Incidence of ergot in populations of Ammophila breviligulata[1]

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This is the first report of the occurrence of ergot (*Claviceps* purpurea) in natural populations of Ammophila breviligulata in Ontario. During 1976 the percentage of infected panicles ranged from 6 to 40 at Rondeau Provincial Park (Lake Erie) and 9 to 12 at Pinery Provincial Park (Lake Huron) but the infection decreased significantly during 1977 probably due to low rainfall. Each panicle contained 1 to 4 sclerotia which were located mainly in the lower spikelets of the panicle. The weight, length and diameter of sclerotia ranged from 15.4 to 28 mg, 7.6 to 10.6 mm. and 2.0 to 2.8 mm, respectively.

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Il s'agit de la premiere mention de la presence de l'ergot (Claviceps purpurea) chez des populations naturelles de Ammophila breviligulata en Ontario. En 1976, le taux de panicules infectees variait de 6 à 40% et de 9 A 12% dans les parcs provinciaux Rondeau (lac Erié) et Pinery (lac Huron) respectivement, mais l'infection a regresse significativement en 1977, peut-être A cause du peu de pluie qu'ont reçue ces régions. Chaque panicule examinee comptait de 1 à 4 sclérotes principalement situés sur les epillets inférieurs. Le poids, la longueur et le diametre des sclérotes variaient de 15.4 à 28 mg, 7.6 à 10.6 mm et 2 à 2.8 mm respectivement.

Introduction

Ammophila breviligulata Fern. is one of the two most common perennial sand binding grasses along the Great Lakes in North America (Olson, 1958). It reproduces both sexually and asexually (Krajnyk and Maun, 1980) but the establishment of plants along the shoreline occurs mainly by fragments of vegetative shoots (Olson, 1958).

The sexual reproduction in *A. breviligulata* is limited only to certain specific habitats such as terraces with sand deposition (Eldred, 1980). Even in flowering habitats, density of flowering culms is low (1 to 23 per m^2) and the percentage of spikelets containing caryopses is only 28 to 48 (Krajnyk, 1979). The poor seed set may be due to infertile pollen (Kubien, 1970), insect damage (Krajnyk, 1979), meiotic abnormalities (Church, 1929), misshapen embryos or endosperm deficiency (Laing, 1958) and soil infertility.

In our studies at Rondeau (Lake Erie) and Pinery (Lake Huron) Provincial Parks, we observed incidence of ergot (causal agent = *Claviceps purpurea* (Fr.) Tul.) in several populations of *A. breviligulata.* Ergot is a major disease of cultivated or naturally occurring cross-pollinated grasses in North America (Hardison, 1976). The open condition of the floret at pollination makes them vulnerable to floral diseases. The development of cross-pollinated crop; *Triticale* species (Briggle, 1969) and male sterile strains of normally self-pollinated crops, wheat (*Triticum aestivum*) and barley (*Hordeum vulgare),* has increased their susceptibility to ergot (Cunfer *et al.,* 1974). Puranik and Mathre (1971) observed that in 1970, 76% of the heads and 36% of the florets of male-sterile barley were infected under natural conditions in Montana. The major source of infection is the carry over of sclerotia in the soil but natural populations of susceptible grasses might also serve as nuclei of infection.

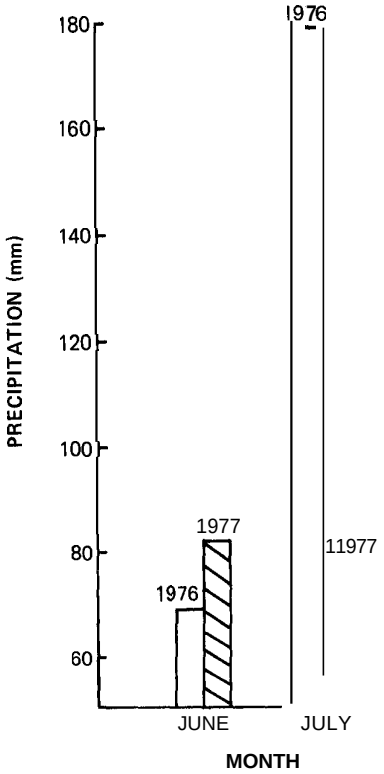

Fig. 1. Monthly mean precipitation during anthesis of A. breviligulata in 1976 and 1977 at Rondeau Provincial Park (weather station located 32 km from the park).

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The purpose of this paper is to report quantitative data on the extent of occurrence of ergot in panicles of *A. breviligulata* along Lake Erie at Rondeau Provincial Park and Lake Huron at Pinery Provincial Park.

Materials and methods

Panicles were harvested at random from 7 populations of *A. breviligulata* at Rondeau Provincial Park and 3 populations at Pinery Provincial Park during 1976 and 1977. The panicles containing ergot sclerotia (horny structures projecting out of spikelets) were separated from the rest of the panicles and the proportion of infected panicles calculated. The location of each sclerotium on a panicle (top, middle or bottom) was recorded. The sclerotium was then carefully removed and its length, diameter and weight were measured.

Table 1. Frequency of infestation of panicles by ergot and number of sclerotia per panicle (± standard error) of *A. breviligulata* at Rondeau and Pinery Provincial Parks.

