

Age Distribution of European Larch Canker in New Brunswick

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ABSTRACT

Ostaf, D. P. 1985. Age distribution of European larch canker in New Brunswick. *Plant Disease* 69:796-798.

The European larch canker, caused by *Lachnellula willkommii*, was found in 30% of the tamarack (*Larix laricina*) stands examined, affecting up to 100% of the trees. Counts of annual rings in cankered trees showed that the oldest canker, found near Saint John, was 25 yr old. Thus, the disease has been present in New Brunswick since at least 1958. Eighty-five percent of the stem cankers incepted on stems 9 yr of age and younger (range 2-17 yr). Incidence of the canker was greatest in areas with high rainfall, low snowfall, mean maximum temperatures greater than 0 C, and greatest number of degree days above 4.4 C from November to March.

The European larch canker, caused by *Lachnellula willkommii* (Hartig) Dennis, was first reported in North America in eastern Massachusetts in 1927 on European larch (*Larix decidua* Mill.), Japanese larch (*L. leptolepis* (Sieb. & Zucc.) Gord.), and tamarack (*L. laricina* (Du Roi) K. Koch) (7). Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco), pitch pine (*Pinus rigida* Mill.), and Scots pine (*P. sylvestris* L.) were also reported to be affected (7), but Hahn and Ayers (2) later showed through field observations and wound inoculations with pure cultures that *L. willkommii* infects only species of *Larix* and *Pseudolarix*. In Europe, young trees infected with the fungus had been girdled and killed and permanent cankers on the trunks of older trees caused stem distortions and breakage (2). Therefore, because of the damaging effects of the disease, attempts were made to eradicate it from plantations in Massachusetts. In 1952, only a few newly infected European larch were located (1), and by 1965, no infected trees were found (8).

The European larch canker was found for the first time in Canada in 1980, infecting tamarack in New Brunswick and Nova Scotia (4). Since then, the canker has been found throughout southeastern New Brunswick and on mainland Nova Scotia (3). Miller-Weeks and Stark (5) subsequently reported the canker in coastal areas of eastern Maine—the first record for the United States since the disease was eradicated in Massachusetts.

Since the disease may have a significant

impact on natural or planted stands of native larch as well as on plantations of exotic larch species, a study was initiated to determine how long the canker has been present in New Brunswick, if a spread pattern exists, and if the occurrence of the canker has a relationship with climate.

MATERIALS AND METHODS

A base line was established along the southern coastline of New Brunswick. Transects perpendicular to the base line were set at 50-km intervals. Points intersecting each transect at 1, 2, 4, 8, 15, 30, 60, and 120 km from the base line were selected. Additional points were selected where transect lines intersected the coast and at 5-km intervals in an east-west direction between the westernmost and next transect.

The tamarack stand nearest to each selected point was examined for the European larch canker. The percentage of trees infected with stem and/or branch cankers at each site was determined, and stem cankers that appeared to be the oldest at each site were collected. Specimens usually displayed one or more of the following: ascocarps of *L.*

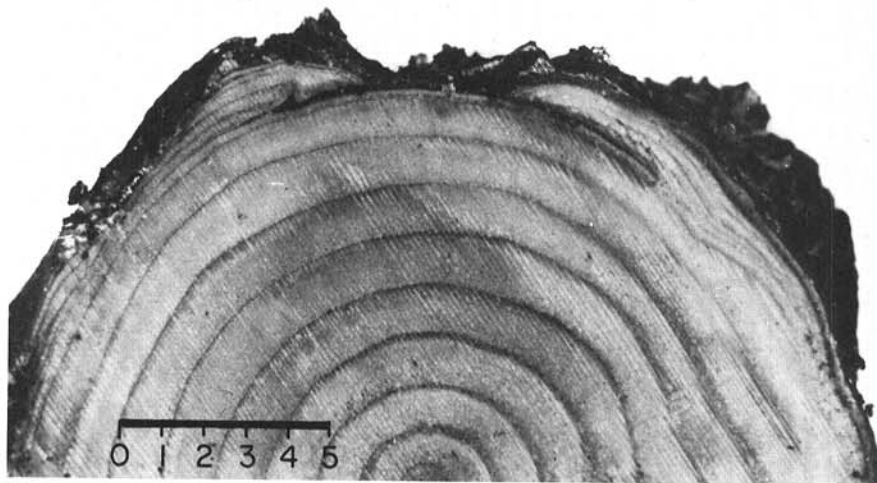


Fig. 1. Cross-sectional disk taken from center of European larch canker; note deformed annual rings. Scale in centimeters.

