

STEM RUST OF WHEAT, BARLEY, AND RYE IN CANADA IN 1968<sup>1</sup>G.J.Green<sup>2</sup>Prevalence and importance in Western Canada

Stem rust (*Puccinia graminis* Pers. f. sp. *tritici* Eriks. and E. Henn.) was scarce on wheat and barley in Western Canada in 1969. It was first reported on July 23, when traces could be found on susceptible wheat varieties in experimental plots in southern Manitoba. Its development for the remainder of the growing season was slow, presumably because of the cool, wet weather that prevailed until late autumn. Precipitation in Manitoba from April 1 to September 9 averaged 17.83 inches (45.29 cm) and the mean temperature was 51.1F (10.6C) with normals of 12.11 inches (30.76 cm) and 56.7F (13.7C), respectively. Stem rust could not be read-

ily found on susceptible wild barley (*Hordeum jubatum* L.) until early October.

Rye stem rust (*P. graminis* Pers. f. sp. *secalis* Eriks. and E. Henn.) was more prevalent than usual. 'Rosen' rye inoculated in the greenhouse with rust collected on wild and cultivated barley was frequently infected.

Stem rust of wheat, barley, and rye in the rust nurseries

Stem rust infections in the nurseries in 1968 were much lighter than usual. There was no rust at 17 of the 32 nursery locations and mere traces oc-

Table 1. Percentage infection of stem rust of wheat (*Puccinia graminis* f. sp. *tritici*) on 14 wheat varieties in uniform rust nurseries at 15 locations<sup>1</sup> in Canada in 1968

Locality	Common wheat								Durumwheat					
	Lee	Thatcher	Selkirk	Red Bobs	Manitou	Marquis	Kenya Farmer	McMurachy	Frontana	Exchange	Noreste 66	Mindum	Ramsey	Stewart 63
Indian Head, Sask.	0	0	0	tr	0	tr	0	0	0	0	0	0	0	0
Brandon, Man.	tr	0	0	2	0	5	0	0	0	0	0	tr	0	0
Morden, Man.	0	0	0	tr	0	0	0	0	0	0	2	5	0	0
Winnipeg, Man.	10	10	1	50	tr	20	1	1	2	1	2	5	tr	tr
Glenlea, Man.	1	tr	tr	50	tr	50	tr	tr	1	1	tr	30	tr	tr
Fort William, Ont.	tr	0	0	0	0	0	0	0	0	0	0	0	0	0
Guelph, Ont.	0	0	0	tr	0	tr	0	0	0	0	0	0	0	0
Vineland, Ont.	0	0	0	tr	0	tr	0	0	0	tr	0	5	0	0
Appleton, Ont.	tr	tr	0	tr	0	tr	0	0	tr	tr	0	15	1	0
Williamstown, Ont.	0	0	0	tr	0	0	0	0	0	0	0	0	0	0
Alfred, Ont.	0	0	0	5	0	0	0	tr	0	0	0	0	0	0
Morewood, Ont.	0	tr	0	tr	0	0	0	0	0	0	0	0	0	0
Macdonald College, Que.	0	0	0	tr	0	tr	0	0	0	0	0	0	0	0
L'Assomption, Que.	0	0	0	tr	0	0	0	0	0	0	0	0	0	0
Normandin, Que.	0	0	0	0	0	tr	0	0	0	0	0	0	0	0

\*No rust was observed in nurseries at 17 other locations: Agassiz and Creston, B. C.; Beaverlodge, Lacombe and Lethbridge, Alta.; Scott and Melfort, Sask.; Verner, Douglas, Kapuskasing and Ottawa, Ont.; La Pocatière and Lennoxville, Que.; Kentville and Truro, N. S.; Fredericton, N. B.; and Charlottetown, P. E. I.

<sup>1</sup> Contribution No. 358, Research Station, Canada Department of Agriculture, Winnipeg.

<sup>2</sup> Plant Pathologist.

curring at eight of the locations (Table 1). Infections of more than 5% occurred only at the four Manitoba locations and Appleton, Ont.

The reactions of wheat varieties in the nurseries were the same as in earlier years. The heaviest infections were on the susceptible varieties 'Red Bobs', 'Marquis', and 'Mindurn'. There were light infections on the moderately susceptible varieties 'Lee' and 'Thatcher' at Winnipeg. The other varieties, which are resistant, were lightly infected at a few locations.

Stem rust was observed on barley at only four locations, but it occurred on rye at 13 locations (Table 2). Infections on rye were generally more severe than those on wheat.

Table 2. Percentage infection of stem rust (*Puccinia graminis*) on three varieties of barley and one variety of rye in uniform rust nurseries at 13 locations\* in Canada in 1968

Locality	Barley			Rye
	Montcalm	Parkland	C.I. 10644	Prolific
Agassiz, B. C.	0	0	0	5
Creston, B. C.	tr	tr	0	1
Glenlea, Man.	3	0	0	10
Williamstown, Ont.	0	tr	tr	25
Alfred, Ont.	tr	15	1	25
Guelph, Ont.	0	0	0	20
Ottawa, Ont.	0	0	0	15
Appleton, Ont.	20	5	5	70
Morewood, Ont.	0	0	0	25
La Pocatière, Que.	0	0	0	20
Macdonald College, Que.	0	0	0	15
Lennoxville, Que.	0	0	0	10
Kentville, N. S.	0	0	0	tr

\*No rust was observed in nurseries at 18 other locations: Beaverlodge, Lacombe and Lethbridge, Alta.; Indian Head, Scott and Melfort, Sask.; Morden and Winnipeg, Man.; Verner, Douglas, Kapuskasing, Fort William, and Vineland, Ont.; L'Assomption and Normandin, Que.; Truro, N.S.; Fredericton, N.B.; and Charlottetown, P.E.I.

