FPL – 27 Elytroderma Disease

The information accessed from this screen is based on the publication: Hunt, R.S. 1978. Elytroderma Disease of Pines. Forestry Canada, Forest Insect and Disease Survey, Forest Pest Leaflet No. 27 4p.

Introduction

Elytroderma disease (Fig) is caused by the ascomycetous fungus, *Elytroderma deformans* (Weir) Darker which is a member of the Hypodermataceae, the needle cast fungi, which attack a particular year of foliage. The infected increment of foliage dies, produces fungus fruiting structures (Fig) and is cast from the tree. This fungus is even more conspicuous than most of the group because on certain hosts it may invade the branches and cause perennial brooms (Fig).

Elytroderma disease has, in recent years, been epidemic in western North America on ponderosa pine, causing considerable economic loss.

Hosts and Distribution

Elytroderma deformans attacks seven pine species (Boyce, 1961; Hepting, 1971), but only needle infection has been recorded in Pinus banksiana Lamb. and P. echinata Mill. Perhaps needle infection has gone unnoticed in other species. The disease is severe in western North America where it may cause perennial brooms in Pinus attenuata Lemm., P. edulis Engelm., P. jeffreyi Grev. & Balf., P. ponderosa Laws. and P. contorta Dougl.

In British Columbia, the hosts are lodgepole pine (P. contorta var. latifolia Engelm.) (Fig), shore pine (P. contorta var. contorta Dougl.) and ponderosa pine. In the Yukon, only lodgepole and shore pine are potential hosts. The fungus is reported to cause needle cast and brooms throughout the range of P. ponderosa in British Columbia. The distribution record on P. contorta is incomplete. It is probable that the fungus may be present throughout the range of this host, but its frequency may vary from one area to another. In British Columbia, this disease has been important in the Kootenays and south central interior; only minor damage is reported for the coast and Yukon, and none from the north central interior.

Life History

The fruit bodies of *Elytroderma deformans* are longitudinal hysterothecia produced on the outer surface of moribund needles (Fig). These dark structures are typical for many members of the family Hypodermataceae to which E. deformans belongs and are therefore not diagnostic by themselves. In late summer and fall, asci within the hysterothecia mature and eject ascospores. These spores are wind borne to the susceptible current year's foliage. The ascospores are two-celled, both of which may germinate and cause infection. Peak spore

discharge is in the fall, although some spores are also released in the spring. Simultaneous outbreaks have occurred hundreds of kilometers apart without any correlation to general weather parameters (Childs, 1968). Spores require low temperatures and moisture for germination (Lightle, 1954). Infection takes place in the fall, but spring infection cannot be ruled out. Whether the fungus penetrates the epidermis of needles or enters stomata has not been resolved. The origin of perennial infections is also poorly understood; the fungus may grow from the needles into the shoot or it may penetrate the bud or young shoot directly (Lightle, 1954; Waters, 1962). Once within the shoot, the fungus can grow in both directions, that is, it can keep up to the host shoot growth and also grow back down the branch, invading other branches and the tree trunk (Roth, 1959). Some trees may recover from the disease when the very weak branches die (Roth, 1959). *Elytroderma deformans* overwinters in three ways: in the cast needles, as new infections in green current needles and in perennial infections in buds and twigs.

In the spring, the needles infected in the previous year turn a striking red (Fig) and produce concolorous pycnidial blisters about 1 mm long. Under moist conditions, pycnidia exude pycnidiospores that are spread by rain splashing. Pycnidiospores are probably only sex spores and do not cause infection (Lightle, 1954; Roth, 1959, Waters, 1962). It has been suggested that if the pycnidiospores do not find environmental conditions satisfactory for dissemination and fertilization, new infections will not survive and ascospores will not develop (Waters, 1962). During the summer, the hysterothecia begin to form, completing the life cycle when the ascospores mature in them.