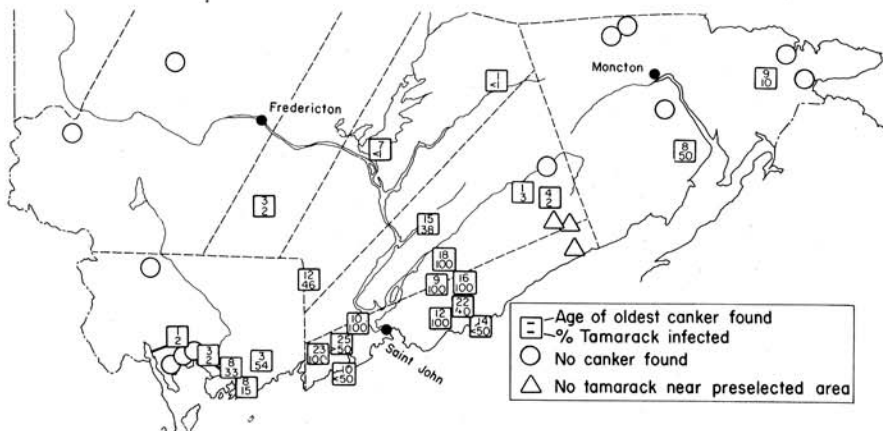


Fig. 2. Incidence and age of European larch canker in tamarack stands in the southern part of New Brunswick in 1983.

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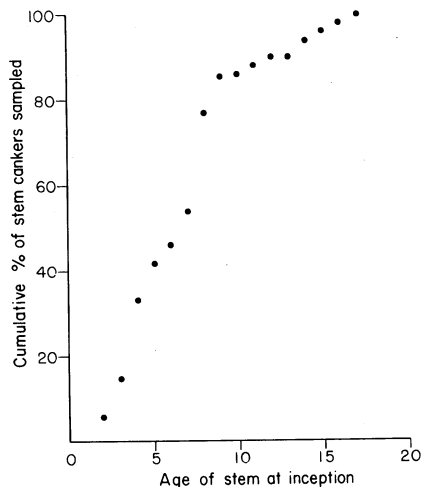


Fig. 3. Age of tamarack stems at inception of European larch canker.

willkommii, large swellings with deep depressions on the stem, resin exudation, or a dead shoot emanating from the center of the canker.

The approximate age of each collected canker was determined on a cross-sectional disk taken from the center of each canker by counting the annual rings formed after the year of canker formation (Fig. 1). The age of the disk at the time of infection was also determined. Disks were used only if the cause of the canker could be determined as *L. willkommii* either by identification of ascocarps on the tree or by isolation of the fungus in pure culture.

The possibility of a relationship between canker incidence and weather conditions during the annual period of canker expansion was investigated. All locations sampled for larch canker, whether positive or negative, recorded in the files of the Canadian Forestry Service, Forest Insect and Disease Survey, plus those examined in the age distribution study, were plotted on a map of the climatic regions of New Brunswick (9).

RESULTS AND DISCUSSION

The highest incidence of European larch canker within tamarack stands occurred in the vicinity of the city of Saint John, where as many as 100% of the stems in each stand were infected (Fig. 2). The oldest canker found was 25 yr old, on a tree that had become infected when it was about 4 yr old. Both the frequency of cankers within stands and the age of cankers decreased north, east, and west of Saint John, which appears to have been a center of introduction for the fungus.

The ages of the 52 stems sampled ranged from 5 to 31 yr. For 85% of the cankers examined, the age of the tree disk at canker inception was between 2 and 9 yr (Fig. 3). Yde-Andersen (12) stated that on *L. decidua*, inception occurred when stems were between 3 and 8 yr old, and on *L. leptolepis*, 70% of the cankers incepted on stems less than 20 yr old. Robak (6)

