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ARMILLARIELLA MELLEAE INFECTION IN A BALSAM FIR PLANTATION IN NORTH CENTRAL MINNESOTA

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ABSTRACT

Armillariella mellea (= Armillaria mellea) caused a loss of 9% in a 10-year-old balsam fir (Abies balsamea) plantation in north central Minnesota. Droughts during the summers of 1976 and 1980 could have predisposed the balsam fir to the root rot. Hardwood stumps that previously occupied the site were the inoculum source of A. mellea. A neighboring red pine stand had no noticeable mortality suggesting that balsam fir is more susceptible to A. mellea infection on this site.

RESULTS AND DISCUSSION

Resin flowed from the bark of the balsam fir, bark beetles (Pityokteites sparsus (LeC.) (Coleoptera: Scolytidae)) were present under the stem bark, and Armillariella mellea (Fr.) Karst. (= Armillaria mellea (Fr.) Quell.) had extensively colonized the root collar and roots (Fig. 1). Stems and roots with resinous bark when examined on two trees with green, but off color needles, showed no evidence of bark beetle attack; however, A. mellea had extensively colonized the root collar and roots. The balsam fir were dying from infection by A. mellea.

INTRODUCTION

During the summer of 1980, trees began dying in a balsam fir (Abies balsamea (L.) Mill.) plantation which is part of a tree improvement project located at the North Central Experiment Station, University of Minnesota, Grand Rapids. The plantation contained 480 balsam fir from 30 seed sources planted as 3-3 stock in 1970. Of the 434 trees remaining in 1980, 37 (9%) died that summer. Twenty-five of the dead balsam fir occurred in one pocket. This paper reports the probable cause of the mortality.

Droughts during 1976 and 1980 may have predisposed the balsam fir to root rot. Precipitation was 46 cm in 1976. The annual precipitation (60 year average) for the location is 64 cm. Precipitation in 1980 was also less than normal (55 cm), especially from April through July 16 cm vs. 31 cm), and may have contributed to the predisposition of the balsam fir to root disease. It has been reported that A. mellea root rot is not evident until a year or more after several consecutive dry summers (Leaphart 1963). In our study, 9% mortality associated with A. mellea infection occurred 4 years after a severe drought and during a dry summer.

METHODS

The bark was removed from the stem and the roots of the dead or dying fir and the trees examined for signs and symptoms of diseases and insects. Isolations were made from diseased tissue by placing chips of wood on 2% malt agar and incubating the cultures at room temperature (ca. 22°C). Hardwood roots present in the stand were also examined, and decayed wood cultured for fungi.

Armillariella mellea infection occurred on trees from four seed sources obtained in Minnesota and Canada.

The site on which the balsam fir were planted was previously a 50-60 year old hardwood stand with aspen (Populus tremuloides Michx.) the most abundant species (270 m³/ha). Red oak (Quercus rubra L.), red maple (Acer rubrum L.), and paper

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birch (*Betula papyrifera* March.) were also present (30 m³/ha). The original stand was logged in the winter of 1968-69 after which *A. mellea* could have colonized the residual stumps and roots. The hardwood stumps still evident in the plantation have been decayed by *A. mellea*, and this fungus was isolated from the stumps. *Armillariella mellea* can spread from residual stumps to live trees (Filip 1979, Pronos and Patton 1977, Shaw and Roth 1976, Shaw *et al.*, 1976, Singh 1975). In our case, hardwood stumps served as the inoculum source of *A. mellea* that infected the balsam fir.

A red pine (*Pinus resinosa* Ait.) plantation next to the balsam fir planting was established in the spring of 1972 with 3-0 seedlings. Red pine planted on oak sites can be killed by *A. mellea* which first invades the residual oak roots (Pronos and Patton 1977). Mortality caused by *A. mellea* is a common occurrence in Minnesota when red pine are planted on sites originally covered with northern pin oak (*Quercus ellipsoidalis* Hill.) (D.W. French, unpublished data). Mortality of red pine declines after the trees reach 8 years of age. No noticeable mortality has occurred in the red pine plantation next to the balsam fir even though they were planted on similar sites. This suggests that the balsam fir was more susceptible to *A. mellea* infection on this hardwood site than the neighboring red pine. This higher mortality of balsam fir in comparison with red pine might have been influenced by the droughts of 1976 and 1980 because red pine is the more drought tolerant species (Fowells 1965).

In conclusion, balsam fir mortality in the 10-year-old plantation was caused by *A. mellea* which had spread from hardwood stumps. Drought probably influenced the severity of the infection. *Armillariella mellea* mortality is a common occurrence in plantations of other conifer species (Filip 1979, Kalil 1981, Pronos and Patton 1977, Singh 1975) and is considered by many to be the only important killing disease of balsam fir (Hepting 1971). *Armillariella* root disease is a potential problem for balsam fir plantations in Minnesota.

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Figure 1. Mycelial fans of *Armillariella mellea* underneath the bark at the base of a dying balsam fir.