Disease Symptoms

The bright red of the previous year's needles is a good indication of *Elytroderma deformans* infection (Fig), but experience is necessary to separate this from winter damage, or other needle cast fungi, such as Davisomycella medusa (Dearn.) Darker. The bright red gradually fades to a straw color (Fig) and on lodgepole pine the needles may become gray. This later stage on lodgepole pine may be readily confused with the needle cast *Lophodermella concolor* (Dearn.) Darker. Infected ponderosa pine needles are cast in early fall, while lodgepole needles are cast in late fall. If new or perennial infections have not become established, infection will cease with needle casting.

Systemic branch infections cause brooms which are readily recognized in ponderosa pine because the shoots are short and the long needles overlap in tufts (Fig). On lodgepole pine, brooms are less conspicuous because the needles are short and do not necessarily overlap. The fungus decomposes the phloem, producing characteristic brown lesions in the inner bark of shoots. The dwarf mistletoe, Arceuthobium americanum Nutt. ex Engelm., also produces brooms and brown lesions in the inner bark of lodgepole pine shoots. This is readily separated from E. deformans by observing the parasitic plants. Only needle casting has been observed on shore pine.

Severe infection results in so much needle casting that only the current needles remain over

much of the crown, producing "lion's tail" symptoms. Needles and shoots are shorter and twigs may be thickened and curved upward. On some trees there is loss of apical dominance so that lateral buds grow and the whole tree resembles a broom.

Damage

The fungus damages the tree by decomposing areas of phloem (Waters, 1962), causing brooms that act as nutrient sinks and causing dwarfing, deformations and vigor loss. Severe infection can result in increment loss and predisposition to other agents. Once perennial infection is established, the fungus can spread vegetatively within the tree so that the impact continues for several years. Childs (1968) found that the more severe the crown symptoms, the less the annual increment, and this deleterious effect increases with time, especially on larger trees. Volume reduction may be as great as 50%. Root rot fungi and bark beetles appear to be more common in stands weakened by Elytroderma disease. It is thus difficult to estimate mortality directly from this fungus. Stands rated heavy for Elytroderma disease have more mortality than those rated light. Damage has sometimes necessitated salvage logging throughout the western range of ponderosa pine. Disease intensity on lodgepole pine in some areas of the Cariboo and Kootenay Forest Districts is very high, but studies have not been made to measure its impact.

Control

Lightle (1955) tested mainly protectant fungicides and did not achieve control of Elytroderma disease. He may have tested the chemicals at the wrong time of year. Parmeter and McCain (per. communication) tested the newer systemic benomyl which also failed to have therapeutic effects.

Practical control then depends on silvicultural manipulations such as clear cuttings in mature stands and thinnings to promote vigorous growth in young stands. Vigorously growing young stands can outgrow infections in the lower crown (Childs, 1968). On valuable trees, pruning out infections, especially brooms, which have potential to grow into the mainstem, is recommended.

References

Boyce, J.S. 1961. Forest Pathology. 3rd ed. McGraw-Hill Co. Pub.

Childs, T.W. 1968. Elytroderma disease of ponderosa pine in the Pacific northwest. U.S.D.A. For. Serv. Res. Pap. PNW-69.

Hepting, G.H. 1971, Diseases of forest and shade trees of the United States. U.S.D.A. For. Serv. Handbook No. 386.

Lightle, P.C. 1954. The pathology of *Elytroderma deformans* on ponderosa pine. Phytopathology 44: 557-569.

Lightle, P.C. 1955. Experiments on control of Elytroderma needle blight of pines by sprays. U.S.D.A. For. Serv., Ca. For. & Range Exp. Sta. For. Res. Note No. 92.

Roth, L.F, 1959. Perennial infection of ponderosa pine by Elytroderma deformans. For. Sci. 5: 182-191.

Waters, C.W. 1962, Significance of life history studies of Elytroderma deformans. For. Sci. 8: 250-254.

Figures

Figure 237-0090. Needle browning on lodgepole pine caused by Elytroderma needle blight.

Figure 237-0088. Needle discoloration and fruit bodies of *Elytroderma deformans* on lodgepole pine.

Figure 237-0091. Witches' brooms on ponderosa pine from systemic infection by Elytroderma needle blight.

Figure 237-0086. Fruit bodies of Elytoderma needle cast.

Figure 237-0089. Elytroderma needle cast.

Figure 237-0092. Elytroderma needle cast.
