RECENT CONIFER DISEASE PROBLEMS IN FOREST NURSERIES IN THE MARITIME PROVINCES

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Abstract

Damping-off and root rot of pine and spruce seedlings have caused losses in three forest nurseries in the Maritime Provinces since 1970. Isolates of Rhizoctonia solani, Fusarium oxysporum, Pythium spp. and Cylindrocarpon sp. obtained from diseased seedlings were pathogenic in laboratory and greenhouse tests. Gray mold caused by Botrytis sp. and snow mold have caused some damage in spruce seedbeds in one nursery, and infections of pines by Lophodermium pinastri have been detected in two nurseries. The greatest losses in conifer nurseries have occurred in container stock grown on media consisting largely of sphagnum peat. These losses, however, were attributable to physical or chemical factors rather than to pathogenic organisms.

Résumé

Depuis 1970, la fonte des semis et le pourridié des racines de Pins et d'Epinettes ont causd des pertes dans trois pépinières forestières dans les provinces Maritimes. Furent trouvés pathogènes, lors de tests en laboratoire et en serre, des isolats de Rhizoctonia solani, Fusarium oxysporum, Pythium sp. et Cylindrocarpon sp. prélevés de semis malades. La moisissure grise, causde par un Botrytis, et la brûlure printanière (snow mold) endommagèrent les semis d'Epinette dans une pépinière, et on ddtecta des infections de Pins par Lophodermium pinastri dans deux pépinières. Les pertes les plus grandes en pépinières de résineux furent subies par les semis en potets poussant dans des sols qui consistaient surtout de tourbe de Sphagnum. Cependant, ces pertes, dans ce cas, étaient plutôt attribuables à des facteurs physiques ou chimiques.

In the provinces of New Brunswick, Nova Scotia, and Prince Edward Island the production of tree seedlings for reforestation has tripled since 1970 to a present level of 15- to 20-million trees per year. Most of the production is in conventional outdoor nursery beds that provide bare-root stock, but this is increasingly supplemented by container stock started in greenhouses. There are four major nurseries located at Juniper and Kingsclear, N.B., Lawrencetown, N.S., and Charlottetown, P.E.I. In addition, there are several private greenhouses that pxoduce container stock for reforestation, and a small research nursery at Acadia Forest Experiment Station near Fredericton, N.H. Each of these nurseries experienced problems that caused mortality or retardation of seedling growth. Routine fungal isolations and pathogenicity tests indicated that some of these problems were due to pathogenic fungi.

Isolations of fungi were made from diseased tissues after the surface was sterilized for 2-3 minutes in 0.5% sodium hypochlorite solution. Three culture media were used: a modified Martin's peptone agar (6), 2% malt agar, and cornmeal agar amended with 100 ppm nystatin, 100 ppm neomycin, and 50 ppm cholesterol. Aseptic pathogenicity tests (Table 1) were conducted according to the method of Vaartaja and Cram (5). Red pine seeds were surface sterilized for 2 minutes in 0.1% $HgCl_2$, rinsed with sterile distilled water, and planted on the surface of a dilute mineral salts agar (5) in 18 x 150 mm tubes. These were incubated under 16-hour daylengths at alternating 22° - 16°C day-night temperatures until 3 to 4 days

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after the seeds had germinated. They were then inoculated from growing cultures of the test fungus and incubated under the same conditions until the seedling died. Pathogenicity was expressed in terms of days from inoculaticn to mortality.

Greenhouse pathogenicity tests were conducted on a soil mix (sandy loam, peat, vermiculite) inoculated before planting with cultures of the test fungus. Pathogenicity was expressed in terms of percent pre-emergence or post-emergence mortality.

Damping-off and root rots in outdoor nursery beds

These two disease complexes were considered together because they occurred on the same soils and were associated with the same fungi. Detectable outbreaks, causing losses in seedling numbers or reductions in seedling quality occurred at the Kingsclear, Acadia, and Lawrencetown nurseries (Table 1). The nursery beds at Kingsclear and Lawrencetown were converted from former farmland and probably inherited their populations of damping-off and root rot fungi from previous crops. Most of the damping-off at Kingsclear occurred on beds that had been treated the previous autumn with Vapam, suggesting either insufficient sterilization or recontamination as illustrated by Vaartaja (4). similarly, damping-off and root rot in the Acadia nursery occurred in beds that had been fumigated the previous autumn with methyl bromide.

