

CONTAINERIZED LODGEPOLE PINE NEEDLE TIP NECROSIS - USDA FOREST SERVICE NURSERY, COEUR D'ALENE, IDAHO

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Containerized seedling production at the USDA Forest Service Nursery in Coeur d'Alene, Idaho, is important for reforestation needs in the Northern Region. Lodgepole pine (*Pinus contorta* Dougl.) is a major species produced at the nursery. Recently, seedlings displaying needle tip necrosis (fig. 1) were discovered scattered throughout greenhouses. Very few affected seedlings were found. Extent of the necrosis on individually affected seedlings was quite low and they usually did not appear adversely affected by the disorder. Because of the common association between needle tip dieback and infection of Douglas-fir seedling roots with *Fusarium* spp. (James 1984a; James 1984b; James 1986a; James 1986b), investigations were conducted to evaluate the role of *Fusarium* root infection on lodgepole pine seedlings with needle tip necrosis.



Figure 1.--Containerized lodgepole pine with needle tip necrosis (arrow) from the USDA Forest Service Nursery, Coeur d'Alene, Idaho

Fourteen seedlings with slight needle tip necrosis were selected from throughout greenhouses. The seedlings represented seven seedlots (table 1), most of which were from National Forests east of the Continental Divide. Seedlings were severed at the groundline and their heights from the groundline to the tip of their terminal buds as well as their caliper were measured. Oven-dry weights of all above-ground portions of seedlings were also determined as a general measure of biomass. Root systems were rinsed thoroughly under running tap water for several minutes to remove adhering soil particles and surface sterilized in 10 percent aqueous sodium hypochlorite for 2 minutes followed by rinsing with distilled water. Ten randomly selected root tips were selected from the root systems of each seedling. Root tips were aseptically cut and placed on an agar medium selective for *Fusarium* (Komada 1975). Plates were incubated at about 22 degrees C under cool fluorescent light for 7-10 days. Number of root tips colonized by *Fusarium* was determined and the *Fusarium* species identified using the taxonomic scheme of Nelson et al. (1983). Simple linear regressions were conducted to compare percent root tip colonization by *Fusarium* with seedling height and oven-dry weight. Percentages underwent arc-sin conversions prior to analysis.

Eleven of the seedlings (78.6 percent) with needle tip necrosis had roots infected with *Fusarium* (table 1). However, among these infected seedlings, percentage of root tips colonized varied greatly. Regressions indicated no correlation between percentage of root tips colonized and seedling height ($r^2 = 0.06$) and seedling oven-dry weight ($r^2 = 0.17$). Therefore, based on this small sample, there were apparently no relationships between amount of *Fusarium* infection of root systems and seedling growth.

Table 1.--Colonization of roots of containerized lodgepole pine seedlings displaying needle tip necrosis with *Fusarium* - USDA Forest Service Nursery, Coeur d'Alene, Idaho

Lot No.	Lot description		Seedling No.	Infection with <i>Fusarium</i>		Hgt.**	Caliper (mm)	Oven-dry weight^
	National Forest	District		Roots infected	% colon.*			
0907	Gallatin	Bozeman	1	No	--	9.0	0.20	0.80
1506	Flathead	Swan Lake	2	Yes	90.0	10.2	0.20	1.50
1845	Gallatin	Livingston	3	Yes	30.0	11.2	0.20	1.00
			4	No	--	8.0	0.10	0.50
			5	Yes	30.0	9.4	0.20	0.50
			6	Yes	30.0	7.8	0.10	0.80
			7	Yes	80.0	7.4	0.10	0.90
			8	Yes	80.0	11.5	0.20	1.20
			9	No	--	11.6	0.20	1.50
1849	Gallatin	Livingston	8	Yes	80.0	11.5	0.20	1.20
4652	Gallatin	Livingston	9	No	--	11.6	0.20	1.50
4786	Helena	Townsend	10	Yes	70.0	9.9	0.20	1.30
6319	Helena	Helena	11	Yes	30.0	10.9	0.20	1.40
			12	Yes	10.0	8.0	0.20	0.90
			13	Yes	10.0	8.8	0.20	0.60
			14	Yes	80.0	11.3	0.20	1.00
			Averages				78.6%	49.1

*Percentage of 10 randomly selected root tips that were colonized by *Fusarium*.

**Height of seedling from the ground line to the tip of its terminal bud in cm.

^Oven-dry weight of all above-ground portions in grams.

The major species of *Fusarium* isolated from seedling root tips was *F. oxysporum* Schlect. This species was isolated from all but one seedling. On that seedling, *F. acuminatum* Ell. & Ev. was isolated. Both of these species have been implicated in containerized seedling root diseases (James 1986a; James 1987), but they both also have strains that are non-pathogenic (James and Gilligan 1984; James et al. 1986; James et al. 1987a). Without controlled pathogenicity tests, ability of these lodgepole pine strains to cause seedling diseases (i.e., foliage symptoms) is unknown.

The relatively large percentage of seedlings that were infected with *Fusarium* in this sample may indicate that needle tip necrosis is an early symptom of root disease for lodgepole pine like it is for Douglas-fir (James 1984a; James 1984b; James 1986b). However, since no completely asymptomatic seedlings were

Lodgepole pine seedlings with slight needle tip necrosis otherwise appeared healthy and were about the same size of nearby seedlings without this necrosis. Therefore, cause and effect relationships are difficult to evaluate. The necrosis may be due to nutrient imbalances or other abiotic factors and may not be involved with *Fusarium* infection. Further investigations will be required to elucidate actual roles of *Fusarium* infection on production of needle tip necrosis in containerized lodgepole pine seedlings.

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