#### Distribution of physiologic races

In 1968, 232 isolates of wheat stem rust were identified as 10 virulence formulas or 9 physiologic races (Table 3). The scarcity of wheat stem rust in Canada limited the number of isolates identified.

Many collections were made in Manitoba from wild barley, but one-third of them were rye stem rust (Table 4). Most collections were made from susceptible wheat varieties or from wild barley.

The methods used to identify races were the same as those used in previous years (1). Virulence formulas (1) show the virulence of the isolates on identified resistance genes. Physiologic races were identified on the varieties 'Marquis', 'Reliance', 'Arnautka', 'Mindum', 'Einkorn', and 'Vernal' of the standard differential hosts. In this report the formula number is followed by the race number in brackets.

The 1968 race distribution was similar to that of 1967 (Table 3). Race C18 (15B-1L Can.) continued to predominate and race C20 (11) was second in order of prevalence. Race C18 (15B-1L Can.) does not threaten the resistant varieties 'Manitou' and 'Selkirk' that predominate in the rust area of Western Canada. Race C20 (11) is virulent on seedlings but is not aggressive on adult plants of 'Selkirk'. Race C17 (56) continued a decline in prevalence that began in 1964 and, in 1968, was found only four times. Races C22 (32) and C25 (38) were the only other significant races identified. They are moderately virulent on seedlings of 'Manitou', but they are not aggressive on adult plants. Race C25 (38) was first found in Eastern Canada in 1964 and reappeared in small amounts in 1965 and 1966. It was not found in 1967, and its reappearance in trace amounts in 1968 was not anticipated. Trace amounts of race C22 (32) have been present in Canada for the last five years at least.

Two new virulence combinations were found. A culture obtained in 1967 was found to be a new race after the 1967 results had been reported (1). It is a strain resembling the currently prevalent race C18 (15B-1L Can.) but it is virulent on Ma<sup>6</sup> - Sr<sup>8</sup>. The formula (C33) is: 6, 9a, 9b/1, 5, 7, 8, 10, 11. The new race C34 (32) was found in Quebec in 1968. The formula is: 1, 6, 7, 9a, 9b, 11/5, 8, 10, 13, 14.

Resistance gene Sr1, first used in 1967, continued to be a useful differential. Genes Sr13, Sr14, Sr15 and Sr16 were used for the first time in 1968. More data is required before their usefulness can be fully evaluated. Sr13 and Sr14 appear promising. Sr15 may be useful in Canada, but Sr16 is of doubtful value, because it is ineffective against most races, and because it confers an indefinite reaction.

Composite collections ofurediospores were used to inoculate a group of highly resistant varieties. No new virulence combinations were found. The varieties 'Mida-McMurachy-Exchange 11-47-26', 'Frontana-K58-Newthatch II-50-17', 'Chris', 'Pitic 62', 'ND 264', 'Wis. 261', 'St 464', and 'C. I. 8155' were resistant or moderately resistant to all composite collections. A selection from a cross between 'Manitou' and a wheat-rye translocation stock

Table 3. Distribution by provinces of physiologic races of *Puccinia graminis* f. sp. *tritici* collected on wheat, barley, and grasses in 1968

Virulence formula number	Physiologic race number	Number of isolates from:					Total number of isolates	Percent of total isolates
		Que.	Ont.	Man.	Sask.	B. C.		
C1	17	0	3	0	0	0	3	1.5
c2	17A	0	2	1	0	0	3	1.5
c4	23	0	0	0	0	1	1	0.5
C17	56	0	3	1	0	0	4	2.0
C18	15B-IL (Can.)	2	9	90	49	0	150	74.2
C19	10	0	2	0	0	0	2	1.0
c20	11	0	5	18	11	0	34	16.8
c22	32	0	0	1	0	0	1	0.5
C25	38	0	1	2	0	0	3	1.5
C34	32	1	0	0	0	0	1	0.5
		3	25	113	60	1	202	100.0

Table 4. Number of isolates of *Puccinia graminis* f. sp. *secalis* from barley and wildbarley in 1968

Location	No.
Quebec	0
Ontario	11
Manitoba	54
Saskatchewan	6
British Columbia	0
Total	71

and a selection from 'P. I. 243065' showed outstanding resistance to the composites.

Resistance gene Sr8 conferred resistance to more of the 1968 isolates than any other gene (93%). Sr6 (81%), Sr9a (80%), and Sr9b (79%) also were highly effective against the 1968 stem rust population (Table 5). These values are very similar to those for 1967.

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Table 5. Percentage of total isolates avirulent on single identified resistance genes

Resistance genes	Avirulent isolates (%)
<u>Sr1</u>	20.8
<u>Sr5</u>	3.5
<u>Sr6</u>	81.2
<u>Sr7</u>	20.3
<u>Sr8</u>	93.0
<u>Sr9a</u>	80.2
<u>Sr9b</u>	79.7
<u>Sr10</u>	4.0
<u>Sr11</u>	22.3

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### Literature cited

- Green, G. J. 1968. Stem rust of wheat, barley, and rye in Canada in 1967. Can. Plant Dis. Surv. 48:9-13.