CONTAINERIZED WESTERN WHITE PINE SEEDLING ROOT DISEASE - USDA FOREST SERVICE NURSERY, COEUR D'ALENE, IDAHO

R. L. James
Plant Pathologist

Timber, Pest Management and Cooperative Forestry
USDA Forest Service
Northern Region
Missoula, Montana

October 1987
Nursery Disease Notes No. 66

Western white pine (*Pinus monticola* Dougl.) is an important reforestation species grown in containers at the USDA Forest Service Nursery in Coeur d'Alene, Idaho. Root disease has been implicated in causing mortality following outplanting on a forest site (James 1985a) and transplants within the nursery (James 1985c; James and Gilligan 1986). Previous investigations (James 1985b) have indicated that *Fusarium* spp. may be important in initiating root disease of containerized white pine seedlings at the nursery.

Problems with seed germination have often resulted in poor seedling emergence and an abundance of empty container cells (fig. 1). Although most of this poor seed germination has been attributed to inherent dormancy characteristics of the seed, some may be due to pre-emergence damping-off caused by *Fusarium* or other seed-borne fungi. Recent examinations of containerized white pine at the nursery indicated fairly widespread occurrence of root-diseased seedlings. Affected seedlings had necrotic foliage which often appeared grey and water-soaked (fig.2); diseased seedlings were scattered throughout greenhouses.

Figure 1.--Containerized western white pine seedlings with poor seedling emergence and an abundance of empty cells at the USDA Forest Service Nursery, Coeur d'Alene, Idaho.

Figure 2.--Root disease of containerized western white pine seedlings at the USDA Forest Service Nursery, Coeur d'Alene, Idaho. Note that affected seedlings had grey, necrotic foliage that appeared water soaked.

Twenty seedlings with root disease symptoms (all the same seedlot, but being produced for four different Ranger Districts on two National Forests) were collected for analysis of associated root-colonizing fungi. Seedling roots were rinsed thoroughly under running tap water for several minutes to remove adhering soil particles. They were then surface sterilized in 10 percent aqueous sodium hypochlorite for 2 minutes and rinsed with distilled water. Ten randomly selected root tips from each root system were aseptically cut and placed on a selective medium for *Fusarium* (Komada 1975). Plates were incubated at about 22 degrees C under cool fluorescent light for 7-10 days after which associated *Fusarium* spp. were identified using the taxonomic scheme of Nelson et al. (1983). Heights of sampled seedlings were measured from the ground line to the top of the terminal bud; seedling caliper and oven-dry weight of above-ground portions were also determined. Simple linear regressions were conducted to evaluate possible correlations between extent of root tip colonization by *Fusarium* and seedling height and oven-dry weight (an approximation of biomass).

Ninety percent of the seedlings with decline symptoms had roots infected with *Fusarium* (table 1). Average percent colonization of root tips for infected seedlings was about 77 percent. There were no apparent correlations between percent colonization of root tips and seedling height or oven-dry weight (coefficents of determination were $R^2=0.02$ for seedling height and $R^2=0.009$ for oven-dry weight).

The only species of *Fusarium* isolated from infected root tips was *F. oxysporum* Schlect. Other fungi including *Trichoderma* and *Cylindrocarpon* were occasionally obtained as well, but not at high numbers.

These results indicate that *F. oxysporum* is an important cause or root disease of containerized white pine seedlings at the nursery. This fungus may be seed-borne (James 1987), although relative amounts of inoculum introduced on contaminated seed are unknown. Although fungicides may be effective in reducing damping-off caused by *Fusarium*, treatments are usually not very effective in controlling root disease on older seedlings (James 1986a; James 1986b). Therefore, the best means of reducing losses is by preventing infection which may be accomplished by seed treatments. As an initial step, sampling of seed to evaluate amounts of *Fusarium* contamination should be conducted as a means of predicting expected amounts of disease.

Table 1.--Colonization of roots of declining containerized western white pine seedlings with *Fusarium* at the USDA Forest Service Nursery Coeur d'Alene, Idaho.

Seedling number	Location National Forest	District	Fusarium Infested	% colonized	Height cm	Caliper mm	Oven-dry weight gms.
1	Kootenai	Yaak	Yes	30	2.3	0.1	0.1
2			No	--	3.0	0.1	0.1
3			Yes	90	2.5	0.1	0.4
4			Yes	40	2.4	0.1	0.2
5			Yes	100	3.1	0.2	0.4
6	Kooteni	Cabinet	Yes	90	2.7	0.2	0.1
7			Yes	100	1.8	0.1	0.1
8			Yes	100	2.9	0.1	0.1
9			Yes	100	1.7	0.1	0.1
10			No	--	1.8	0.1	0.1
11	ID Pan.	St.Maries	Yes	100	1.8	0.1	0.1
12			Yes	20	3.0	0.2	0.2
13			Yes	80	2.9	0.2	0.2
14			Yes	50	3.0	0.1	0.1
15			Yes	90	3.1	0.1	0.2
16	Kootenai	Troy	Yes	70	2.7	0.1	0.2
17			Yes	100	3.2	0.1	0.1
18			Yes	100	2.5	0.1	0.1
19			Yes	70	3.1	0.1	0.2
20			Yes	60	2.1	0.1	0.1
	Averages	% infested	90.0	77.2	2.6	0.12	0.16

LITERATURE CITED

James, R. L. 1985a. Containerized western white pine seedling mortality at the Bonners Ferry Ranger District, Idaho Panhandle National Forests. USDA Forest Serv., N. Reg., Rpt. 85-18. 7 p.

James, R. L. 1985b. Decline of containerized western white pine seedlings at the USDA Forest Service Nursery, Coeur d'Alene, Idaho. USDA Forest Serv., N. Reg. 4 p.

James, R. L. 1985c. Root diseases of transplanted western white pine seedlings at the USDA Forest Service Nursery, Coeur d'Alene, Idaho. USDA Forest Serv., N. Reg. 4 p.

James, R. L. 1986a. Mortality of containerized western larch seedlings at the Champion Timberlands Nursery, Plains, Montana. USDA Forest Serv., N. Reg. 3 p.

James, R. L. 1986b. Tip dieback of containerized lodgepole pine and Douglas-fir seedlings, Champion Timberlands Nursery, Plains, Montana. USDA Forest Serv., N. Reg. 3 p.

James, R. L. 1987. Occurrence of *Fusarium* on conifer seed from Northern Rocky Mountain nurseries. *In*: Landis, T. D. (tech. coord.). Proceedings: Combined Western Forest Nursery Council and Intermountain Nursery Association Meeting. USDA Forest Serv., Gen. Tech. Rpt. RM-137. pp 109-114.

James, R. L. and C. J. Gilligan. 1986. Root diseases of western white pine transplants at the USDA Forest Service Nursery, Coeur d'Alene, Idaho. USDA Forest Serv., N. Reg. Rpt. 86-11. 8 p.

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 Univ. Press, University Park. 193 p.