ISSN 0820-8107

MARITIMES FOREST RESEARCH CENTRE

TECHNICAL NOTE NO. 82

A WOOD QUALITY STUDY OF DEAD AND DYING BALSAM FIR - THE INCIDENCE OF ARMILLARIA ROOT ROT

Evidence suggests that at least some of the growth loss and mortality in balsam fir stands on Cape Breton Island may be the result of the action of a fungus.

The shoe string root rot Armillaria mellea (Vahl ex Fr.) Kummer is a cosmopolitan fungus infecting hardwood and softwood trees in a wide variety of forest regions, stands and sites. The fungus causes root and butt decay, reduction in growth, decline in vigor, dieback or thinning of the crown and, eventually, tree mortality. It lives and grows in soil, feeding on dead wood, and spreads by spores liberated from honey-colored fruiting bodies or mushrooms, rhizomorphs (fine, black root-like filaments), or by root contacts with infected trees. Tree mortality occurs after the fungus kills the root collar. Economic losses due to this fungus are difficult to estimate since it is often associated with trees that have been weakened or stressed by insects such as the spruce budworm, balsam woolly adelgid, or root collar weevil; by weather; or, by poor site conditions.

As part of the wood quality study of dead and dying balsam fir from Cape Breton Island Plot 314 (see Technical Notes Nos. 54, 55 and 70) the incidence of Armillaria mellea was assessed.

The Study Area

The study area has been described in Technical Note No. 55. It was a normal stocked (1244 stems/ha) balsam fir stand

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on Cape Breton Highlands with a volume of 239 m^3/ha and a basal area of 42 m^2/ha. The site was a well-drained, sandy loam soil belonging to the mini to orthic humo ferric podzol soil group. The area has been subjected to repeated defoliation by the spruce budworm since 1974.

The Root Rot

The stumps of sample trees were examined for signs of A. mellea, particularly the characteristic black rhizomorphs and white mycelial fan. In addition, the 50 mm disc stump section was cultured for determination of decay organisms.

A total of 141 balsam fir trees (54 living and 87 dead) were examined for the presence of A. mellea. The results are presented in Table 1. About 90% of the dead trees, regardless of the number of years since mortality occurred, had evidence of the fungus. This is not unexpected since the fungus is a saprophyte, deriving its nutrients from dead wood.

Approximately 40% of all the living trees had evidence of A. mellea. However, 70% of the moribund trees (total defoliation <75%) were infected with the fungus. Trees in this defoliation class would probably die even if not subjected to any further defoliation by the spruce budworm. The presence of A. mellea in ca 20% of the "healthy" trees suggests that some growth reduction that may occur may be the result of a combination of spruce budworm defoliation and the fungus. Once established in the healthy trees, any further strees or weakening as a result of defoliation by the budworm could result in the proliferation of the fungus resulting in tree mortality.

Armillaria root rot poses a difficult problem to the forest manager. Losses can be significant but unpredictable. One should become familiar with the action of this organism and its implication to forest management.

Technical Note 82 is one of a series of reports (see following list) dealing with the quality of wood from dead and dying balsam fir.

An Overview - J.H. Johnston and D.G. Embree - Technical Note 54
History of Plot 314 - D.P. Ostaff - Technical Note 55
Study Methods - D.G. Embree and J.H. Johnston - Technical Note 70
Armillaria Root Rot - D.P. Ostaff - Technical Note 82
The Moisture Content and Wood Decay Relationships by Mortality Classes - G. van Raalte and L.P. Magasi
Wood Loss During Debarking - G. van Raalte
Lumber Recovery - G. van Raalte, J.H. Johnston and D.G. Embree
Tree Breakage and Logging Waste - I.C. Millar and L. Coady
Insect Behavior and Tree Mortality - D.P. Ostaff
Wood Rot Measurements - I.C. Millar, L.P. Magasi, J.T. Basham
Heart Rot - L.P. Magasi, I.C. Millar, J.T. Basham
The Highlights and Summary of the Pulping Studies - D.G. Embree and J.H. Johnston
Using Budworm-Killed Balsam Fir for Composite Products - Forintek Canada Corp.

- Don Ostaff
Forest Insect and Disease Survey
April 1983

Table 1. The occurrence of the shoe-string root rot Armillaria mellea in balsam fir trees from Plot 314 Cape Breton Highlands.

Tree Condition Class	No. of Trees Examined	No. with A. mellea[a]	Percent Infected
Living			
50-75% Total Defoliation	28	5	18
75-90% Total Defoliation	14	7	50
90-100% Total Defoliation	12	11	92
Living Total	54	23	39
Dead			
Less than 1 summer	14	13	93
1 summer	18	14	78
2 summers	18	14	78
3 summers	10	10	100
4 summers	21	21	100
5+ summers	6	5	83
Dead Total	87	77	89
Living and Dead Total	141	100	71

[a]Determined by culturing and/or presence of black rhizomorphs or white mycelial fan.