FPL 15 – Annosus Root Rot

The information accessed from this screen is based on the publication: Morrison, D.J. 1979. Annosus Root Rot in Douglas-fir and Western Hemlock in British Columbia. Forestry Canada, Forest Insect and Disease Survey, Forest Pest Leaflet No. 15 8p.

Fomes annosus is now know as Heterobasidion annosum

Introduction

Annosus root disease, caused by the fungus Fomes annosus (Fr,) Karst.*Heterobasidion annosum* (Fr.) Bref.], is an important disease of immature coniferous forests in the temperate zone. In the past 30 years, the incidence and damage caused by the fungus has increased greatly, particularly in plantations in Europe and parts of the southeastern United States. This increase has been attributed to spacing and thinning operations that create conditions favorable for spread of the fungus.

Intensive forest management is creating a potentially serious problem in British Columbia. This leaflet describes annosus root disease as it occurs in British Columbia, including the hosts, range and life history of the fungus, and symptoms, damage and control of the disease.

Distribution and Hosts

The distribution of F. annosus in B.C. has been determined by decay sample and sporophore collection and basidiospore trapping. Fomes annosus occurs throughout the coastal Douglas-fir and western hemlock zones and adjacent parts of the coastal sub-alpine zone, and in the interior western hemlock zone and adjacent parts of the interior Douglas-fir and subalpine zones.

In coastal B.C., F. annosus causes butt rot in old-growth trees, particularly western hemlock (Tsuga heterophylla (Raf.) Sarg.) and amabilis fir (Abies amabilis (Dougl.) Forbes), and root and butt rot in second growth western hemlock, Abies spp., Douglas-fir (Pseudotsuga menziesii (Mirb.) Franco), western red cedar (Thuja plicata Donn) and Sitka spruce (Picea sitchensis (Bong.) Carr.)(4). Western hemlock and Douglas-fir are hosts in the interior.

Life History

Fomes annosus is present as a butt rot in many old-growth stands, particularly those with a large hemlock component. The fungus remains viable in the roots and stump of old-growth trees for several decades, depending on stump size and degree of colonization. The disease becomes established in second-rotation stands when roots contact the fungus in the old-growth stump. Trees younger than 12 to 15 years may be killed; trees older than 15 years usually develop butt rot, but are rarely killed.

Fruiting bodies (conks) of F. annosus are found on stumps and logs containing advanced

decay. Spores are produced throughout the year in coastal forests (4) and at least during summer and early autumn in the interior wet belt (Morrison, unpublished). Spores are wind dispersed and may be carried for many kilometers (Fig). Spores landing on freshly cut stumps or basal wounds germinate and the mycelium colonizes the wood. All commercial conifer species, with the exception of western red cedar and yellow cedar (Chamaecyparis nootkatensis (D. Don) Spach), are susceptible to spore infection (4). Following infection, a stump and root system may be rapidly colonized by the fungus, some roots showing advanced decay in 2-3 years. Similarly, the lower bole and roots of trees are colonized by F. annosus after infection through basal wounds. Spread from old-growth stumps, spacing and thinning stumps or scarred trees to adjacent healthy trees occurs by mycelial transfer at root contacts.

Damage in Second Rotation Stands

Annosus root disease rarely causes direct mortality; however, by killing and decaying structural roots, it is a frequent contributor to windthrow.

Fomes annosus is most damaging as a cause of heart rot. A typical time frame for development of heart rot in western hemlock, where old-growth residue is the source of inoculum, is as follows: age 15, tree roots contact inoculum and infection occurs; age 20, stain or incipient decay is present at the root collar, and age 25, decay is evident at an average stump height. Decay, which continues to develop throughout the rotation, may reach a height of 7 m in the bole and occupy 20% of total tree volume by age 50. Infection centers originating from old-growth inoculum contained from 2 to 15 trees in a 50-year-old coastal hemlock stand (Fig). These stands may contain as many as 12 centers per ha (2).

Six to 12 months after spacing or thinning, F. annosus was detected in 0 to 100% (average 40%) of the stumps (1, Morrison, unpublished); during the following 5 years, the percentage of colonized stumps declined to 0 to 20 (average 7) through loss of viability and replacement by competitors (2). In spite of this significant decline, there is usually a large increase in the amount of inoculum on a site following spacing or thinning. The average time interval between colonization of a spacing or thinning stump by F. annosus and root infection of adjacent residual trees is 5 years.

