herbarium (DAVFP) records show that the distribution of *H. pinicola* coincides with that of *L. concolor*. Although collections are sparse in the northern half of B.C., one record came from Mayo in the Yukon.

Since increment loss to needle casts and blights may be severe under some circumstances (11, 12) some practical control may be necessary. Genetic variation in susceptibility is known with *S. pini* and *L. concolor*; it is therefore worthwhile to select the most resistant trees or exclude the most susceptible trees when picking trees for seed orchards (9, 18, 19). As with many other foliage and branch diseases, the maintenance of vigorous growing stock by thinning and the encouragement of mixed stands where practical will help prevent growth loss. Nurseries that grow pine stock should be as far as possible from pine forests, as planting stock may disseminate inoculum into new areas; this has occurred with *S. pini* (13) and *Lophodermium seditiosum* (16).

The chemical control of needle diseases may be practical under some circumstances, such as in nursery beds and Christmas trees. It is not practical in natural forest stands. Bordeaux mixture, maneb and chlorothalonil have been used successfully to control needle diseases (2, 4).

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