Tip Dieback of Containerized Douglas-fir Seedlings at the Montana State Nursery Missoula

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April 1984

Nursery Disease Notes No. 15

Several containerized Douglas-fir (Pseudotsuga menziesii (Mirb.) Franco) seedlings grown for a winter crop during 1983-84 at the Montana State Nursery, Missoula displayed various levels of needle and stem tip dieback. Some affected seedlings had only a few necrotic needles at their apex (figure 1), while others had more severe top and lateral branch dieback (figure 2). Fungal sporulation on above-ground necrotic tissues was not evident.

Figure 1. Containerized Douglas-fir seedling with needle tip dieback symptoms at the Montana State Nursery. This seedling (84-13) had only a few necrotic needles, but extensive root infection and soil mix colonization by Fusarium oxysporum.

Several symptomatic seedlings were collected and taken to the laboratory for isolation of associated organisms. Isolations were made on 2% water agar and a selective medium for Fusarium spp. (Nash and Snyder 1962). The Fusarium medium was used because seedlings with similar symptoms at the U. S. Forest Service Nursery in Coeur d'Alene, Idaho were previously found to be infected with F. oxysporum Schlecht. (James 1984b). Isolations were made from necrotic needle and stem tissue and root tips, most of which were white and appeared healthy.

Four symptomatic containerized seedlings were selected for sampling Fusarium populations in their peat vermiculite soil mix. Soil mix samples were collected at three locations within each Leach container for three of the four sampled seedlings (top sample = within 5.5 cm of the top; middle = within 11.0 cm and 5.5 cm of the top; bottom = below 11.0 cm from the top). For the other seedling, a soil mix sample was collected in approximately the middle of the container. Standard soil dilution estimates were used to obtain Fusarium population estimates (Nash and Snyder 1962).

Results and Discussion

Fusarium oxysporum was isolated from the root tips of all seedlings sampled with needle or stem dieback symptoms (table 1). Populations of Fusarium from

Figure 2. Containerized Douglas-fir seedling with needle tip dieback symptoms at the Montana State Nursery. This seedling (84-12) had more severe top and lateral branch dieback. Its roots and soil mix were extensively colonized by Fusarium oxysporum.

Table 1. Populations of Fusarium from peat vermiculite soil mix used to grow containerized Douglas-fir seedlings at the Montana State Nursery, Missoula.[1]

Seedling Number	Location Within Leach Container		
	Bottom	Middle	Top
84-11	-	553	-
84-12 (figure 2)	3199[2]	0	133
84-13 (figure 1)	267[2]	0	133
84-14	0	0	0

[1]Seedlings sampled displayed needle or stem tip dieback. Figures in table are propagules of Fusarium per gram of sample. Fusarium was isolated from the root tips of all sampled seedlings.

[2]Includes both F. oxysporum and F. roseum; all other samples were F. oxysporum.

Peat vermiculite soil mixes varied from zero to almost 3200 propagules per gram (table 1). In general, higher populations were found in the bottom one-third of soil mix columns. This may be due to leaching of Fusarium propagules through the container as a result of overhead irrigation. These levels of Fusarium approximate those reported for infested field soils (Edmonds and Heather 1973; Smith 1970).

Relating soil populations of Fusarium to expected levels of disease are difficult, primarily because of presence of saprophytic strains of most Fusarium species (Bloomberg 1971; Booth 1971). However, several workers (Edmonds and Heather 1973; Komada 1975; Nash and Snyder 1962) believe that propagule levels in the soil provide a good approximation of expected disease.

The results reported here indicate that relatively high levels of Fusarium may be associated with mild disease symptoms such as slight needle or main stem dieback. It is possible that symptoms progress resulting in eventual seedling mortality. However, growers at the Montana State Nursery indicate that extensive containerized seedling mortality does not normally occur.

