Incidence of wheat spindle streak mosaic in Essex, Kent and Lambton counties, Ontario, 1973-81

L.F. Gates[1]

In the 10 seasons 1973-1982 inclusive, symptoms of wheat spindle streak mosaic (WSSM) were moderate to prominent in severity and extent in five years, very widespread and severe in 1973 and 1974, and were slight or confined to lower leaves in 1977, 1979 and 1982. Year by year the average incidence of visible infections for individual counties ranged usually between 4 and 33% infected shoots. Wheat in all three counties had an average of 60% of visibly-infected shoots in 1974 or in 1975. Estimated overall yield losses by counties from visible infections in 1973-81 were: Essex 3.5%, Kent 3.4%, and Lambton 2.4%, currently (1983) representing 3400, 2800 and 3200 tonnes per year respectively, with a total value for the three counties of $1,300,000 annually.

Can. Plant Dis. Surv. 66:1, 1-3, 1986.

De 1973 à 1982 inclusivement, on a observé les variations suivantes des symptômes du virus de la filosité panachbe du blé, modérés a importants en sévérité et en distribution durant 5 ans, très rbpandus et sévères en 1973 et 1974, et légers ou limités aux feuilles inférieures en 1977, 1979 et 1982. D'annbe en annbe, l'incidence moyenne des infections visibles dans chaque comté varie habituellemententre 4 et 33% de tiges infectbes. Dans les trois comtbs, le blé en 1974 ou en 1975 avait en moyenne 60% des tiges visiblement infectbes. On estime les pertes de rendement par comté dues aux infections visibles a 3.5% pour l'Essex, 3.4% pour le Kent et 2.4% pour le Lambton, ce qui reprbsente pour l'année 1983 des pertes de 3400, 2800 et 3200 tonnes par annbe respectivement, avec une valeur totale annuelle de $1,300,000 pour les trois comtbs.

Introduction

Wheat spindle streak mosaic (WSSM) occurs most extensively in s. Ontario, Michigan and New York State, and has become particularly prominent in sw. Ontario, where much of Ontario's winter wheat (*Triticum aestivum* L. em. Thell.) is grown and where fields are often planted with wheat every third year. The virus vector is the soilborne fungus *Polymyxa graminis* Led. (5.1 1), which enters wheat roots in the fall and introduces the virus. Symptoms develop in the spring, when the wheat starts growing again, and are especially prominent when long periods at about 10°C occur (7, 9, 10). Direct controls have not been practical (3, 8), but genotypes differ in incidence and intensity of symptoms. Surveys of the disease in 1973-81 in Essex, Kent, and Lambton Counties of sw. Ontario, and comparisons of its incidence in several commercial cultivars are reported here.

Methods

Surveys were made during May, when symptoms show the most clearly on recently-grown leaves. Fields were selected at random and enough counts made on 0.3-1 m lengths of row to give a consistent estimate of the proportion of infected shoots. WSSM was also counted or scored in plots of the Ontario Winter Wheat Cooperative Tests at Malden, Ontario, on soil infested with the viruliferous vector.

[1] *Plant Pathologist, Research Station, Agriculture Canada, Harrow, Ontario, NOR 1GO*

Accepted for publication October 30, 1985

Results and discussion

Surveys. Surveys (Table 1) continue those of earlier seasons (1,2). As found earlier by Slykhuis (7,9,10), springs in which very warm periods occurred in April and May (e.g. 19771, or when the weather became and stayed very warm when the wheat started to grow (e.g. 19821, resulted in low infection counts, whereas years with cold May weather (e.g. 1973) or cold nights in May (e.g 1974) were years with high infection counts. As the virus persists for five or more years in resting spores of *P. graminis* (7), and as symptoms are so strongly influenced by weather conditions, variations in disease assessments over the survey period may show variations in symptom expression more than variations in disease incidence.

