

CONTAINERIZED ENGELMANN SPRUCE SEEDLING MORTALITY,
USDA FOREST SERVICE NURSERY,
COEUR D'ALENE, IDAHO - 1987

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Engelmann spruce (*Picea engelmanni* Parry) is an important reforestation species in the Northern Region. Many containerized spruce seedlings are produced each year at the USDA Forest Service Nursery, Coeur d'Alene, Idaho. Disease losses of these containerized seedlings occur in every crop, but usually at low levels (James and Gilligan 1985). Several different pathogenic organisms have been shown to be associated with spruce seedling diseases. These include *Sirococcus strobilinus* Preuss (James 1983), *Botrytis cinerea* Pers. ex Fr., and several species of *Fusarium*, *Cylindrocarpon*, and *Phoma* (James and Gilligan 1985).

Shortly after seedling emergence of the spring 1987 crop, unusually high disease losses became apparent in a few of the spruce lots at the nursery. Losses were manifested as a large number of empty cells in which no seedlings had emerged and typical post-emergence damping-off. High disease losses were especially common in seedlot 4860; however, greater than normal disease was also detected in lots 4937 and 6465. In most of the other spruce seedlots, disease levels appeared more normal. Most diseased seedlings were grouped together (fig. 1) rather than being randomly distributed throughout trays. Most affected seedlings were entirely necrotic, although some had only a few of their needles dead.

The first (spring) crop of containerized seedlings at the nursery has to be sown in late February because of the time required to produce two crops in greenhouses. During seedling emergence in 1987, outside weather was very cold and wet. A prolonged period of overcast weather persisted and the humidity within greenhouses usually exceeded 90 percent. Growers were unable to reduce this humidity and noticed rapid disease development in seedlings shortly after they emerged. Typically, growers apply captan to reduce damping-off losses, but often limit applications until germination is mostly complete because of possible phytotoxic effects to young developing germinants. Captan was applied when disease losses became prominent, but little effect was noticed.



Figure 1. Group mortality of 2-month-old containerized Engelmann spruce seedlings at the USDA Forest Service Nursery, Coeur d'Alene, Idaho.

Collections of diseased seedlings in the three most affected lots (4860, 4937, and 6465) were made. An entire tray (200 cells) of lot 4860 was evaluated. Seedlings with disease symptoms were washed thoroughly under running tap water to remove adhering soil particles and were either placed in moist chambers or incubated on a selective medium used to isolate *Fusarium* spp. (Komada 1975). Portions of seedlings placed on the medium included cotyledons, stems, and roots. Seedlings were incubated for 5 days at about 22 degrees C, after which fungi sporulating on tissues were identified.

Conditions of each seedling in the tray of lot 4860 evaluated included: healthy (asymptomatic) = 31.5 percent, partially necrotic (at least some cotyledons were green) = 4.5 percent, totally necrotic (all cotyledons were necrotic) = 49.5 percent, empty cells (no emerged seedlings) = 14.5 percent. This high level of diseased seedlings and empty cells was unusual (James and Gilligan 1985). Most diseased seedlings were colonized with *Fusarium* spp. (table 1). These fungi were isolated most frequently from either cotyledons or roots. Also, ungerminated seed sampled from empty cells indicated very high (82.5 percent) levels of contamination with *Fusarium* spp. *Sirococcus strobilinus* was found on 62.5 percent of the diseased

seedlings assayed. It sporulated most commonly on cotyledons of seedlings placed either in moist chambers or on Komada's medium.

Table 1.--Colonization of diseased Engelmann spruce seedlings and seed from lot 4860 with *Fusarium* spp. 1/

Seedling infection	Percent colonized with <i>Fusarium</i>
Cotyledons	69.8
Stems	34.0
Roots	41.5
Any portion	79.1
Seed infection	
No. sampled	57
No. with <i>Fusarium</i>	47 (82.5%)

1/ Assayed seedlings displayed disease symptoms (partially or totally necrotic). Assayed seed were collected from empty cells.

It appeared from this evaluation that seed-borne *Fusarium* and *Sirococcus* were responsible for the high disease levels evident in three lots of containerized Engelmann spruce at the nursery. Pathogen levels on seed prior to sowing are unknown, but environmental conditions during seed germination and seedling establishment were ideal for buildup and spread of both of these groups of organisms. Growers indicated that extensive disease became evident quickly, which might indicate that pathogen levels on seed from the three most affected lots were unusually high. Damping-off losses were also very high during the spring 1987 crop of western larch in other greenhouses of the nursery (James 1987).

Reducing future losses to either *Fusarium* or *Sirococcus* should involve a screening program of seedlots with expected problems, such as those with very poor germination. Careful monitoring during the germination period is also useful because if fungicides are applied in a timely manner, they are usually effective in reducing damping-off losses (James 1986).

LITERATURE CITED

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