NEEDLE TIP DIEBACK OF CONTAINERIZED DOUGLAS-FIR SEEDLINGS AT THE COEUR D'ALENE NURSERY, IDAHO

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Needle tip dieback of containerized Douglas-fir (Pseudotsuga menziesii (Mirb.) Franco) seedlings grown at the Coeur d'Alene Nursery in Idaho was investigated. Several primary needles of affected seedlings had tip necrosis; terminal tufts of needles were also often killed (figure 1). Tip necrosis was most prevalent near the top of seedlings. Affected seedlings were scattered within greenhouses rather than being concentrated in groups or within certain areas. Mortality was not common; those few seedlings that had died were quickly removed by greenhouse workers.

Figure 1.--Containerized Douglas-fir seedling with needle tip necrosis and leader dieback from the Coeur d'Alene Nursery.

Live seedlings with needle tip necrosis and several recently killed seedlings were taken to the laboratory for analysis. Root systems of live seedlings were examined after careful removel of growing media and compared to roots of dead seedlings. Surface sterilized (10 percent aqueous sodium hypochlorite for 1 minute) necrotic needle tips were placed on 2 percent water agar (WA) for isolation of colonizing fungi. Root tips of live seedlings and necrotic lateral roots of recently killed seedlings were also placed on WA and a selective medium for Fusarium (developed by Nash and Snyder (1962)) after being surface sterilized. Samples of growing media from containers were also placed on Fusarium medium. All plates were incubated at 25° C under continuous cool fluorescent light and emerging fungi transferred to potato dextrose agar (PDA) slants. Species of Fusarium were identified using the taxonomic guides of Booth (1971) and Toussoun and Nelson (1968).

Root systems of live seedlings were generally healthy with very little root necrosis (figure 2). Root tips were white and small feeder roots were abundant. On the other hand, recently killed seedlings had few lateral feeder roots and extensive root necrosis.

No fungi were isolated from surface sterilized necrotic needle tips. Isolations from roots of both live and recently killed seedlings yielded Fusarium oxysporum Schlecht. (figure 3). This fungus was also commonly isolated from container-growing media (figure 4). Isolates of F. oxysporum from live and recently killed seedlings and growing media had similar morphological and cultural characteristics. No other fungi were isolated on selective Fusarium medium. However, Trichoderma and Penicillium were isolated along with F. oxysporum on WA.

Fusarium oxysporum was identified from its production of both macroconidia and microconidia (figure 5), chlamydospores (figure 6), and small, mostly unbranched microconidiophores. Colonies on PDA produced abundant fluffy, white aerial mycelium and dark purple pigment in the agar. Sporodochia were not evident. It is suspected that Fusarium oxysporum caused death of the recently killed seedlings examined. Since the fungus was also isolated frequently from roots and growing media of live seedlings, it may be involved in causing needle tip dieback as well. It is known that F. oxysporum can infect seedlings shortly after seed germination and remain inactive for several months. Whether or not the fungus becomes active pathologically depends on virulence of the strain and vigor of the seedlings. It is possible that the isolate of F. oxysporum obtained from live seedlings with needle tip necrosis was not as virulent as that obtained from recently killed seedlings. Although these isolates appeared morphologically similar, pathogenicity tests might reveal differences in virulence.

Figure 2.--Root system of containerized Douglas-fir seedling with needle tip necrosis. Roots are generally healthy with little necrosis and abundant white tips.

Figure 3.--Growth of Fusarium oxysporum from root tips of live containerized Douglas-fir seedlings. Root tips were incubated on selective Fusarium medium.

Figure 4.--Growth of Fusarium oxysporum on growing media from containerized Douglas-fir seedlings with needle tip necrosis. Growing media were incubated on selective Fusarium medium.

Figure 5.--Macroconidia (black arrow) and microconidia (red arrow) of Fusarium oxysporum isolated from containerized Douglas-fir seedlings (X450).

Figure 6.--Chlamydospore (arrow) of Fusarium oxysporum isolated from containerized Douglas-fir seedlings (X1000).

Fusarium oxysporum commonly infects seed of Douglas-fir and other conifer species. The fungus can often be found on the seedcoat as well as inside the seedcoat on the endosperm. Occurrence of the fungus on containerized conifer seedlings is usually the result of sowing infected seed. On rare occasions, container-growing media might contain populations of Fusarium. After killing seedlings, the fungus may produce sporodochia on the main stem just above the ground line which may provide spores for infection of nearby seedlings. Based on distribution of seedlings with needle tip necrosis and low levels of seedling mortality at the Coeur d'Alene Nursery, it is suspected that F. oxysporum was probably seedborne.

Because of low levels of current seedling mortality, efforts to control F. oxysporum on containerized Douglas-fir is currently not necessary. Addition of fungicides would not reduce fungal populations much because of problems of chemical penetration. Maintaining vigorous seedlings will probably help limit extent of needle tip necrosis, although the role of F. oxysporum in production of this symptom remains unclear.

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