In the 10 seasons 1973-1982 inclusive, symptoms were moderate to prominent in severity and extent in five years, very widespread and severe in 1973 and 1974, and were slight or confined to lower leaves in 1977, 1979 and 1982. Year by year the average incidence of visible infections for individual counties ranged usually between 4 and 33% infected shoots. Wheat in all three counties had an average of about 60% of visibly-infected shoots in 1974 or in 1975.

Survey counts are generally lower from 1976 onwards when Fredrick was planted over most of the area surveyed. In comparative trials (see below), infection counts were lower on Fredrick than on the previously-grown Yorkstar.

From 1979 onwards, wheat was often planted after soybeans, and therefore late. In 1979, and to some extent later, infection was lower than previously. Late planting is known to reduce symptom level in the following season (3,12), presumably because many of the tillers that then develop in the spring

Table 1. Incidence of wheat spindle streak mosaic in Essex, Kent and Lambton counties in 1973"-81.

County	Year	Number of Fields with: No disease	Trace of disease (none in counts)	up to 10% visibly-infected shoots	11-50% visibly-infected shoots	51-90% visibly-infected shoots	91-100% visibly-infected shoots	Average visible infection for all fields (%)
Essex	1973	5	6	11	9	8	11	39
	1974	7	3	11	21	12	4	32
	1975	2	3	1	11	18	11	60
	1976†	6	5	3	3	3	5	31
	1977	11	5	9	11	1	0	10
	1978	5	5	13	25	3	5	26
	1979	3	0	26	38	2	1	19
	1980	13	0	11	9	6	0	16
	1981	10	19	8	8	12	8	30
Kent	1973	2	7	10	11	3	18	46
	1974	0	2	6	10	10	11	56
	1975	6	0	11	9	9	2	33
	1976†	1	1	4	13	2	1	27
	1977	5	0	11	5	0	0	9
	1978	5	0	5	10	1	0	21
	1979	6	0	12	8	0	0	8
	1980	3	0	6	7	1	3	30
	1981	11	4	10	11	4	5	24
Lambton	1973	3	3	3	2	3	2	30
	1974	1	1	2	2	5	7	63
	1975	1	0	8	2	3	0	21
	1976†	3	1	5	3	1	0	15
	1977	6	1	6	3	0	0	8
	1978	7	0	4	3	0	0	14
	1979	8	0	9	1	0	0	4
	1980	6	0	3	4	1	0	15
	1981	10	3	8	4	0	2	12

* Overall average infection levels for 1969-72 were: Essex 37, Kent 35, Lambton 21%. (Gates 1973).
† From 1976 onwards, Fredrick replaced Yorkstar over most of the area surveyed.

mature before symptoms appear. However, planting late enough to reduce WSSM risks winterkill (3), as occurred in 1979 in many fields in Kent County along the shore of Lake Erie.

Yield losses. The average percentages of visibly infected shoots in Essex, Kent and Lambton Counties for 1973-81 were 29.28 and 20 respectively. Infected stands or plants compared with healthy ones are reduced in yield by 10%(1; infected v. symptom-free and presumably uninfected areas in fields of Yorkstar), 15% (4; average for 5 cultivars of field comparisons of rows treated with infectious or sterilized inoculum) and 28%(13; average loss in seed weight per plant for 9 susceptible cultivars). The third estimate comes from plants spaced 22 cm apart, and reflects largely the effects of reduced tillering of infected plants, which may be less important in normally-sown rows except in areas thinned by winter damage. From the average of the first two estimates, a fully infected field would lose about 12% in yield. If in the surveys symptomless, though possibly infected, shoots are assumed to give full yields, the overall yield losses by counties from visible infections in 1973-1981 were Essex 3.5%, Kent 3.4% and Lambton 2.4% currently (1983) representing 3400, 2800 and 3200 tonnes per year, respectively, with a total value for the three counties of $1,300,000 annually. In seasons in which wheat in a county averaged 60% infection, its yield loss would be about 7%. Losses in the less susceptible Fredrick in 1976-1981 totalled 6300 tonnes per year for the three counties, with an annual value of $880,000, with the additional risk that infection of Fredrick with WSSM also reduces its winterhardiness (6).