Thin-barked species, such as western hemlock and Abies spp., are easily damaged during thinning operations. In the coastal region, wounds larger than 9 square dm (1 sq ft) on the roots and lower bole of hemlock have a 0.5 probability of being colonized by F. annosus (3). The fungus spreads rapidly into the root sand up the bole, decaying each year an average of 0.75% of the gross volume of injured trees.

Recognition

Annosus root disease occurs in pockets or infection centers around an inoculum source and may contain as many as 15 trees, depending on stand age. Trees younger than 15 years that

have a major portion of their root system killed by F. annosus exhibit crown symptoms typical of root diseases, i.e., reduced leader and branch growth, chlorotic foliage and distress cone crop.

Trees with butt rot do not exhibit any external symptoms; usually the disease is not detected until the trees are cut (Fig). Trees with decayed structural roots are susceptible to windthrow and, in hemlock stands, often indicate the presence of F. annosus. Small (2-4 mm diam) cream-colored pustules are frequently present on the surface of roots decayed by the fungus.

The early stage of decay varies, depending on host species. A yellow-brown stain on the crosssection of hemlock stumps appears initially over an infected root, but eventually encompasses the central portion of the heartwood. Advanced decay in hemlock has a yellow stringy texture, usually spotted with black flecks.

A red-brown stain in the heartwood is characteristic of the early stage of F. annosus decay in Douglas-fir; eventually, the wood breaks down to form a yellow, pitted, stringy decay.

Fruit bodies produced at or near ground line on roots and stems of windthrown trees and on stumps are common on hemlock and, to a lesser extent, on Douglas-fir, other conifers and some hardwoods. The perennial, leathery fruit bodies vary in shape from appressed (resupinate) to bracket-like (effused-reflexed). When the fruit body is young, the margin is white and the upper surface red-brown; with age, the upper surface becomes dark brown to black. The lower surface has small regular pores and varies from white to cream.

Control

When F. annosus becomes established in a stand through stumps of the previous rotation or through stumps or wounds created during intensive management operations, no procedure, except land clearing, is known for controlling the disease. Control guidelines for F. annosus are intended to prevent a buildup of inoculum on intensively managed sites by controlling stump infection and avoiding wounds on residuals.

Stump infection may be prevented by uniformly covering the cut surface of stumps with 10% aqueous solution of zinc chloride or borax powder as soon as possible, preferably immediately, after felling. A dye, such as rhodamine b, should be added to permit a quick visual check for coverage and untreated stumps. Borax may be applied with a saltshaker-type container, and zinc chloride solution with a pressure sprayer or squeeze bottle. Penetration and retention of chemical are best when stump surfaces are horizontal.

A non-phytotoxic dressing that will prevent entry of decay fungi through wounds is yet to be developed. Hence, if volume loss is to be prevented, scarring of thin-barked species, such as hemlock and Abies spp., must be minimized. This may be accomplished by 1) suspending commercial thinning operations during the period of sapflow; 2) using buffer trees (remove at end of operation) and buffer pads on trees along skid trails to reduce scarring on residuals; 3) favoring thick-barked species (e.g., Douglas-fir) as crop trees when marking, and 4) harvesting trees with severe root or lower bole scars.

References

1. Morrison, D.J. and A.L.S. Johnson. 1970, Seasonal variation of stump infection by Fomes annosus in coastal British Columbia, For. Chron. 46: 200-202.

2. Morrison, D.J. and A.L.S. Johnson. 1978. Stump colonization and spread of Fomes annosus 5 years after thinning. Can. J. For. Res. 8: 177-180.

3. Wallis, G,W. and D.J. Morrison. 1975. Root rot and stem decay following commercial thinning in western hemlock and guidelines for reducing losses. For. Chron. 51: 203-207.

4. Wallis, G.W. and G. Reynolds. 1970. Fomes annosus root and butt rot: a threat in managed stands in coastal British Columbia. For. Chron. 46: 221-224.

Figures

Figure 240-0069. Heterobasidon annosum sporophore.

Figure 240-0067. Advanced decay in western hemlock caused by *Heterobasidon annosum*.

Figure 240-0068. Incipant decay symptoms in a western hemlock stump caused by *Heterobasidon annosum*.