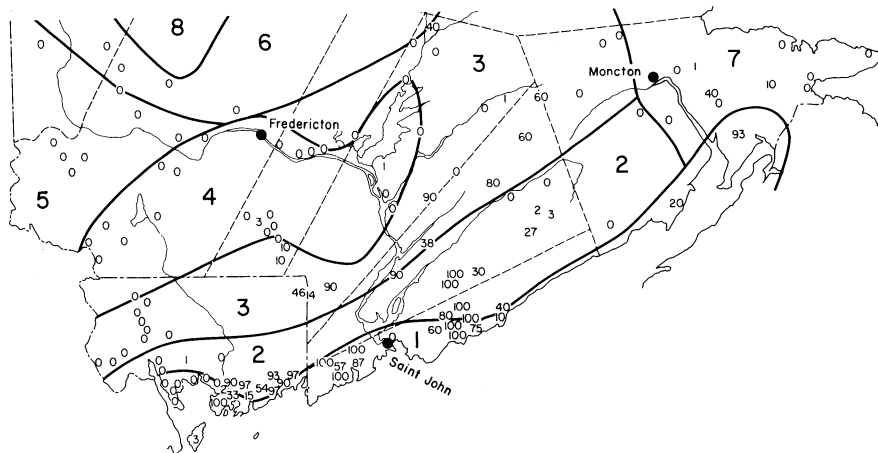


Fig. 4. Percentage of stems infected with European larch canker in tamarack stands in the southern part of New Brunswick by climatic region.

Table 1. Incidence of European larch canker in tamarack in the climatic regions of New Brunswick

Climatic region ^a	No. of sites examined	Percentage of sites with range of infection				
		0	1-25%	26-50%	51-75%	76-100%
1	27	18	11	7	15	48
2	24	33	17	12	8	29
3	33	67	9	9	6	9
4	22	91	9	0	0	0
5	8	100	0	0	0	0
6	17	100	0	0	0	0
7	19	84	10	5	0	0
8	18	100	0	0	0	0
9	7	100	0	0	0	0
10	17	88	12	0	0	0
Total	192					

^a Climate generally becomes more severe from region 1 to region 10 (9).

Table 2. Climatic factors that may influence *Lachnellula willkommii* during November to March in the climatic regions of New Brunswick^a

Factor	Climatic region ^b									
	1	2	3	4	5	6	7	8	9	10
Mean total rainfall (mm)	76.3	55.0	49.2	48.3	30.0	35.9	38.5	20.5	23.1	25.5
Mean total snowfall (cm)	39.1	34.9	47.4	46.8	43.6	50.5	49.8	55.9	49.9	66.1
Mean max. temp. (C)	1.2	0.7	0.3	-0.1	-0.8	-1.2	-0.5	-3.5	-2.9	-2.7
Mean monthly temp. (C)	-3.3	-4.5	-5.7	-5.2	-6.4	-6.7	-5.5	-9.0	-7.9	-7.9
Mean growing degree days (basis 4.4 C)	63.5	60.3	43.8	47.0	40.0	30.2	42.8	15.8	25.5	23.9

^a From van Groenewoud (9).

^b Climatic regions are areas with more or less distinctive and homogeneous climates delineated by three multivariate statistical methods of data from meteorological stations (10).

found no cankers incepted on stems and branches of *L. decidua* more than 10 yr old. In this study, the youngest stem of *L. laricina* at the time of canker inception was 2 yr and the oldest was 17 yr.

The oldest specimens of larch canker were located within 15 km of the southern coast of New Brunswick, an area of oceanic climate with frequent periods of fog. Eighty-eight percent of sites with infected trees were located in climatic regions 1, 2, and 3 (Fig. 4), where 63, 38, and 15%, respectively, of all sites examined had more than 50% of the

stems infected (Table 1). No sites with this level of infection were found in any other climatic region. In climatic region 1, the incidence of infected stems was greater than 50% on 77% of the sites where the disease was found. Examination of climatic data for November to March for each climatic region of the province (9) shows that regions 1, 2, and 3 are characterized by more rainfall, less snowfall, higher maximum temperatures, higher mean monthly temperatures, and a greater number of growing degree days (above 4.4 C) than the other climatic

regions (Table 2). Temperature and precipitation during November to March, the period of canker expansion (2), appear to be suitable for canker development. In Europe, extensive attacks of *L. decidua* also occur in areas with a cool climate with high humidity and frequent fog (11). Robak (6) found extensive cankering in larch stands older than 30 yr in regions with an oceanic climate.

The European larch canker pathogen has been in New Brunswick since sometime before 1958, and it appears to have spread slowly in all directions from the area of the oldest canker. Based on the climatic regions of New Brunswick, and temperature and precipitation factors during the active growing period of the fungus, one would expect highest

incidence and intensity of cankers in climatic regions 1 and 2. Regions 1, 2, and 3 appear to be the areas of highest hazard.

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