NEEDLE TIP DIEBACK OF CONTAINER-GROWN WESTERN WHITE PINE SEEDLINGS CHAMPION TIMBERLANDS NURSERY PLAINS, MONTANA

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During production of the 1989 crop of container-grown seedlings at the Champion Timberlands Nursery, Plains, Montana, several scattered western white pine (***Pinus monticola*** Dougl.) seedlings displayed needle tip dieback symptoms. Affected seedlings were several months old and scattered throughout white pine production areas within greenhouses. Needle tips were initially chlorotic, but necrosis (browning) of tissues occurred later, extending several cm down affected needles. Within necrotic zones on needles, black structures resembling fungal sclerotia were evident. Growers thought the dieback symptoms might be due to infection by ***Botrytis cinera*** Pers.:Fr. since symptoms appeared late in the crop cycle and sclerotial-like structures which might be indicative of ***Botrytis*** (James 1984) were prominent on needles. Therefore, several seedlings with distinctive needle tip dieback symptoms were analyzed for presence of ***Botrytis*** and other possible pathogenic fungi.

Necrotic needles were washed thoroughly for several minutes under running tap water, surface sterilized in a 10% bleach solution (0.525% aqueous sodium hypochlorite) for one minute, then rinsed with sterile distilled water. Pieces of necrotic needles were then placed in moist chambers consisting of filter paper moistened with sterile water within a sterile plastic petrie dish. Moist chambers were incubated at about 24°C under diurnal cycles of cool, fluorescent light for 3 days, after which they were examined for fungal colonization. Colonizing fungi were transferred to microscope slides and identified to genus using a standard taxonomic guide (Barnett and Hunter 1972).

Because needle tip dieback symptoms were also similar to indications of root disease (James 1986, 1987; James and others 1988), efforts were taken to determine extent of root colonization by potential pathogens. Roots of diseased seedlings were washed thoroughly to remove adhering particles of growing media. They were then examined under the binocular microscope (10-70X) for evidence of deterioration and/or decay. Roots generally lacked indications of decay, although there were very few white root tips that would be expected on actively growing roots. Epidermal tissues remained attached to the stele and were not easily sloughed off. Roots were aseptically dissected into pieces

about 3-5 mm in length. Pieces were cut from throughout root systems, i. e., intercalary pieces as well as root tips. Twenty root pieces were selected from each seedling, surface sterilized as described above, rinsed with sterile distilled water and placed on an agar medium selective for ***Fusarium*** spp. and related root disease fungi (Komada 1975). Plates were incubated under diurnal cycles of cool, fluorescent light at about 26°C for 7-10 days. Fungi emerging from root pieces were identified to genus using the taxonomic guide of Barnett and Hunter (1972). Selected ***Fusarium*** isolates were transferred to potato dextrose and carnation leaf agar for identification of species using the monographs of Booth (1971), Gerlach and Nirenberg (1982), and Nelson and others (1983).

Botrytis did not colonize any necrotic needle tissues sampled. However, ***Alternaria*** (primarily ***A. alternata*** (Fr.)Keissler) thoroughly colonized most of these tissues. This fungal species was identified using descriptions by Domsch and others (1980), which characterized ***A. alternata*** as producing long chains of pigmented, irregularly-shaped conidia ornamented with a short beak. This species is a common colonizer of dead organic matter including above-ground portions of many plants (Neergaard 1945). Although ***A. alternata*** may be a minor pathogen under certain circumstances (Domsch and others 1980; Lloyd 1972), it is usually considered saprophytic (Ellis 1971).

Roots of all sampled seedlings were thoroughly colonized with ***Fusarium oxysporum*** Schlecht. All 20 root pieces plated from each seedling was colonized with this species. The only other fungus recovered from seedling roots was ***Penicillium*** sp., which was isolated very infrequently. ***Fusarium oxysporum*** is a well-documented pathogen of conifer seedlings (Bloomberg 1971; James and others 1988b), including western white pine (James 1985, 1987). This fungus causes needle tip dieback symptoms of diseased container-grown seedlings (James 1986, 1987; James and others 1988b) and may also be responsible for killing infected white pine seedlings once outplanted in forests (James 1985). ***Fusarium oxysporum*** has a history of occurrence at the Champion Timberlands Nursery (James and others 1988b), causing disease on several different conifer hosts. The fungus is both seedborne (James and others 1988b) and introduced into crops on contaminated containers (James and others 1988a). Reducing contamination of reused containers by improved methods of disinfection recently developed at the nursery (James and Woollen 1988), should help reduce future damage by ***Fusarium***. Other important steps needed to reduce disease includes rinsing seed thoroughly in running water (minimum of 48 hrs.), cleaning greenhouse interiors with disinfectant between seedling crops, and physically removing diseased seedlings when they are found .Previous experience (James and others 1988a) indicates that fungicides are generally ineffective once root disease symptoms become evident .Therefore, cultural and sanitation approaches offer the best chance to reduce future damage from ***Fusarium*** root disease.

In conclusion, needle tip dieback symptoms of container-grown western white pine seedlings at the Champion Timberlands Nursery were probably due to extensive root colonization by ***F. oxysporum***. This pathogen did not elicit much root decay in examined seedlings, but was still able to disrupt host physiology enough for foliage symptoms to appear. Since the fungus infects cortical cells and disrupts vascular transmission of water and nutrients (Bloomberg 1966), wilt and dieback symptoms often result. Steps outlined above can be used to reduce future damage from this disease.

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