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Susceptibility of the Larch Sawfly to Pleistophora schubergi *(Microsporida)*

Yield of Seed in Larix laricina *in Newfoundland*

Bark Beetle Carriers of Gremmeniella abietina *and Other Pathogenic Microfungi*

Occurrence of the Introduced Sawfly Acantholyda erythrocephala *(L.) in Ontario*

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TO READERS OF BI-MONTHLY RESEARCH NOTES

WITH THIS ISSUE, BI-MONTHLY RESEARCH NOTES BECOMES CANADIAN FORESTRY SERVICE RESEARCH NOTES AND IS A QUARTERLY PUBLICATION.

A FRENCH EDITION WILL BE PUBLISHED UNDER THE TITLE OF *REVUE DE RECHERCHES DU SERVICE CANADIEN DES FORÊTS*.

OUR EDITORIAL POLICY IS UNCHANGED. WE WILL CONTINUE TO ACCEPT NOTES ON CURRENT RESEARCH CONDUCTED BY THE CANADIAN FORESTRY SERVICE AND PUBLISH THEM BY AUTHORITY OF THE MINISTER OF THE DEPARTMENT OF THE ENVIRONMENT.

THE NAMES OF MEMBERS OF REVIEW BOARDS CONSIDERING MANUSCRIPTS SUBMITTED FOR PUBLICATION SHALL NOT BE DISCLOSED.

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The yield of seed in the Avondale plantation was assessed over 4 yr (Table 2). Seed extraction and germination methods were similar to those already described. Weight of seed, total numbers of seeds per cone, and full seeds per cone were variable. However, the weight of cones and germative capacity varied less from year to year. The total numbers of seeds per cone declined over the 4-yr period; but the numbers of full seeds declined for 3 yr and then increased in 1979.

Information in the literature on quantity and quality of seed produced in larch in the boreal forest is sparse. The Ontario Lands and Forests *Manual of Seed Collecting* describes seed weight as an indirect measure of seed quality and cites seed weights of larch ranging from 1.38 g to 2.04 g, with a mean of 1.80 g. These data are comparable to those reported for the Avondale plantation.

TABLE 1
Quantity and quality of larch seed in natural stands and plantations in Newfoundland in 1976.

Natural stands	Average cone weight	Weight of 1000 seeds	Total seeds per cone	Full seeds per cone	Germinative capacity
Western Nfld. (8 stands)					
Range	0.12 0.20	1.32 2.03	2.1 11.8	0.9 4.9	72.3 99.3
Mean	0.16	1.68	5.5	2.0	92.2
Central Nfld. (5 stands)					
Range	0.10 0.18	0.74 1.54	1.3 3.5	0.1 1.9	78.6 100.0
Mean	0.15	1.31	2.1	0.7	92.6
Eastern Nfld. (6 stands)					
Range	0.19 0.27	1.26 2.25	5.6 14.7	1.0 14.1	73.0 97.0
Mean	0.23	1.82	10.7	8.4	86.0
Plantations					
Western Nfld.					
Mean	0.21	1.42	15.5	1.8	78.3
Central Nfld.					
Mean	0.30	1.40	8.8	4.4	92.9
Eastern Nfld.					
Stand 1 Mean	0.22	2.07	9.6	7.6	89.9
Stand 2 Mean	0.18	1.48	8.4	2.8	95.5

TABLE 2
Quantity and quality of larch seed produced in the Avondale plantations from 1976 to 1979

Year collected	Cone weight (g)	Weight of 1000 seeds (g)	Total seeds per cone	Full seeds per cone	Germinative capacity
1976	0.22	2.07	9.6	7.6	89.9
1977	0.27	1.31	6.3	1.7	100.0
1978	0.17	1.06	4.4	0.1	100.0
1979	0.28	1.46	3.1	2.0	99.8

Reasonable estimates of full seeds per cone are necessary when cone collections are planned for provenance tests. For example, collection from one of the eastern Newfoundland stands in 1976 resulted in 1.4 L of cones with an average of 10.7 full seeds per cone. On a per litre basis this means that 4 500 full seeds per litre of cones was produced. Results from other collections in Newfoundland show that young (15-yr-old) trees produce up to 0.5 L of cones and mature trees from 2 to 5 L. On this basis and in a good seed year, a young tree could be expected to produce approximately 2 000 full seeds, whereas mature trees would yield 9 000 to 22 500 full seeds. The numbers of full seeds per cone were less than 10.7 in most collections, therefore, the previous figures are near the maximum yields obtainable.—J. Peter Hall, Newfoundland Forest Research Centre, St. John's Newfoundland.

