ROOT DISEASE OF CONTAINER-GROWN PACIFIC SILVER FIR SEEDLINGS - NORTH WOODS NURSERY, ELK RIVER, IDAHO

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During the 1989 growing season at the North Woods Nursery, Elk River, Idaho, higher than normal amounts of post-emergence damping-off and early root disease was detected on container-grown Pacific Silver fir (***Abies amabilis*** (Dougl.) Forb.). Primary cause of diseases was attributed to several species of ***Fusarium*** (James 1989). When the crop was several months old, examples of seedlings with root disease symptoms (needle tip and general foliar necrosis and wilting) were collected for comparisons with the earlier diseased seedlings to determine if the same disease organisms were involved.

Symptomatic seedlings were scattered throughout the growing area rather than being concentrated within groups or in certain portions of greenhouses. Root necrosis of seedlings with above-ground symptoms was evident; however, this necrosis did not always commence at root tips and progress proximally as usually occurs on diseased container-grown seedlings (James 1986a). Some seedlings had root necrosis commencing on the main tap or lateral roots just below the groundline and extending distilly from there. This pattern would indicate that pathogens attacked roots near the groundline, decaying them and causing disruption of water and nutrient transport from fine roots up into the seedling crown. This pattern of pathogenesis has been noted on some bareroot seedlings (James 1986b), but generally not for container-grown seedlings.

Necrotic portions of the main taproot or adjacent large lateral roots were sampled for infection by potentially pathogenic fungi from 16 seedlings displaying various levels of foliar necrosis and wilting. Roots were carefully excised and washed to remove particles of growing media. Necrotic zones within roots, including some non-moribund tissues adjacent to necrotic cells, were extracted and surface sterilized in a 10% bleach solution (0.525% aqueous sodium hypochlorite) for 1 minute. They were then rinsed with sterile water and placed on an agar medium selective for ***Fusarium*** spp. and related fungi (Komada 1975). Plates were incubated under diurnal cycles of cool, fluorescent light at about 26°C for 7-10 days. Emerging fungi were identified to genus using the taxonomic guide of Barnett and Hunter (1972) .Selected ***Fusarium*** isolates were transferred to carnation leaf and potato dextrose agar for identification using the descriptions of Nelson and others (1983).

Fusarium spp. were isolated from necrotic root tissues of each diseased seedling sampled (Table 1). In order of abundance of isolation, these species included ***F. acuminatum*** Ell. & Ev., ***F. solani*** (Mart.)Appel & Wollenw., *F.* ***sambucinum*** Fuckel, and ***F. oxysporum*** Schlecht. With the exception of ***F. oxysporum***, each of these species were isolated from younger diseased seedlings of the same crop (James 1989). In that previous sample, ***F. acuminatum*** was also the most frequently isolated species. This species is often the most commonly encountered ***Fusarium*** in container operations (James and others 1989a) .Isolates of ***F. acuminatum*** may be quite virulent on seedlings (James and others 1989b).

Table 1. Colonization of roots of container-grown Pacific Silver fir seedlings with ***Fusarium*** and ***Trichoderma*** species - North Woods Nursery, Elk River, Idaho.

Colonization Percentage[1]
Fusarium Species

Seedling Number	*acuminatum*	*solani*	*sambucinum*	*oxysporum*	*Trichoderma*
1	80	70	0	0	0
2	80	20	0	0	0
3	89	11	0	0	11
4	25	50	75	0	0
5	0	0	0	100	0
6	29	43	71	14	0
7	17	0	83	50	17
8	100	43	0	0	29
9	0	100	0	0	0
10	0	0	0	100	0
11	100	0	57	29	0
12	100	33	0	0	33
13	29	86	0	0	14
14	100	13	0	0	62
15	100	33	0	0	33
16	100	0	0	0	100
Averages	61.9	31.4	16.9	16.1	18.6

[1]6-10 necrotic root pieces sampled per seedling.

Fusarium oxysporum is a common pathogen of container-grown seedlings (James and others 1989a). However, it was isolated from only 5 of these older seedlings (Table 1) and none of the younger diseased ones (James 1989). In three cases (seedlings #5, 7, and 10) this species was the most likely cause of disease. However, it was probably only partially involved in disease of the other sampled seedlings.

Roles of either ***F. solani*** or ***F. sambucinum*** in disease of these seedlings is unknown. Isolates of ***F. solani*** have not been evaluated for their pathogenicity on conifer seedlings and those of ***F. sambucinum*** previously tested have been largely non-pathogenic (James and others 1989b).

This evaluation corroborates previous work (James 1989) which showed the importance of several species of ***Fusarium*** in causing root disease of Pacific Silver fir seedlings at the North Woods Nursery in 1989. It is suspected that most ***Fusarium*** inoculum was introduced into container operations on infested seed. However, once these organisms are introduced, they may persist on containers and infect subsequent seedling crops unless containers are adequately cleaned after each use (James and others 1988). Other important steps to reduce future damage includes treating seed with running water rinses or surface sterilants to reduce amounts of pathogen contaminants, sanitizing the interior of greenhouses between crops, and rogueing diseased seedlings when found to prevent secondary spread. These steps should help keep pathogen and disease levels low in the future.

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