Leaf and Shoot Blight of Aspen Caused by *Venturia macularis* in Northern Minnesota

NEIL A. ANDERSON, Professor, Department of Plant Pathology, University of Minnesota, St. Paul, MN 55108, and RALPH L. ANDERSON, Plant Pathologist (retired), North Central Forest Experiment Station, USDA, Forest Service, St. Paul, MN 55108

ABSTRACT

ANDERSON, N. A., and R. L. ANDERSON. 1980. Leaf and shoot blight of aspen caused by Venturia macularis in northern Minnesota. Plant Disease 64:558-559.

Venturia macularis caused leaf and shoot blight of aspen (*Populus* rremuloides). The disease became epidemic on 3-yr-old sprouts and decreased height growth 8–10 cm (3–4 in.) annually and deformed the trees. The aspen ramets put out secondary shoots in 1973 when 80% of the initial shoot growth was infected. Secondary shoot growth did not occur in 1974 and 1975 when 49 and 44% of the new growth, respectively, had leaf and shoot blight. The disease was controlled by applications of benomyl.

In May 1971, a fire destroyed several thousand acres of timber in northeastern Minnesota. Large areas of aspen (Populus *tremuloides* Michx.) were included in the fire, called the "Little Sioux Burn." Sprout regeneration of aspen occurred later in the growing season. By 1973, an epidemic of the leaf and shoot blight fungus Venturia macularis (Fr.) Miller & Von Arx (= Venturia *tremulae* Aderh.) had developed (1). The fungus infects only the leaves and shoots of the current year's growth. Infected shoot tissue becomes black, brittle, and often reflexed, resembling a "shepherd's crook." Symptoms on diseased leaves are hypertrophy, curling, and partial or total black necrosis.

Infection occurs only on immature plant tissue, and disease is restricted to the apical portion of the current year's growth. As the season progresses, aspen leaf and shoot tissue becomes resistant. A diseased leaf or stem is not a perennial source of infection, and the new, immature plant tissue is infected each spring. Ascospores form in perithecia that develop mainly in overwintered leaves on the ground or occasionally on the shoots. The conidial stage of the fungus was shown by Dance (2) to be *Pollacia* radiosa (Lib.) Bald and Cif. Conidia appear as an olive green layer on necrotic tissue 12 days after infection and are probably the main source of inoculum (4,5). A closely related species, Venturia populina (Vuill.) Fabric., causes leaf and shoot blight of balsam poplar (Populus tacamahaca Mill.). Ascospores of this fungus are liberated from individual perithecia for up to 40 hr; Dance (3) indicated that the short period of spore release was probably an adaptation to the limited period during which the host tissue was susceptible to infection.

In Canada, Dance (4) used horizontally and vertically oriented glass slides to trap conidia from 6 June to 19 September 1957; 86% of the conidia on horizontal slides and 93% of those on vertical slides were collected in June. Most conidia appeared to be carried to the slide as clumps of spores in airborne water droplets. Spore dispersal depended on amount and duration of rainfall. The period of aspen growth that year was

from 8 May to mid-June. Big-tooth aspen (*Populus grandidentata* Michx.) is also susceptible to this fungus, but bud break is usually 2 wk later than in trembling aspen.

At present there is considerable interest in hybrid poplars and improved strains of native aspen. Our study was undertaken to obtain information on the effect of the leaf and shoot blight disease on aspen growth.

MATERIALS AND METHODS

The study was made in the largest area of burned-over aspen, located in Sec. 6. T. 65 N., R. 14 W. A central point was located on the study area, and 20 m (66 ft) from it (in three of the four cardinal directions) three 1150-acre plots (radius = 5 m) were established. Additional points were set up at 100- and 200-m intervals in each of the cardinal directions, with three 1150-acre plots located around each point. A total of 24 plots were established. On each 1/50-acre (0.008 1 ha) plot the first 50 aspen were selected for study on a radius line that moved clockwise from due north. The number of trees on each plot ranged from 60 to 100. The trees were examined in the fall of 1973, 1974, and 1975. If a tree died, a tree was added to keep the sample size of each plot at 50. Because one plot had only 27 trees, the total number of trees in the study was 1,177. The percentage of the current year's growth infected with leaf and shoot blight was noted for each tree. The aspen ramets usually had a central stem with an apical growing point and 4–10 lateral branches. The percentage of shoot blight was determined by counting the number of diseased and healthy shoots for each tree. Leaf blight was associated with infected shoots. Other diseases were recorded when observed.

To measure the effect of the leaf and shoot blight disease on aspen height growth and to test the efficacy of the fungicide benomyl(methyl 1-[butyl-carbamoyl]-2-benzimidazole carbamate) to control the disease, 12 3.7 X 3.7 m plots were established in 1974. On six plots, the aspen suckers were cut at the ground line in the spring of 1974 to create a crop of first-year suckers; no trees were cut on the other six plots. The trees on three cut and three uncut plots were sprayed with benomyl at the rate of 2.4 g/L (2 lb per 100 gal) at 2–3 wk intervals during the growing seasons of 1974 and 1975. The percentage of shoot blight on these trees was noted each year and tree height was measured in the autumn of 1975.

