NEEDLE TIP DIEBACK OF BAREROOT LODGEPOLE PINE SEEDLINGS USDA FOREST SERVICE NURSERY, COEUR D'ALENE, IDAHO

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Lodgepole pine (*Pinus contorta* Dougl.) bareroot seedlings at the USDA Forest Service Nursery in Coeur d'Alene, Idaho have sometimes displayed distinct dieback of needle tips during their second growing season (Fig. 1). Symptoms often showed up shortly after root pruning. Extent of needle tip dieback seldom progressed to the point of seedling mortality. Only isolated groups of seedlings were usually affected.

To evaluate the association of potentially pathogenic organisms with this disorder, selected seedlings with moderate to severe levels of needle dieback were evaluated. Severity of symptoms was recorded using a subjective scoring system based on extent of needles which were necrotic, i. e., severely affected seedlings had needle necrosis which extended for 2-3 cm from their tips whereas moderately affected seedlings had less than this amount of necrosis on most of their needle tips. Presence of pathogens on roots of selected seedlings was assayed because needle dieback symptoms may be an indication of root disease of conifer seedlings (James 1984, 1986, 1987a). Seedlings were carefully excavated to remove most of their roots. Roots were washed thoroughly under running tap water for a few minutes to remove adhering soil particles. They were then surface sterilized in a 10 percent bleach solution (0.525 percent aqueous sodium hypochlorite) for 1 minute and rinsed with sterile distilled water. Small pieces of root (2-3 cm in length) were aseptically cut from either actively growing roots (those light brown to reddish-brown in color with white tips) or non-active roots (those which were dark brown to black in color without white tips). Very little root decay was evident on most root systems. Root pieces were placed on selective agar media used to isolate common root pathogens of conifer seedlings: Komada's medium (Komada 1975), used for isolation of *Fusarium* spp. and similar fungi and V-8 juice agar amended with pimaricin, used to isolate *Pythium* and *Phytophthora* spp. Plates with Komada's medium were incubated at about 26°C under diurnal cycles of cool fluorescent light for 7-10 days, whereas V-8 juice agar plates were incubated at about 24°C in the dark for 5 days. Emerging fungi were transferred to standard potato dextrose agar and identified using a standard taxonomic guide (Barnett and Hunter 1972).

Results of root isolations are summarized in table 1. Most roots yielded only *Trichoderma* and *Cylindrocarpon*. *Trichoderma* spp. are common soil inhabiting fungi which are usually saprophytic colonizers of organic material (Beagle-Ristaino and Papavizas 1985). Many of these fungi may be antagonistic to or competitive with soil-borne pathogens (Papavizas 1985). *Cylindrocarpon* spp. are also common soil fungi (Booth 1966); however, some species may be pathogenic on forest tree seedlings (James 1988). These fungi have

commonly been isolated from the roots of non-diseased seedlings at the Coeur d'Alene Nursery (James 1989; James and Gilligan 1988) and may be common colonizers of the roots of many seedlings without eliciting disease symptoms (James 1987b, 1988).

Fusarium spp., which may elicit needle tip dieback symptoms in infected seedlings (James 1984, 1986, 1987a), was not detected on the roots of bareroot lodgepole pine seedlings in this evaluation. *Pythium* and *Phytophthora* spp. were also not isolated. Therefore, it appears that these common nursery pathogens were not responsible for needle tip dieback symptoms.

Isolation results indicated that needle tip dieback of bareroot lodgepole pine seedlings was most likely not due to the action of pathogenic fungi. Therefore, it appears that some abiotic cause was involved. Two possibilities include: 1. greater than normal drying following root pruning due to removal of feeder roots or 2. needle tip burn due to excessive fertilizer. Since symptoms were most evident shortly after root pruning, it is suspected that this operation was at least partially responsible for symptom production. Ensuring sufficient irrigation following root pruning may alleviate future problems. To diagnose if fertilizer problems were responsible, chemical analyses of foliage would be necessary.

Table 1. Occurrence of fungi on the roots of bareroot 2-0 lodgepole pine seedlings with needle tip dieback symptoms at the USDA Forest Service Nursery, Coeur d'Alene, Idaho.

		Colonization Percentage**	
Seedling No.	Dieback Severity*	Active Roots	Non-active Roots
1	Severe	23 TRI 100 CYL	77 TRI 15 CYL 8 PEN
2	Moderate	57 TRI 14 CYL	42 TRI 33 CYL
3	Moderate	7 TRI 27 CYL	86 TRI 7 CYL
4	Severe	18 TRI 27 CYL	71 TRI 29 CYL
5	Moderate	33 TRI 13 CYL	18 TRI 14 CYL
6	Severe	44 TRI 44 CYL	93 TRI 7 CYL
All Seedlings		31 TRI 40 CYL	77 TRI 17 CYL 1 PEN

* Based on linear extension of dieback symptoms on needles. Severe dieback indicates necrosis extending for 2-3 cm from needle tips and moderate dieback indicates necrosis of less than 2 cm on most tips.

** Percentage of root pieces colonized with appropriate fungi:

TRI = *Trichoderma* spp.
CYL = *Cylindrocarpon* spp.
PEN = *Penicillium* spp.

Figure 1. Bareroot lodgepole pine seedling with severe needle tip dieback symptoms from the USDA Forest Service Nursery, Coeur d'Alene, Idaho.

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