DWARFING OF CONTAINERIZED DOUGLAS-FIR SEEDLINGS- USDA FOREST SERVICE NURSERY, COEUR D'ALENE, IDAHO

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Containerized Douglas-fir (Pseudotsuga menziesii Franco) seedlings are often damaged by root pathogens within northern Rocky Mountain forest tree nurseries. The most commonly encountered group of pathogens are species of Fusarium (James et al. 1987). These fungi commonly colonize the roots of seedlings and may elicit disease symptoms in infected seedlings. Besides mortality, root pathogens can cause foliar chlorosis and general growth reduction (James 1986a; James et al. 1987). Therefore, when containerized Douglas-fir seedlings were recently found at the USDA Forest Service Nursery that were dwarfed and slightly chlorotic, growers thought that root pathogens were perhaps responsible for the problem.

Therefore, dwarfed seedlings were collected and isolations made from their roots to detect presence of root pathogens. Twenty seedlings in various stages of dwarfing were selected for sampling. Seedlings were carefully removed from their pine cell containers so as to minimize root damage. Roots were washed thoroughly under running tap water for a few minutes to remove adhering soil particles. They were then surface sterilized in 10% aqueous sodium hypochlorite for 2-3 min and rinsed with sterile distilled water. Ten root pieces approximately 1-2 cm in length were selected from each root system. Selected pieces were aseptically removed and placed on an agar medium selective for Fusarium spp. (Komada 1975). Plates were incubated for 7-10 days at about 24 degrees C under cool fluorescent light. Fungi emerging from root pieces were transferred to potato dextrose agar for identification. The standard taxonomic guide of Nelson et al. (1983) was used for identification of Fusarium species.

Isolation results are summarized in table 1. Only 35 percent of the seedlings with dwarfing symptoms were infected with Fusarium spp. This is much less than would be expected if the major cause of the disorder was root infection by these fungi (James 1986c; James et al. 1987). On the other hand,

Table 1. Occurrence of Fusarium and Cylindrocarpon spp. on roots of dwarfed containerized Douglas-fir seedlings - USDA Forest Service Nursery, Coeur d'Alene, Idaho.

No. Seedlings Sampled:	20
Height (mm)	
Average:	123.8
Range:	92-167
Standard Deviation:	23.3
Oven-dry Wgt. (g)	
Average:	1.18
Range:	0.63-1.94
Standard Deviation:	0.33
Infection Percentage	
Fusarium	
Seedlings:	35.0
Roots*:	42.9
Cylindrocarpon	
Seedlings:	70.0
Roots*:	49.3

* Percent of sampled roots (10/seedling) colonized with Fusarium or Cylindrocarpon on infected seedlings only.

species of Cylindrocarpon were isolated from 70 percent of the sampled seedlings. These organisms are common root colonizers of conifer seedlings (Booth 1966; James 1987) and some isolates are capable of causing seedling diseases. However, it is unknown if any of the isolates obtained from Douglas-fir roots in this investigation are capable of inciting diseases.

The most common species of Fusarium isolated from Douglas-fir roots was F. oxysporum Schlect. Three morphologically distinct isolates of this species were obtained. Each had different characteristics of aerial mycelium, pigmentation, and sclerotial and sporodochial formation. The other species isolated was F. sambucinum Fuckel. Some of these Fusarium isolates were possibly pathogenic, however without inoculation tests it is unknown which and how many were capable of causing disease symptoms.

Results of this investigation indicated that pathogenic root fungi were probably not responsible for production of dwarfing symptoms on Douglas-fir container seedlings. Fusarium and possibly Cylindrocarpon spp. can readily be isolated from the roots of nondiseased conifer seedlings at the Nursery (James et al. 1987; James and Gilligan 1988). However, they were not present in high enough concentrations to probably be responsible for the dwarfing symptoms found on affected seedlings. It is likely that other non-pathogenic causes were responsible for the symptoms. These might include fertlizer problems, i. e. too much or too little of needed nutrients at critical times during seedling development. Another possibility might be low vigor seed from high elevations

which often produces shortened slow growing seedlings (James 1986b). There may also have been soil mix problems for affected seedlings, such as compaction and/or poor drainage and aeration.

LITERATURE CITED

Booth, C. 1966. The genus Cylindrocarpon. Commonwealth Mycological Institute. Mycol. Papers No. 104. 56p.

James, R. L. 1986a. Diseases of conifer seedlings caused by seed-borne Fusarium species. In: Shearer, R. C. (compiler). Proceedings: Conifer Tree Seed in the Inland Mountain West Symposium. USDA Forest Service, Intermountain Res. Sta., Gen. Tech. Rept. INT-203. pp. 267-271.

James, R. L. 1986b. Needletip dieback of containerized Douglas-fir seedlings at the USDA Forest Service Nursery, Coeur d'Alene, Idaho: associated root fungi. USDA Forest Service, Northern Region. Nursery Dis. Notes #27. 7p.

James, R. L. 1986c. Relationships between extent of root colonization and foliar symptom production in containerized Douglas-fir, ponderosa pine, and lodgepole pine seedlings infected with Fusarium at the Montana State Nursery, Missoula. USDA Forest Service, Northern Region. Nursery Dis. Notes #28. 19p.

James, R. L. 1987. Root deterioration of containerized western white pine seedlings, Plum Creek Nursery, Pablo, Montana. USDA Forest Service, Northern Region. Nursery Dis. Notes #47. 5p.

James, R. L., R. K. Dumroese, D. L. Wenny, J. F. Myers and C. J. Gilligan. 1987. Epidemiology of Fusarium on containerized Douglas-fir seedlings. 1. Seed and seedling infection, symptom production, and disease progression. USDA Forest Service, Northern Region. Rept. 87-13. 22p.

James, R. L. and C. J. Gilligan. 1988. Association of Fusarium with non-diseased containerized ponderosa pine seedlings at the USDA Forest Service Nursery, Coeur d'Alene, Idaho. USDA Forest Service, Northern Region. Rept. 88-5. 10p.

Komada, H. 1975. Development of a selective medium for quantitative isolation of Fusarium oxysporum from natural soil. Rev. Plant Protec. Res. 8:114-125.

Nelson, P. E., T. A. Toussoun and W. F. O. Marasas. 1983. Fusarium species: an illustrated manual for identification. The Pennsylvania State University Press, University Park. 193p.