ENTOMOLOGY

Bark Beetle Carriers of *Gremmeniella abietina* and Other Pathogenic Microfungi.—The North American race of *Gremmeniella abietina* (Lagerb.) Morelet, infecting small trees and lower branches of larger trees (Dorworth et al., Plant Dis. Rep. 61:887-890, 1977), is an important causal agent of mortality of young pines (*Pinus* spp.) (Martineau and Lavallée, Annual Report, Forest Insect and Disease Survey, Can. For. Serv. 32-48, 1970) in Quebec. A race of *G. abietina* on spruces (*Picea* spp.) causes mortality of young trees (Smerlis, Plant Dis. Rep. 51:584-585, 1967; Smerlis, Laur. Forest Res. Cent. Inf. Rep. LAU-X-23, 1976) in the central region of the province. Bark beetle galleries are frequently associated with diseased red pine (*Pinus resinosa* Ait.). They are less common in eastern white pine (*P. strobus* L.), jack pine (*P. banksiana* Lamb.), Scots pine (*P. sylvestris* L.), black spruce (*Picea mariana* (Mill.) B.S.P.), red spruce (*P. rubens* Sarg.), and white spruce (*P. glauca* [Moench] Voss). The presence of insect galleries on branches and stems of conifers infected by *G. abietina*, particularly where the entrance holes are adjacent to fruiting bodies of the fungus, is indicative of a possible vector-pathogen relationship. To determine whether or not adults of the bark beetles are contaminated with *G. abietina*, isolations from some insects were made during the summer of 1979.

Dead red pine branches showing entrance holes of insect galleries were collected on 13 June and 12 September near Matane, and on 4 and 30 July and 9 and 24 August near Les Méchins (both in Matane County and 50 km apart). The branches collected on 13 June had died approximately a year before and bore mature pycnidia of *G. abietina*, and the remaining branches had died during the spring of 1979. On 13 June it was cloudy with showers, but the other collection days were sunny. Branches were brought to the laboratory and stored in a dark cold-room at 2° C. Within 24 h they were examined in a lighted room at 20° C and isolations were attempted from the bark beetle adults present. The bark near gallery entrances was lifted, either with a sterile scalpel or a

needle, and the exposed adult was deposited with a needle on a sterilized 5 x 5 cm^2 piece of paper. When the adult had advanced to the edge of the paper, it was held above an open petri dish containing 30 mL of 3% malt agar, and the insect dropped to the medium. The dish was immediately closed. After 30 min the dish was inverted and opened, and the insect was removed with a sterile needle. The plates were incubated in a dark cold-room at 10° C. The 81 insects involved were placed individually in vials and numbered for identification purposes. Sixty-three were identified as *Orthotomicus caelatus* Eichh. and 18 as *Pityophthorus* sp. Because of the complexity of the genus *Pityophthorus* Eichh. and the small number of specimens available, no attempt was made to identify them to species. Table 1 gives the percentage of adults plated from each of the six collections.

The isolations demonstrated that adults of both *O. caelatus* and *Pityophthorus* sp. are carriers of *G. abietina*. Sixty-two percent of the *Pityophthorus* adults collected on 13 June were contaminated with the fungus (Table 1), whereas 7 to 46% of *O. caelatus* adults collected from 4 July to 12 September carried it. It is interesting to note that *O. caelatus* is contaminated with *G. abietina* for a longer period than reported for spore discharge. In central Quebec, spores of *G. abietina* occurring on jack pine are discharged from the first week of May to the first week of August, the maximum occurring in the third week of June (Smerlis, Bi-mon. Res. Notes 24:10, 1968). The time difference might be phenological. It is also possible that toward the end of summer, adults of *O. caelatus* are contaminated with mycelial fragments or that conidia are formed on the mycelium in insect galleries.

In addition to *G. abietina*, several other fungi were isolated from the adults of *O. caelatus* and *Pityophthorus* sp. (Table 1). Six of these are known to be causal agents of cankers or diebacks of various species of conifers. Pathogenicity has been demonstrated for *Leucostoma kunzei* (Fr.) Munk (Waterman, Phytopathology 45:686-691, 1955; Lavallée, Can. J. Bot. 42:1495-1502, 1964), *Potebniamyces coniferarum* (Hahn) Smerlis (Hahn, Plant Dis. Rep. 41:623-633, 1957; Smerlis, Can. J. Forest Res. 3:7-16, 1973), *Scoleconectria cucurbitula* (Tode ex Fr.) Booth (Smerlis, Plant Dis. Rep. 53:979-981, 1969), *Sydowia polyspora* (Brev. & v. Tav.) E. Müll. (Smerlis, Can. J. Bot. 48:1613-1615, 1970), and *Tympanis hypopodia* Nyl. and *T. laricina* (Fckl.) Sacc. (Smerlis, Phytoprotection 51:47-51, 1970).

