FUSARIUM ROOT DISEASES OF CONTAINERIZED DOUGLAS-FIR, WESTERN LARCH, AND LODGEPOLE PINE SEEDLINGS AT THE CHAMPION TIMBERLANDS NURSERY, PLAINS, MONTANA

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Fusarium spp. are often associated with needletip dieback and mortality of containerized conifer seedlings (James 1985b; James 1984c). Infected seedlings may die as the fungus progressively decays roots, although factors contributing to disease progression are largely unknown. Previous investigations at the Champion Timberlands Nursery (James 1984a) indicated that Fusarium oxysporum Schlect. and F. solani (Mart.)Sacc. were common contaminants of Douglas-fir (Pseudotsuga menziesii (Mirb.)Franco) seed. These seed-borne fungi may contribute to damping-off of young germinants and root disease of older seedlings (James 1985).

To determine if Fusarium spp. were associated with root diseases of containerized conifer seedlings, as is common in several other nurseries (James 1984b; James 1984c; James 1986), seedlings with various levels of foliar necrosis were sampled for occurrence of Fusarium on their roots. Disease symptoms were especially severe and widespread on Douglas-fir (figure 1). Eleven Douglas-fir, seven western larch (Larix occidentalis Nutt.), and five lodgepole pine (Pinus contorta Dougl.) seedlings were collected from the nursery and taken to the laboratory for analysis. On most seedlings, 10 lateral roots were randomly selected and cut from the main tap root. Selected roots were surface sterilized in 4 percent bleach (0.21 percent aqueous sodium hypochlorite) for 4 minutes and rinsed thoroughly to remove excess bleach. Tips of each root were aseptically cut and placed on a selective medium for Fusarium (Komada 1975). Other portions of each root were also placed on the selective medium to determine relative extent of Fusarium colonization. All plates were incubated for 7 days at about 24°C under a 12-hour diurnal light-darkness regime. The number of roots and root tips infected with Fusarium were counted to determine percentage of infecton.

Sampled seedlings had from 40-100 percent necrotic foliage. Each of these seedlings had most of their root systems extensively colonized by F. oxysporum, the only Fusarium species isolated. In most cases, 100 percent of the root tips and other root pieces sampled were colonized by F. oxysporum. Degree of root colonization was not correlated with level of foliar necrosis, probably because selected seedlings were in such advanced stages of disease.

Figure 1.--Root disease of containerized Douglas-fir seedlings caused by Fusarium oxysporum at the Champion Timberlands Nursery.

Fusarium oxysporum often colonizes roots of many different kinds of plants without causing disease symptoms (Armstrong and Armstrong 1948; Bloomberg 1966). It is possible that this fungus, which was likely seedborne (James 1984a), infected seedlings during early stages of the growth cycle, but did not elicit symptoms of foliar necrosis until seedlings were older. Environmental factors such as competition for water or nutrients could have affected seedling resistance to F. oxysporum. Secondary spread of the fungus may also have been important. These factors may have contributed to the extensive occurrence of root disease in older containerized conifer seedlings, particularly Douglas-fir, at the Nursery.

In summary, this investigation emphasized the importance of F. oxysporum as a root disease pathogen of containerized conifer seedlings at the Champion Timberlands Nursery. It is likely that the problem originated from contaminated seed. Because this disease is difficult to control with

fungicides once infection has occurred, emphasis should be placed on reducing the amount of infected seed. Screening effects of standard seed treatments on amount of Fusarium contamination is an important first step in reducing future losses. Once the level of seed infection is reduced to acceptable limits, other problems, such as reducing secondary spread or other sources of inoculum, can be investigated.

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