FIELD MORTALITY OF WESTERN WHITE PINE TRANSPLANTS - KOOTENAI NATIONAL FOREST

R. L. James
Plant Pathologist

USDA Forest Service
Northern Region
1202 Ironwood Dr.
Coeur d'Alene, Idaho

Nursery Disease Notes #71

August 1988

Western white pine (Pinus monticola Dougl.) is an important reforestation species that is well suited to sites in northern Idaho and northwestern Montana. Demand for containerized white pine seedlings for these areas often exceeds the supply available. Container stock produced for the Three Rivers Ranger District, Kootenai National Forest in norhwestern Montana at the USDA Forest Service Nursery, Coeur d'Alene, Idaho could not be planted as scheduled in the fall of 1987 because most sites were too dry for adequate seedling survival. Therefore, this stock was returned to the nursery and transplanted into standard seedbed soil until the spring of 1988 when it was lifted for outplanting. The nursery soil had been fumigated with Basamid® prior to seedling transplanting.

Shortly after field planting in the spring of 1988, many of these seedlings began to show disease symptoms. Examination of diseased seedlings indicated that their roots were mostly necrotic; extensive lateral root epidermis decay was evident and most other roots appeared water-soaked. Seedling needle tips were the first to turn necrotic and fungi were often growing on these necrotic tips. Foliage symptoms were typical of wilting due to deterioration of root systems.

Eight seedlings with disease symptoms were analyzed for occurrence of pathogenic organisms on their roots. Roots were washed thoroughly under running tap water to remove adhering soil particles, surface sterilized for 3 minutes in a 10% aqueous sodium hypochlorite (bleach) solution, and then rinsed with sterile distilled water. Ten root pieces (1-2 cm in length each) were selected from each root system. Pieces included some from the tips of lateral roots and others dissected from within roots. Root pieces were placed on a selective agar medium (Komada 1975) and incubated for 7-10 days at about 24 degrees C under cool fluorescent light. Organisms emerging from root pieces

were identified using standard taxonomic guides (Booth 1966; Nelson et al. 1983).

All eight sampled seedlings had roots that were infected with both Fusarium spp. and Cylindrocarpon spp. Both of these groups of fungi are potentially pathogenic to conifer seedlings (Booth 1966; James and Gilligan 1984). Sixty-one percent of the sampled root pieces were colonized with Fusarium while 68 percent were colonized with Cylindrocarpon. The most commonly isolated species of these fungi were F. oxysporum Schlect., F. acuminatum Ell. & Ev. and C. didymum (Hartig)Wollenw. All of these species have previously been implicated in conifer seedling diseases (James 1986a; James 1987).

Fusarium spp. are common colonizers of the roots of containerized seedling stock. This sometimes results in disease and mortality of infected stock (James 1986b) and other times infected seedlings do not show disease symptoms (James and Gilligan 1988). Therefore, isolation of fusaria from the roots of these seedlings could not be considered unusual. It is possible that the processes of storage, shipping, transplanting, and lifting may have stressed the seedlings to the point where Fusarium present on the roots became "pathogenic" and caused disease. Another possibility is that transplanting infected seedlings into fumigated soil allowed pathogens on roots to proliferate in the absence of competitors and colonize most of the root system, even though disease symptoms were not evident until seedlings were outplanted. In any event, it is likely that Fusarium and Cylindrocarpon were at least partially responsible for disease production and mortality of the white pine seedlings.

Greater use of transplants for reforestation may be beneficial from the standpoint of increased field survival. However, care must be taken to ensure that seedlings are not stressed so that pathogens that may occur on their roots do not cause mortality. Periodic sampling of stock for root colonization by potential pathogens may help managers predict survivability in the field.

LITERATURE CITED

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

Duchesne, L. C., R. L. Peterson and B. E. Ellis. 1988. Interaction between the ectomycorrhizal fungus Paxillus involutus and Pinus resinosa induces resistance to Fusarium oxysporum. Can. J. Bot. 66:558-562.

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. 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. and C. J. Gilligan. 1984. Studies of Fusarium associated with containerized conifer seedling diseases: pathogenicity tests of isolates from the Alpine Nursery, Kalispell, Montana. USDA Forest Service, Northern Region. Rept. 84-14. 29p.

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.