Name of Park	Population No.	Panicles infected (%) 1976	1977	No. of sclerotia per panicle 1976	1977
Rondeau	1	5.8"	1.1	2.5 ± 0.3	1.4 ± 0.3
	2	11.7"	0.5	3.5 ± 0.6	1.2 ± 0.2
	3	32.2"	4.4	2.5 ± 0.3	1.7 ± 0.2
	4	31.2"	2.2	2.8 ± 0.2	1.4 ± 0.2
	5	40.4"	4.9	2.7 ± 0.2	1.3 ± 0.2
	6	-	4.2	-	1.4 ± 0.2
	7	-	1.8	-	1.3 ± 0.1
Pinery	1	11.7"	0	1.6 f0.3	0
	2	9.2"	0	1.8 f0.4	0
	3	1.6"	0	-	0

*Significantly different (P = .05) from values in 1977 according to the "t" test.

Results and discussion

Panicles of *A. breviligulata* are susceptible to infection by ergot - a disease specific to species and varieties of the family Poaceae (Brentzel, 1947). Sclerotia were found at the time of panicle maturation (end of July) along Lake Erie and Huron shorelines. The percentage of panicles that contained one or more ergot sclerotia in Rondeau Provincial Park populations during 1976, ranged from 5.8 to 40.4% (Table 1). In contrast only 9 to 12% of the panicles in Pinery Provincial Park populations were infected with ergot. During 1977, however, the disease incidence decreased to only 0.5% to 5.0% of the panicles at Rondeau and 0% at Pinery Provincial Park mainly because of significantly higher precipitation during June and July 1976 (Fig. 1). According to Weniger (1924) ergot epidemics develop in wet seasons.

The number of sclerotia per panicle was also variable during 1976 and 1977. At Rondeau each panicle contained 2.5 to 3.5 sclerotia per panicle during 1976 and 1.2 to 1.7 during 1977 (Table 1). The Pinery populations contained 1.6 to 1.8 sclerotia per panicle in 1976 and none during 1977.

The average weight per sclerotium in Rondeau and Pinery populations during 1976 ranged from 15.4 to 25.8 mg, the length from 8.8 mm to 10.5 mm and the diameter from 2.1 mm to 2.4 mm (Table 2). In 1977, the weight per sclerotium for Rondeau populations ranged from 15.8 to 28 mg, and the length and diameter ranged from 7.6 to 10.6 mm and 2.0 to 2.8 mm, respectively. Such resting sclerotia would provide a source of infection for future generations not only for populations of *A. breviligulata* but also for other susceptible grasses or crops in that region.

The sclerotia on a pancicle were most abundant in the middle and bottom of a panicle. Infected panicles collected from Rondeau populations in 1976 and 1977 showed that only 17% of the sclerotia were found in the top one third of the panicle, 42% in the middle one third and 41% in the bottom one third of a panicle. Examination of panicles from the two populations at Pinery Provincial Park showed that

Table 2. The average weight, length and diameter per sclerotiurn (± standard error) collected from populations of *A. breviligulata* at Rondeau and Pinery Provincial Parks.

Location	Population No.	Average Size Per Sclerotium: Weight (mg) 1976	1977	Length (mm) 1976	1977	Diameter (mm) 1976	1977
Rondeau	1	15.4 ± 0.8	25.4 ± 7.9	8.8 ± 0.2	10.6 ± 1.5	2.1 ± 0.04	2.4 ± 0.1
	2	16.0 ± 0.9	15.8 ± 9.0	9.1 ± 0.2	7.6 ± 1.0	2.1 ± 0.04	2.0 ± 0.4
	3	25.8 ± 1.2	20.5 ± 2.1	10.4 ± 0.2	10.0 ± 0.5	2.4 ± 0.04	2.2 ± 0.1
	4	20.8 ± 0.8	20.9 ± 6.6	10.4 ± 0.2	10.5 ± 1.1	2.2 ± 0.03	2.1 ± 0.2
	5	23.4 ± 1.0	20.6 ± 2.5	10.4 ± 0.2	10.6 ± 0.7	2.3 ± 0.03	2.3 ± 0.1
	6	-	16.7 ± 2.0	-	9.1 ± 0.5	-	2.1 f0.1
	7	-	28.0 ± 3.2	-	10.0 ± 0.7	-	2.8 ± 0.1
Pinery	1	22.0 ± 2.9	-	10.5 ± 0.8	-	2.4 ± 0.1	-
	2	19.6 ± 2.8	-	9.1 ± 0.5	-	2.2 ± 0.1	-
	3	-	-	-	-	-	-

33% of the sclerotia were at the top one third of a panicle, 53% in the middle one third and 14% in the bottom one third (For detailed data please refer to Krajnyk, 1979).

In conclusion it may be stated that shorelines of lakes and oceans provide suitable conditions for the growth and spread of this disease because the germination of sclerotia, ascospores and conidia and the growth of hyphae is the highest at high relative humidity (Brentzel, 1947) and high soil moisture conditions (McCrea, 1931). The ergot sclerotia can replace caryopses in about 3.5 spikelets on a panicle thus contributing to a reduction in the number of fertile spikelets per panicle.

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