Table 2. Reactions of winter wheat cultivars grown in Ontario to exposure to natural infection with wheat spindle streak mosaic virus, 1975-84, Malden, Ontario,

	Visibly-infected shoots %			Infection score 1 (low) – 9 (high)*					
Cultivar	1975	1976	1977	1978	1979	1980	1981	1983	1984
Yorkstar	86	30	20	8	8	9	6	9	6
Fredrick	71	18	14	6	5	9	5	7	1
Gordon			9	5	9	6	6	9	4
Favor				9	9	8	9	9	7
Houser							6	9	6
Augusta							8	9	6
Frankenmuth							7	9	8

* 9 =essentially all shoots showing infection.

Cultivar reactions to wheat spindle streak mosaic virus. Fredrick and Gordon (Table 2) showed fewer shoots with symptoms than Yorkstar. The recently-licenced cultivars Favor, Houser, Augusta and Frankenmuth had more infection. Although they yielded as well as or better than Fredrick on soil infested with viruliferous vector, increased use of them will make WSSM more prominent.

Literature cited

1. Gates, L.F. 1969. Incidence and effects of wheat spindle streak mosaic in Essex and Kent Counties, Ontario, 1967-68. Can. Plant Dis. Surv. 49:58-59
2. Gates, L.F. 1973. Incidence of wheat spindle streak mosaic in Essex, Kent Lambton Counties, Ontario, 1969-72. Can. Plant Dis. Surv. 53:58-59.
3. Gates, L.F. 1975. Influence of sowing dates, soil amendments, and cultivars on wheat spindle streak mosaic in winter wheat. Can. J. Plant Sci. 55:891-895.
4. Nguyen, H.T., and R. P. Pfeifer. 1980. Effects of wheat spindle streak mosaic virus on winter wheat. Plant Dis. 64: 181-184.
5. Nolt, B.L., C.P. Romaine, S.H. Smith, and H. Cole. 1981. Further evidence for the association of ***Polymyxa graminis*** with the transmission of wheat spindle streak mosaic virus. Phytopathology 71:1269-1272.
6. Paliwal, Y.C., and C.J. Andrews. 1979. Effects of barley yellow dwarf and wheat spindle streak mosaic viruses on cold hardiness of cereals. Can. J. Plant Pathol. 1:71-75.
7. Slykhuis, J.T. 1970. Factors determining the development of wheat spindle streak mosaic caused by a soil-borne virus in Ontario. Phytopathology 60:319-331.
8. Slykhuis, J.T. 1973. Characteristics of suppression of wheat spindle streak mosaic by nitrogen fertilizers. Can. J. Plant Sci. 53:477-483.
9. Slykhuis, J.T. 1974. Differentiation of transmission and incubation temperatures for wheat spindle streak mosaic virus. Phytopathology 64:554-557.
10. Slykhuis, J.T. 1975. Seasonal transmission of wheat spindle streak mosaic virus. Phytopathology 65: 1133-1136.
11. Slykhuis, J.T., and D.J.S. Barr. 1978. Confirmation of ***Polymyxa graminis*** as a vector of wheat spindle streak mosaic virus. Phytopathology 68:639-643.
12. Wiese, M.V., and A.V. Ravenscroft. 1976. Planting dates affect the disease stress and yield of Michigan winter wheat. Proc. Am. Phytopathol. Soc. 3:291. Abstract.
13. Wiese, M.V., A.V. Ravenscroft, and E.H. Everson. 1974. Incidence of wheat spindle streak mosaic among ten wheat cultivars and its effect on yield. Plant Dis. Rep. 58:522-525.