RESULTS AND DISCUSSION

In 1973, an epidemic of *V. macularis* on the aspen in the study area infected 96% of the trees, and an average of 80% of new growth had leaf and shoot blight. The trees put out a second flush of growth, and 36% of these shoots were infected (Table 1). The following year, 87% of the trees had leaf and shoot blight, but the incidence of infection (49%) was lower than in 1973. In 1975, 82% of the trees were infected and 44% of the new growth had leaf and shoot blight. With the decrease in disease intensity in 1974 and 1975, secondary growth occurred on only a few trees and the percentage of trees with infected secondary growth was less than 1%.

Table 1. Percentage of aspen with primary (early) and secondary (midseason) shoot blight infection and average percentage of crowns with primary and secondary infection

	Primary infection			Secondary infection		
Year	Trees (%)	Crown (av.%)	(SD)	Trees (%)	Crown (av.%)	(SD)
1973	95.8	80.3	33.7	35.9	31.44	44.8
1974	87.4	48.6	37.1	0.4	52.00[a]	···
1975	82.2	44.0	35.9	0.1	10.00[b]	···

[a] Based on five trees.
[b] Based on one tree.

Table 2. Average percentage of aspen crowns with shoot and leaf blight on cut (1-yr-old) and uncut (4-yr-old) ramets sprayed with benomyl at 2-3 wk intervals throughout the 1974 growing season

	Replicate 1				Replicate 2				Replicate 3			
	Cut		Uncut		Cut		Uncut		Cut		Uncut	
Treatment	%	SD	%	SD	%	SD	%	SD	%	SD	%	SD
Sprayed	16.4	34.3	1.1	3.8	6.1	22.2	0.7	9.0	18.2	38.6	0.9	2.9
Unsprayed	53.4	8.5	58.5	30.6	75.1	40.1	58.0	39.3	53.2	44.4	20.7	33.7

In 1974, the percentage of new growth infected averaged 60.6 (range, 53.2–75.1) on the three cut and unsprayed plots and 13.6 (range, 6.1–18.2) on the three cut and sprayed plots (Table 2). The percentage of new growth infected averaged 45.7 (range, 20.7–58.5) on the uncut and unsprayed trees and 0.9 (range, 0.7–1.1) on the uncut and sprayed trees.

The average height of the 112 2-yr-old trees on the cut and sprayed plots in 1975 was 100.18 cm (39.4 in., SD = 16.7 in.); the 68 cut and unsprayed trees averaged 84.8 cm (33.4 in., SD = 14.7 in.). The average height of the 120 trees on the uncut plots that were 5 yr old and had been sprayed for two seasons with benomyl was 221.9 cm (87.4 in., SD = 30.5 in.) and that of the 120 unsprayed trees was 201.4 cm (79.3 in., SD = 29.8 in.).

V. macularis has the potential of becoming epidemic and causing disease on juvenile aspen. In our study, the nearest sources of inoculum were two unburned aspen stands, each about 0.8 km from the study area. The average annual growth loss due to the disease as determined by the fungicide study was 7.6 cm (3 in.) during years one and two and 10.2 cm (4 in.) during years four and five. If a 7.6-cm growth loss is assumed for the third year of growth (no growth loss data were available), the total height loss for the 5 yr of aspen growth would be about 43.2 cm (17 in.). The sprayed trees had increased height growth, decreased shoot blight, and, most important, superior form. The unsprayed trees tended to have multiple leaders. Spraying throughout the growing season does not appear necessary unless secondary growth occurs, as in 1973. The final spray in most years could be applied about 1 July.

No cankers caused by *Hypoxylon mammatum* (Wahl.) Miller were noted on any of the trees. However, three leaf diseases were noted: *Ciborinia bifrons* Whet, in 1973, *Septoria musiva* Pk. in 1974 and 1975, and trace amounts of *Melampsora medusae* Thuem. in all three years. A canker disease that usually appeared near the ground line was noted on 34 trees. The diseased bark had an orange brown color and pycnidia that resembled those of *Dothichiza populea* Sacc. and Briard, but no spores were found.

LITERATURE CITED

1. BARR, M. E. 1968. The Venturiaceae in North America. Can. J. Bot. 46:799-864.
2. DANCE, B. W. 1959. A cultural connection between Venturia *tremulae* Aderh. and its imperfect stage in Ontario. Can. J. Bot. 37:1139-1140.
3. DANCE, B. W. 1961. Leaf and shoot blight of poplars (Section Tacamahaca Spach) caused by Venturia populina (Vuill.) Fabric. Can. J. Bot. 39:875-890.
4. DANCE. B. W. 1961. Spore dispersal in *Pollacia* radiosa (Lib.) Bald, and Cif. Can. J. Bot. 39:1429-1435.
5. WEISGERBER, H. 1969. Untersuchungen über Pollacia radiosa, den erreger der triebspitzen-krankheit an pappeln der sektion Leuce Duby. Phytopathol. Z. 66:50-68.