Both F. oxysporum and F. roseum (Lk.) Sacc. were isolated from seedling root tips and peat vermiculite soil mixes. Fusarium oxysporum was identified on the basis of microscopic and cultural characteristics (Booth 1971; Toussoun and Nelson 1968). Isolates obtained produced abundant ovoid-ellipsoid microconidia measuring 6.6u-8.8u long and 1.5u-2.6u wide. These were borne on short phialidic conidiophores about 12-20u long and 2.0-3.0u wide (figure 3). Macroconidia were less abundant, slightly falcate with 1-3 septa, and measured 27-46u long and 3-5u wide. Ovoid, subhyaline, granular chlamydospores measuring about 8-9u in diameter were common in cultures 10-14 days old. Distinct violet pigmentation was produced in cultures on potato dextrose agar (PDA). The isolates of F. roseum obtained did not produce microconidia, but falcate macroconidia measuring 13.2-26.4u long and 1.8-3.0u wide were abundant. Globose to fusiform chlamydospores were common in cultures several days old. A deep reddish pigment was produced in cultures on PDA.

Species of Fusarium may be seedborne (James 1983a; James 1983b) or may possibly be introduced on contaminated peat vermiculite soil mixes (James 1984a). If disease losses, especially seedling mortality, are high, steps should be taken to reduce seed contamination or sterilize soil mixes (James 1984a).

Additional work is needed to determine the pathogenic potential of the Fusarium isolates obtained in this study. It is possible that pathogenic and saprophytic fungal strains are present. Environmental stresses may exert influences on the pathogenic behavior of the Fusarium isolates obtained.

Acknowledgements

Assistance of C. J. Gilligan with sampling Fusarium population levels is appreciated.

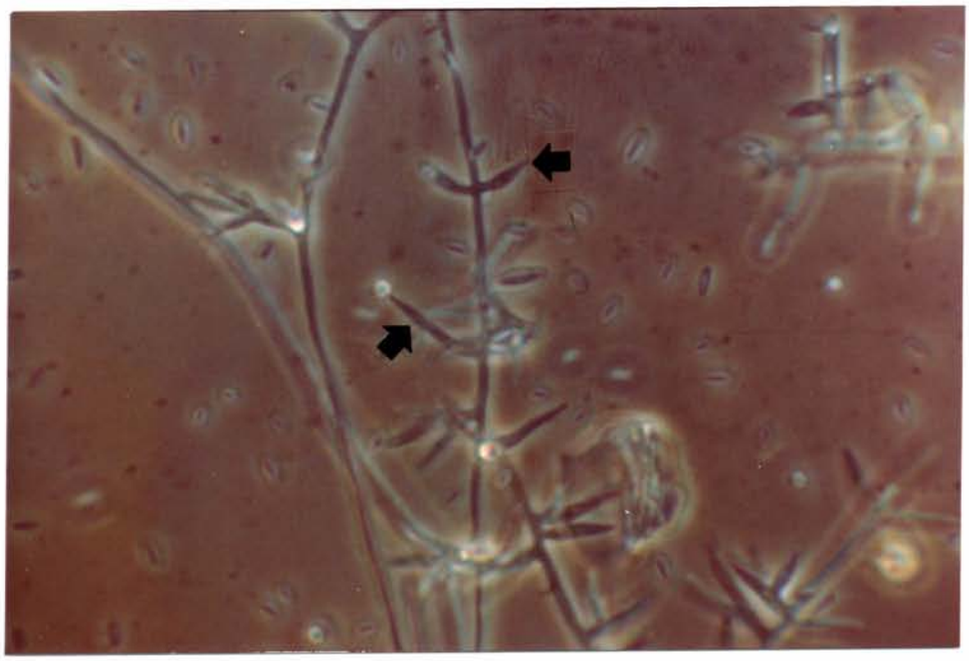

Figure 3. Phialidic microconidiophores (arrows) of Fusarium oxysporum isolated from containerized Douglas-fir seedling (84-11) displaying needle tip dieback (X450).

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