FUSARIUM OXYSPORUM ASSOCIATED WITH MORTALITY OF 1-0 BAREROOT DOUGLAS-FIR SEEDLINGS - MONTANA STATE NURSERY, MISSOULA

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Conifer seedling production at the Montana State Nursery in bareroot beds has been previously hampered because of losses from root diseases, primarily those caused by *Fusarium* spp. (James 1986). Efforts to reduce losses have resulted in soil fumigation with general biocides such as methyl bromide/chloropicrin to reduce or eliminate populations of pathogens. However, seedbeds fumigated during the late summer of 1986 and sown with Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco) seed in the spring of 1987 experienced scattered seedling mortality by the summer of 1987. Investigations were conducted to identify organisms associated with this seedling mortality.

Soil samples had been previously collected from nearby seedbeds producing Colorado blue spruce seedlings. These beds had also been fumigated in 1986. Results (James 1987a) indicated that although *Fusarium* and *Pythium* were detected in the soil, they were found at very low levels (about 40 colony-forming units/g for *Fusarium* and about 3 cfu/g for *Pythium*). These levels were probably too low to provide sufficient inoculum for much infection.

Six seedlings with root disease symptoms were analyzed for occurrence and extent of root infection by potential pathogens. Roots of the seedlings were rinsed thoroughly under tap water for a few minutes to remove adhering soil particles and were then surface sterilized in aqueous sodium hypochlorite (bleach) for a few seconds. Each root system was aseptically dissected into from 5 to 10 pieces so that the entire root system could be sampled. Root pieces were placed on an agar medium selective for *Fusarium* spp. (Komada 1975). Plates were incubated at about 22 degrees C under cool fluorescent light for 7-10 days. Fungi emerging from root pieces were identified and the number of pieces colonized by *Fusarium* calculated.

Isolation results are summarized in table 1. All diseased seedlings had roots that were infected with *Fusarium oxysporum* Schlect. No other *Fusarium* spp. was isolated. A few of the root pieces yielded common saprophytic fungi such as *Trichoderma* and *Phoma*, but these were not consistently isolated. Because of the high percentage of root system colonization by *F. oxysporum* , it is likely that this fungus was responsible for the disease of 1-0 bareroot Douglas-fir seedlings at the nursery. The low populations of *Fusarium* that were detected in fumigated soil would indicate that inoculum for seedling infection probably had to come from some other source, such as infested seed. Douglas-fir seed commonly harbors

Fusarium inoculum, including *F. oxysporum* (James 1987b). However, sincesamples from affected seedlots were not assayed, extent of *Fusarium* contamination of seed was unknown.

Table 1.--Colonization of roots of diseased bareroot Douglas-fir seedlings with *Fusarium oxysporum* Montana State Nursery, Missoula

Seedling No.	Roots infected with F. oxysporum	Colonization percentage*
1	+	90.0
2	+	85.7
3	+	71.4
4	+	62.5
5	+	60.0
6	+	33.3
Totals	100.0	69.8

*Based on percent of sampled root pieces colonized by F. *oxysporum*.

Previous experience indicates that soil fumigation is usually effective in reducing damping-off and root disease losses in forest tree nurseries. However, it is important that pathogenic inoculum not be re-introduced into fumigated soil. Because of the lack of natural competitors in fumigated soil, introduced pathogens may proliferate and cause severe disease. Therefore, seedlots destined to be sown in fumigated soil should probably be sampled for pathogen levels prior to sowing to ascertain potential hazards. Once root disease is detected in seedbeds, efforts to reduce losses such as fungicide drenches are often not effective. The best control approach is to prevent initial infection.

LITERATURE CITED

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