Of the two species of bark beetles plated, *Pityophthorus* sp. is the more common. It was present in 93% of the 27 samples collected in 1979 from eastern white pine, jack pine, Scots pine, red pine, black spruce, red spruce, and white spruce. *Orthotomicus caelatus* was present in 22% of the samples, and it was found only on jack pine and red pine.

The genus *Pityophthorus* is large, containing about 50 species in Canada alone, nearly all of which attack dead or dying twigs and small branches of coniferous trees. Many of the species are so similar taxonomically that they are difficult to separate, and as a result their seasonal history and habits are not well known.

Orthotomicus caelatus is a common bark beetle found in spruces and pines throughout Canada (Bright, Can. Dep. Agric., Publ. 1576, 1976). It is not considered of economic importance, since it normally invades only dead or dying trees. Its occurrence in twigs as reported

TABLE 1
Fungi isolated from *Orthotomicus caelatus* and *Pityophthorus* sp., and the percentages of adults contaminated

Fungi isolated	Percentages of adults contaminated											
	13 June*		4 July		30 July		9 August		24 August		12 September	
	A(2)**	B(13)	A(13)	B(0)	A(11)	B(1)	A(14)	B(0)	A(12)	B(4)	A(11)	B(0)
Alternaria sp.			15		18				8			
Epicoccum purpurascens Ehrenb. ex Schlecht.			8						8			
Leucostoma kunzei (Fr.) Munk	100		92		82		79		83	50	27	
Lophium mytilinum (Pers.) Fr.		8			9		7		8	25	18	
Gremmeniella abietina (Lagerb.) Morelet		62	23		46		7		8		9	
Penicillium spp.		15	23		9							
Potebniamyces coniferarum (Hahn) Smerlis			8		18				8			
Scoleconectria cucurbitula (Tode ex Fr.) Booth	50	15	54		36	100	7			50	27	
Strasseria geniculata (Berk. & Br.) Höhn.			8						8			
Sydowia polyspora (Brev. & v. Tav.) E. Müll.	100	69	46		36		21		25	25	73	
Tympanis hypopodia Nyl.											46	
T. laricina (Fckl.) Sacc.			8								37	
Unidentified		15	23		27		57		42		9	

*Date of collection.
**A(2) = *Orthotomicus caelatus*, two adults plated; B(13) = *Pityophthorus* sp., 13 adults plated.

here is unusual, for it is found mainly in the thick bark of trees and stumps.

In view of the potential importance of these bark beetles as vectors of disease-causing fungi, further work should be done to determine their seasonal history, habits, and ability to transmit *G. abietina* and other pathogens to healthy trees.—E. Smerlis and R.J. Finnegan, Laurentian Forest Research Centre, Ste.-Foy, Que.

Occurrence of the Introduced Sawfly *Acantholyda erythrocephala* (L.) in Ontario.—This European web-spinning sawfly was first reported in Canada by Eidt and McPhee (Bi-mon. Prog. Rep. 19(4):2,1963). McPhee collected seven larvae from mugho pine (*Pinus mugho* Turra var. *mughus* Zenari) in Scarborough Township in 1961. These were reared and identified by D.C. Eidt as *A. erythrocephala*. The insect had been reported earlier feeding on red pine (*Pinus resinosa* Ait.), white pine (*P. strobus* L.), mugho pine, Scots pine (*P. sylvestris* L.), Japanese red pine (*P. densiflora* Sieb. & Zucc.), and Austrian pine (*P. nigra* Arnold) in New Jersey and Pennsylvania (Griswold, Rev. Appl. Entomol. (A) 27:651, 1939), having been first found in North America at Chestnut Hill, Pa., in 1925 (Wells, Rev. Appl. Entomol. (A) 14:641, 1926). In Ontario it is significant because it causes serious defoliation of pines, which are planted extensively in the province.

TABLE 1
Number of collections of *A. erythrocephala* recorded by the Forest Insect and Disease Survey in Ontario

Stage	May	June	July	August	Total
Egg	6	1			7
Larva	4	19	5	1*	29
Pupa					
Adult	4	1			5

*This collection was from Kenora District.

