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PHOMA BRANCH DIEBACK OF 3-0 BAREROOT DOUGLAS-FIR SEEDLINGS USDA FOREST SERVICE NURSERY, COEUR D'ALENE, IDAHO

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During the summer of 1997, several bareroot Douglas-fir (*Pseudotsuga menziesii* var. *glauca* [Beissn.] Franco) seedlings which had been held over for a third growing season at the USDA Forest Service Nursery in Coeur d'Alene, Idaho developed branch dieback. Affected seedlings were scattered throughout the 3-0 beds in the northern portion of Field 9. No apparent pattern of affected seedlings was noticed; seedlings with branch dieback symptoms were scattered throughout the beds (Figure 1). Individual affected branches were necrotic and appeared reddish brown against a backdrop of green foliage (Figure 2). Necrosis usually extended along branches for several centimeters; in some cases, entire branches had died back to the main stem. No seedling mortality was evident.

Several affected seedlings were excavated and transported to the laboratory for examination and analysis. Seedling roots were carefully washed to remove adhering soil particles. They were then examined under the microscope (30-50X) to determine occurrence and extent of root decay. Previous work with container-grown seedlings had shown that seedlings with extensive root disease often had tip or branch dieback (James 1984c; James et al. 1987). Twenty necrotic branches from several seedlings were selected for isolation of associated fungi. Branches were excised at about 2 cm above the necrotic zone (determined by removing epidermal tissues and examining underlying tissues for off-color necrosis). Tissues between noticeably dead and live tissues were designated the **canker margin**. Small pieces of canker margin were excised with a sterile scalpel, surface sterilized for 60 sec. in a 10% bleach solution (0.525% aqueous sodium hypochlorite), washed three times with sterile distilled water, blotted dry, and placed on 2% water agar. Plates with canker margin tissues were incubated at about 24°C under diurnal cycles of cool, fluorescent light for 7 days. Fungi emerging from canker margin tissues were transferred to potato dextrose and oatmeal agar (James and Hamm 1985) for identification.

Roots of examined seedlings were healthy. Little or no noticeable root decay was found. Because roots appeared nondiseased, isolations were not made from them.

* Stationed in Coeur d'Alene, Idaho

Figure 1. Bareroot 3-0 Douglas-fir seedlings with branch dieback at the USDA Forest Service Nursery, Coeur d'Alene, Idaho.

Figure 2. Branch dieback on bareroot 3-0 Douglas-fir seedlings at the USDA Forest Service Nursery, Coeur d'Alene, Idaho.

Table 1. Fungi associated with canker margins of bareroot 3-0 Douglas-fir seedlings with branch dieback at the USDA Forest Service Nursery, Coeur d'Alene, Idaho.

Fungal Species	Percent of Canker Margins[1]
Phoma eupyrena	50
Phoma pomorum	15
Phoma glomerata	5
Phoma chrysanthemicola	5
All *Phoma* Species	75
Stemphylium sp.	15
Unknown Fungus	5

[1] Based on 20 cankers sampled.

The major group of fungi associated with canker margin tissues were species of *Phoma* (Table 1). Four different *Phoma* species were isolated from canker margins: *P. eupyrena* Sacc., *P. pomorum* Thum., *P. glomerata* (Corda) Wollenw. & Hochapf., and *P. chrysanthemicola* Hollos. By far the most commonly isolated species was *P. eupyrena*. This species has been associated with conifer seedling nursery diseases, particularly causing stem dieback (James 1990; James and Hamm 1985) and necrosis (James 1983a; James and Schwandt 1989) of bareroot pine species. The other *Phoma* species are most often saprophytic on necrotic plant tissues, although some level of pathogenesis has been previously described for all three species (Dorenbosch 1970; James 1984a, 1987a, 1987b). Experience in conifer seedling nurseries indicates that *P. eupyrena* has the greatest pathogenic potential of all *Phoma* spp. (James 1983a, 1983b, 1984b; James and Cooley 1987; James and Hamm 1985).

Phoma spp. are mostly soil-borne and usually do not become important pathogens unless inoculum is disseminated onto aerial portions of plants (Domsch et al. 1980; Dorenbosch 1970). Soil-borne propagules commonly accumulate around "soil collars" that may develop at the base on small seedlings as a result of water splash (James 1979; Kliejunas et al. 1985; Srago 1978; Srago et al. 1989). In some cases, inoculum can be disseminated to aerial portions of seedlings some distance from the groundline. In such cases, *P. eupyrena* may cause shoot or branch dieback. However, this type of disease has mostly been associated with pine: ponderosa and lodgepole (James 1979; James and Cooley 1987), Scots (James 1987b), Mugo (James 1984b) and Japanese black pine (James and Schwandt 1989). This is the first report of branch dieback being associated with *Phoma* spp. on Douglas-fir seedlings.

The other identified fungus isolated from some canker margins was an *Stemphylium* sp. Fungi in this genus are capable of causing plant diseases (Farr et al. 1989). However, they have never been associated with diseases of conifer seedlings (Farr et al. 1989). This and the fact that this fungus was isolated so infrequently indicates that *Stemphylium* was probably not involved in causing branch dieback.

Phoma-incited branch dieback was not causing important losses to bareroot Douglas-fir seedlings at the nursery. Occasional seedlings had to be culled because of excessive branch dieback, but most seedlings had few enough symptoms to be shipped for outplanting. It is possible that *Phoma* infection may have accelerated due to increased stress from overcrowding resulting from holding seedlings for an additional year. Normally, Douglas-fir seedlings are grown for only two years at the nursery and are shipped as 2-0 stock. However, occasionally some seedlots have to be held for an additional year because customers are unable to plant the stock as planned. When this happens, seedlings may become overly dense within seedbeds, providing conditions under which some fungi cause disease (Sutherland 1984). Problems might be alleviated by reducing seeding density, thereby limiting crowding of established seedlings. In most cases, seedling crops are harvested after two years, thus precluding density problems.

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