DIEBACK OF WESTERN LARCH SEEDLINGS - BIGFORK TREE IMPROVEMENT SITE SWAN LAKE RANGER DISTRICT, FLATHEAD NATIONAL FOREST

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During the fall of 1988, foliar dieback symptoms were evident on scattered western larch (Larix occidentalis Nutt.) seedlings at the Bigfork Tree Improvement Site, Swan Lake Ranger District, Flathead National Forest. Affected seedlings were container stock that had been planted in the spring of 1988 as an early selection trial. Symptoms appeared as necrotic dieback from terminals and lateral branches. Several seedlings also had white "spots" on healthy needles, although this did not appear to be related to the dieback. These spots were apparently egg groups of spiders or insects.

Dieback portions of seedlings were initially examined microscopically for epiphytic fungal growth. When none was found, necrotic tissues were washed under running tap water for several minutes and placed in moist chambers to evaluate colonization by fungi. Necrotic tissues were found to be commonly colonized by Botrytis cinerea Pers. ex Fr. and species of Alternaria. Although Botrytis can cause necrosis of conifer needle and stem tissue (James 1986a), this pathogen usually causes disease problems only in nurseries where canopy density is full and only during cool, wet weather (James 1984). The dieback problem at the Bigfork Tree Improvement Site was detected after a very warm, dry summer growing season (although the plantation had been frequently irrigated). Therefore, it is likely that Botrytis was not the "primary" cause of dieback symptoms; rather it probably colonized tissues killed as a result of some other problem. Likewise, Alternaria spp. were also probably secondary colonizers of necrotic tissues.

Therefore, roots of seedlings with dieback symptoms were analyzed for colonization by fungi that might possibly elicit these symptoms (James 1984b, 1987b). Six seedling with dieback symptoms of different severity (table 1) were analyzed. Seedling roots were washed thoroughly under running tap water to remove adhering soil particles. They were then surface sterilized in an aqueous 10% bleach solution (active ingredient = sodium hypochlorite) for 2 minutes and rinsed with sterile distilled water. Ten to 15 pieces (2-3mm in

length) were aseptically cut from each root system and placed on a selective agar medium for Fusarium spp. (Komada 1975). Plates with root pieces were incubated at about 22°C for 7-10 days under cool fluorescent light. Emerging fungi were identified to genus; selected Fusarium isolates were transferred to potato dextrose and carnation leaf agar and identified using the taxonomic scheme of Nelson, Toussoun and Marasas (1983).

Table 1. Fungi colonizing roots of western larch seedlings with dieback symptoms - Bigfork Tree Improvement Site[1].

Tree No.[2]	Fusarium	Cylindrocarpon	Fungus Trichoderma	Penicillium	Other
4-1	53.3	6.7	86.7	6.7	20.0
5-1	13.3	93.3	26.7	6.7	13.3
14-3	46.1	0	15.4	0	53.8
15-6	30.8	0	15.4	0	84.6
156-7	85.7	7.1	42.9	0	28.6
159-4	90.0	10.0	0	10.0	90.0
Totals					
% Infection	100.0	66.7	83.3	50.0	100.0
Colon. Rate	51.2	21.2	33.7	3.7	45.0

[1] Figures in table are percent of root pieces colonzed with appropriate fungi.

[2] Dieback symptoms:
- 4-1: only terminal leader died back.
- 5-1: top 1/2 of crown died back.
- 14-3: top 1/2 of crown died back.
- 15-6: top 2/3 of crown died back.
- 156-7: top 1/4 of crown died back.
- 159-4: crown mostly green; only one lateral branch with dieback.

All sampled seedlings had roots infected with Fusarium spp. (table 1). However, extent of root colonization was not related to severity of dieback symptoms. Fusarium oxysporum Schlecht. was the species most commonly isolated. However, F. acuminatum Ell. & Ev., F. tricinctum (Corda)Sacc., and F. sambucinum Fuckel were also isolated from roots. Other frequently isolated fungi included Cylindrocarpon, Trichoderma, Penicillium, and others including Phoma and Alternaria. More than 50-% of the sampled root pieces were colonized by Fusarium, strongly implicating these fungi as possible causes of the dieback symptoms. Previous investigations (James 1984b, 1986b, 1986c, 1987b) have shown that Fusarium causes dieback symptoms of conifer seedlings primarily by decaying roots, thus preventing seedlings from taking up moisture and nutrients. As a result, severely-infected seedlings essentially wilt due to the loss of functional roots. The other fungi isolated from roots were mostly common saprophytes and probably unable to elicit dieback symptoms. Possible exceptions were Cylindrocarpon and Phoma, which may be pathogenic to seedlings under certain conditions (James 1988; James and Hamm 1985).

Results of this investigation implicate Fusarium spp. as probable causes of dieback symptoms on young western larch seedlings at the Bigfork Tree Improvement Site. It is likely that seedlings became infected while being grown at the nursery, even though they lacked disease symptoms. Stress associated with storage and outplanting was probably important in expression of dieback symptoms. Also, Fusarium may have become pathogenically active when soil temperatures reached high levels during the summer (Bloomberg 1973).

It has previously been shown that Fusarium on roots of outplanted seedlings may cause mortality, particularly during the first growing season (James 1987a). However, these fungi are often replaced by other organisms, including mycorrhizal fungi, once seedlings are planted in forest soil (James and Dumroese, unpublished; Smith 1967). Replacement may not occur as readily when seedlings are planted in grassland or agricultural soil, due to different soil mycofloras.

In order to reduce future problems from Fusarium root disease on stock used for tree improvment plantations, amounts of stress seedlings are subjected to should be minimized. Proper storage, handling, and planting techniques are essential. Irrigation to prevent drought stress when temperatures are high is also important. Nevertheless, some disease may occur unless amount of root infection while seedlings are in the nursery can be reduced. Several approaches to reduce this infection are currently being investigated. Hopefully, this work will result in more healthy seedlings which are not infected with Fusarium when they leave the nursery.

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