A brief description of the life history follows. Adults emerge in the second half of April or early in May. Three to ten eggs are embedded in slits cut in a row on the flattened surface of pine needles of the previous year's growth. The egg stage lasts about 22 days. Newly hatched larvae spin a loose web at the base of the needles, within which they feed gregariously. Larvae in later instars spin silken tubes, in which they feed for 2 to 3 wk between early May and late June. After feeding, the fully grown larvae drop to the ground and form earthen cells 5 to 8 cm

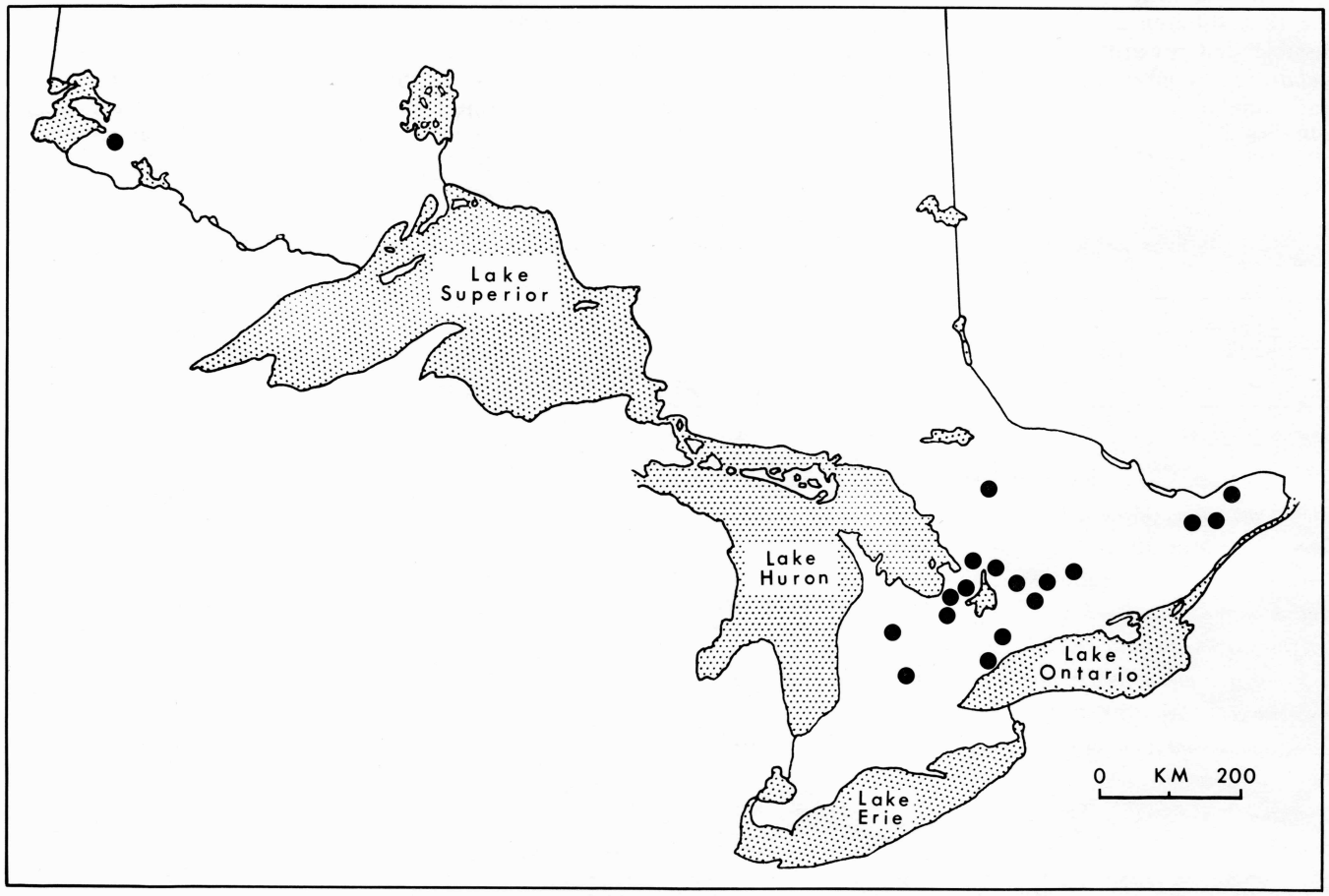

Figure 1. The distribution of *Acantholyda erythrocephala* (L) in Ontario.