Most seedlings with root rot or damping-off yielded Fusarium oxysporum Schlect., many isolates of which proved to be pathogenic (Table 1). In addition, some seedlings yielded Rhizoctonia, Pythium, or Cylindrocarpon, most of which were highly pathogenic. It is not known if Fusarium plays a primary role in seedling disease in the nursery or is an invader of seedlings weakened by the more aggressive pathogens (1, 2, 3, 5).

Table 1. Damping-off and root rot occurrences in conifer seedlings in Maritime forest nurseries and pathogenicity of the major fungi isolated from diseased seedlings

Location and species	Stage	Date	Symptom	Fungi isolated: Species	Pathogenicity: Aseptic tests[1]	Pathogenicity: Greenhouse tests[2]
Kingsclear						
Red pine	2:1	9/71	Root rot	Fusarium oxysporum		
Red spruce[3]	1:0	7/73	Damping-off	Rhizoctonia solani	+++	+
				Fusarium oxysporum	++	0
Red pine[3]	1:0	7/73	Damping-off	Rhizoctonia solani	+++	+
				Fusarium oxysporum	++	0
Lawrencetown						
White spruce	2:1	11/71	Root rot	F. oxysporum	++	+
Scots pine	1:0	11/71	Root rot	F. oxysporum	+	0
Red pine	1:0	7/72	Damping-off	R. solani	+++	
				F. oxysporum	+	
Red pine	2:0	9/72	Root rot	F. oxysporum	++	
				Cylindrocarpon sp.	++	
Red pine	2:0	7/73	Root rot	Pythium sp.	++	
				F. oxysporum	+	
Acadia						
Red pine'	1:0	1/73	Damping-off	Pythium sp.	+++	
				F. oxysporum	++	
Spruces[4]	1:0	7/73	Root rot	Pythium sp.	+++	
				F. oxysporum	++	

[1] Seedlings killed in less than 20 days after inoculation (+++), 20–40 days (++), 40–80 days (+), or over 80 days (0).

[2] Mortality significantly greater than in uninoculated controls (+), or not significantly greater (0) at P = 0.05.

[3] Seedbeds fumigated with vapam (80 gal/acre) in the fall. Seeding took place in spring.

[4] Seedbeds fumigated with methyl bromide in the fall. Seeding of spruces in fall, red pine in spring.

Foliage diseases

Snow molds caused patches of dead seedlings in 2–0 white and black spruce in the Juniper nursery in the spring of 1972. The associated fungi were not identified. In the same nursery beds, patches of gray mold (Botrytis sp.) occurred during the summers of 1971 and 1972.

Needlecasts of pines caused by Lophodermium pinastri (schrod. ex Hook) Chev. have been detected in a jack–pine windbreak in Juniper and in 3-0 red pine at Lawrencetown. The latter crop was unfit for planting because of the damage. Although this disease has not to date caused extensive damage in the Maritimes, its destructive effects have been observed in a nearby American nursery from which white pine seedlings, many infected with L. pinastri, were imported and planted in various localities in Nova Scotia during the spring of 1973.

Problems in container–grown seedlinss

Large scale mortality in seedlings grown on peat in small plastic, Styrofoam, or paper containers has resulted in the loss of nearly a million seedlings since 1970. Suspected causes, when determined, were temperature and moisture extremes, nutritional imbalances, and excessive applications of fungicides. Few of the funai isolated from dying seedlings, e.g. Trichoderma viride Pers. ex S. F. Gray, Gliocladium roseum (Link) Bainier and Endosone pubescens (Sacc. and Ellis) Zycha, were pathogenic in either greenhouse or aseptic inoculations.

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Literature cited

7. Bloomberg, W. J. 1973. Fusarium root rot of Douglas fir seedlings. Phytopathology 63:337-341.

2. Roth, L. F., and A. J. Riker. 1943. Life history and distribution of Pythium and Rhizoctonia in relation to damping–off of red pine seedlings. J. Agr. Res. 67: 129-148.

3. Tint, H. W. 1945. Studies in the Fusarium damping–off of conifers. I. The comparative virulence of certain Fusaria. Phytopathology 35: 421-457.

4. Vaartaja, O. 1967. Reinfestation of sterilized nursery seedbeds by fungi. Can. J. Microbiol. 13: 771-776.

5. Vaartaja, O., and W. H. Csam. 1956. Damping–off pathogens of conifers and of caragana in Saskatchewan. Phytopathology 46: 391-397.

6. Wensley, R. N., and C. D. McKeen. 1962. A soil suspension–plating method of estimating populations of Fusarium oxysporum f. melonis in muskmelon wilt soils. Can. J. Microbiol. 8: 57–64.