Pythium sylvaticum in Canadian forest nurseries

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Pythium sylvaticum is widespread in Canada and, at least in some soils, very abundant. It was associated with damping-off of *Pinus resinosa* in forest nurseries. In aseptic pathogenicity tests, *P. sylvaticum* was highly virulent.

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Pythium sylvaticum, que l'on trouve partout au Canada, est au moins tres abondant dans certains sols. On l'associe a la fonte des semis de *Pinus resinosa* dans les pepinieres forestieres. *P. sylvaticum* s'est revele très virulent lors d'essais aseptiques de pathogenicite.

The purpose of this report is to discuss briefly the occurrence of *Pythium sylvaticum* Campbell and Hendrix (1967) in Canada and to describe results of a pathogenicity test with red pine, *Pinus resinosa* Ait.

Incidental to studies on fungitoxicants in nursery soil, to be published elsewhere, observations were made on this *Pythium* species, which deserves special attention. Most isolates of this predominantly heterothallic species do not produce oogonia (unless mated with a compatible strain) and have not been recognized in the past when all *Pythium* species were thought to be homothallic (Middleton 1943).

This species has also been called *Pythium debaryanum* var. *pelargonii* Braun (Pratt and Green 1971), and possibly other names. The synonymy and other confusion surrounding this species is partly a result of the species unexpectedly containing heterothallic and homothallic strains of varying strengths (Pratt and Green 1971). These aspects will be dealt with in another paper.

Methods and results

Occurrence

In 1972, 1973, 1974, and 1975 *Pythium sylvaticum* was frequently found in the sandy soil at the Dolman Ridge nursery at the Canadian Forestry Service's Research Forest at Ramsayville, Ont. The identity of the heterothallic isolates was established through pairings with known female and male isolates. This fungus was also isolated from red pine seedlings growing in the nursery in untreated beds and in beds treated with various fungitoxicants.

In 1973 and 1974 *P. sylvaticum* was similarly found in sandy, litter-amended soil at the nursery of the Petawawa Forest Experiment Station, Chalk River, Ont. An attempt was made to find what proportion of the damping-off disease in this nursery was caused by this fungus. Diseased portions of the seedlings were placed on 1.5% water agar and the pathogens isolated and identified. The incidence of *P. sylvaticum* in 64 seedlings sampled on 23 June 1974 was 10. Similar results were obtained in samplings at other dates.

I have also isolated *P. sylvatium* from *Picea glauca* seedlings from two nurseries in Saskatchewan (Indian Head - loamy soil, and Big River - sandy soil).

The survey of *Pythium* in Ontario forest nurseries, including Petawawa, done in 1966 (Vaartaja 1968) did not report *P. sylvaticum.* Probably this species was present but could not be recognized until Campbell & Hendrix (1967) discovered heterothallism in this species. To check this possibility a few remaining viable cultures from the 1966 survey were reexamined. As a result *P. sylvaticum* was recorded from additional locations in Ontario: Midhurst nursery - sandy soil; Orono nursery - sandy soil; Longlac nursery - sandy soil; Maple - agricultural land (loam); Maple - Southern Forest Experiment Station (sandy soil).

Cultures received from other mycologists in Canada were also identified as *P. sylvaticum:* diseased *Picea engelmannii* seedling from Oliver nursery, Alberta (Dr. D. Hocking); rotting carrot, Lower Fraser Valley, B.C. (Dr. H. S. Pepin); carrot growing in muck soil, Bradford, Ont. (Ms N. Kalu) and Port Colbourne, Ont. (Dr. D. J. S. Barr); *Pinus resinosa,* Fredericton, N.B. (Dr. R. E. Wall).

To determine whether *P. sylvaticum* occurs in Quebec, a compost soil made from sandy turf under a sparse maple forest at Lucerne, Que., was analyzed using methods similar to that in the Ontario survey (Vaartaja 1968). Out of 64 *Pythium* propagules per 1 cm^3 soil, 25 were identified as *P. sylvaticum.*

The above data indicate that (a) *P. sylvaticum* occurs widely in Canada; (b) it is found in different Canadian soils, sometimes in high incidences; and (c) it is associated with conifer damping-off and other plant diseases in Canada.

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Table 1. Indices of health of red pine seedlings in aseptic inoculation experiments with 19 isolates of ***Pythium sylvaticum*** and single isolates of 4 other, better known pathogens. 3-month tests in a growth chamber

Pathogen	No. of isolates	Health index*
Pythium sylvaticum	19	4.8 ± 2.6†
Pythium aphanidermatum	1	1.5
Phytophthora cactorum	1	***2.0***
Pythium ultimum	1	4.0
Rhizoctonia solani	1	***7.0***
Controls	2	100

* Where 0 = death of seedling before emergence of catyledons from seeds, and 100 = no symptoms of disease (see text).

† Average ± standard deviation.

Pathogenicity

The potential pathogenicity c 19 representative isolates of ***P. sylvaticum*** was tested on ***Pinus resinosa*** in replicated aseptic cultures on autoclaved water agar in large test tubes capped with glass vials. Into these were dropped germinating aseptic seeds that had been treated with 1% sodium hypochlorite to eliminate surface contaminants and incubated on autoclaved water agar until they reached an early stage of germination. The vials were kept for 3 months in growth chambers (night-day temperatures between 15° and 30°C, photoperiod 18 h, light intensity 1500 ft-c). The effect of infection was estimated visually and expressed by an index based on the amount of growth relative to that of seedlings in fungus-free controls. Thus death before cotyledons appeared was rated as 0, death at an early cotyledonal stage as 10, death when first few needles were half grown as 20, slight reduction in root growth as 90. For comparative purposes, the pathogenicity of an isolate of ***P. aphanidermatum*** (Edson) Fitzpatrick from the Ramsayville forest and one isolate of ***Phytophthora cactorum*** (Leb. & Cohn) Schroet, ***Pythium ultimum*** Trow, and ***Rhizoctonia solani*** Kuehn from the Petawawa Station were similarly tested.

All isolates of ***P. sylvaticum*** tested killed the seedlings at an early stage, often during later stages of germination (Table 1). These isolates representing male, female, and homothallic strains and widely different geographic origins showed no appreciable differences in pathogenicity. They were from Auckland, New Zealand; Georgia, U.S.A.; British Columbia and Ontario, Canada. The health index (average growth of seedlings) was only 4.8 (control 100). The pathogenicity of ***P. sylvaticum*** was similar to that of the four other fungi, all well known as highly virulent pathogens. The isolate of ***P. sylvaticum*** from rotting carrot was also virulent on pine thus suggesting lack of pathogenic specialization in this species.

Aseptic tests show only pathogenic potential, which is not always realized in unsterile soil with the abundant competing microflora (Vaartaja 1968). In the tests of Hendrix and Campbell (1968) ***P. sylvaticum*** was only slightly virulent on three Southern pines in unsterile soil and with a low inoculum density, <20 propagules per gram of soil. With either a higher inoculum density or less competition in soil, one may expect this pathogen to cause considerable seedling losses.

Literature cited

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