STEM RUST OF WHEAT IN CANADA IN 1963

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Prevalence and importance in western Canada

Wheat stem rust (Puccinia graminis Pers. f. sp. tritici Erikss. & Henn.) was present throughout most of the cultivated areas of Manitoba. Saskatchewan and Alberta, but it did little damage. It was first observed in Manitoba on June 17 and, by early August, susceptible varieties in experimental plots throughout that province were severely infected. The resistant varieties Selkirk and Pembina, which occupy nearly all the commercial wheat acreage in the rust area of Manitoba and southeastern Saskatchewan, were nearly free from infection. The durum wheat variety Ramsey and the predominant barley variety Parkland had only traces of rust. Light infections occurred on Thatcher wheat throughout Saskatchewan. In Alberta, infections an Thatcher were light, but some fields of susceptible varieties, such as Marquis and Red Bobs, were damaged.

Incidence in the rust nurseries

Wheat stem rust was present in nurseries from Lethbridge, Alta., eastwards to Quebec, Que., (Table 1). The most severe infections on susceptible varieties occurred in nurseries from Melfort, Sask., eastwards to Fort William, Ont. The comparatively light infections on the varieties Lee, Mindum and Thatcher indicate that race 15B, which can attack them, was not as common as races such as 56 that cannot attack them. The scarcity of rust on the varieties McMurachy and Selkirk indicate that little, if any, of the rust present could attack varieties carrying the gene Sr6 that protects Selkirk from race 15B. Race 17A, making its first appearance in Canada, probably contributed to the light infections on the durum variety Ramsey at Glenlea and Brandon, Man. Kenya Farmer has been resistant in nurseries across Canada since 1954.

Stern rusts of barley and rye in the rust nurseries

Stem rust infections on the barley varieties in the nurseries generally paralleled those on the wheat varieties. Presumably most of the stem rust on barley was wheat stem rust except at Creston, B. C., and Appleton and Williamstown, Ont., where infections of stem rust on barley were accompanied by heavy stem rust infections on rye and light infections on wheat. At these locations rye stem rust (P. graminis Pers. f. sp. secalis Erikss. & Henn.) probably attacked the barley.

Stem rust of rye occured sporadically in nurseries in all regions except the Maritime Provinces.

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Table 1. Per cent infection of stem rust of wheat (Puccinia graminis f. sp. tritici) on 12 wheat varieties in 24 1/ uniform rust nurseries in Canada in 1963.

Locality	McMurachy	Lee	Kenya Farmer	Red Bobs	Marquis	Mindum	Thatcher	Selkirk	Thatcher6 x Transfer	Exchange	Frontana	Ramsey
Lethbridge, Alta.	0	t	0	40	40	t	t	0	0	5	0	0
Lacombe, Alta.	0	0	0	1	t	0	0	0	0	0	0	0
Scott, Sask.	0	t	0	40	20	1	t	0	t	1	0	0
Melfort, Sask.	0	t	0	70	70	t	3	0	0	20	0	0
Indian Head, Sask.	0	t	0	80	80	20	3	0	5	70	0	0
The Pas, Man.	0	2	t	50	60	t	t	0	30	30	t	0
Brandon, Man.	--	20	1	80	80	40	5	0	20	90	30	5
Morden, Man.	t	20	t	70	70	5	5	0	2 0	4 0	t	0
Glenlea, Man.	0	t	0	70	60	10	t	0	t	20	0	20
Winnipeg, Man.	t	10	t	80	90	10	10	t	10	80	5	t
Fort William, Ont.	0	t	0	70	70	2	3	0	20	30	t	0
Kapuskasing, Ont.	0	t	0	5	5	0	0	0	0	t	0	0
Kemptville, Ont.	0	t o 1	0 2	0	0	0	0	0	0	t	0	0
Ottawa, Ont.	0	0	0 1	0	5	0	0	0	0	t	0	0
Verner, Ont.	0	1	0 1	0	5	t	2	0	t	5	0	t
Appleton, Ont.	0	0	0	20	5	0	0	0	0	0	0	0
Alfred., Ont.	0	0	0	40	10	0	0	0	0	0	0	0
Williamstown, Ont.	0	0	0	1	1	0	0	0	0	0	0	0
Macdonald College, Que.	0	t o 1	0 1	0	0	0	0	0	0	t	0	0
Lennoxville, Que.	0	0	0	t	t	0	0	0	0	0	0	0
La Pocatiere, Que.	0	0	0	40	10	0	0	0	0	t	0	0
Normandin, Que.	0	0	0	2	1	0	0	0	0	0	0	0
L'Assomption, Que.	0	0	0	t	t	0	0	0	0	0	0	0
Quebec, Que.	0	0	0	3	3	0	t	0	t	0	0	0

1/ No rust was observed in nurseries grown at Saanichton, Agassiz, and Creston, B.C., Beaverlodge and Edmonton, Alta., St. Catharines and Guelph, Ont., Fredericton, NB, Kentville, Nappan, Brule, and Boulardarie, N.S., and St. John's West and Doyles, Nfld.

Distribution of physiologic races

Race 56 continued to be the most common race of wheat stem rust in Canada (Table 2) but its predominance was threatened, especially in western Canada, for the first time since 1958. Race 15B-1L (Can.) which had been increasing gradually since its discovery in 1956 increased sharply to 41.9 per cent of the isolates from all sources. A few isolates of several new races were obtained. The most important of these were biotypes of race group 11-32; 9 of the 20 isolates of this race group attacked seedlings of the varieties Selkirk and Pembina. The 20 isolates were separated into 7 subraces (Table 4). The most threatening of these seems to be the same as race 11F or 32B of the Cooperative Rust Laboratory, St. Paul, Minnesota. This subrace can attack seedlings of Selkirk, Golden Ball, and the Marquis lines carrying genes Sr6 to Sr11, but its pathogenicity on adult plants of varieties such as Selkirk and Pembina has not yet been determined. Naming the other subraces of the 11-32 group does not seem practicable at this time. Race 17A, which can attack Lee and Golden Ball, has not been found previously in Canada. It can attack the durum variety Ramsey which has been cultivated in the rust area of western Canada for several years.

The rank of the races for prevalence is not changed when only isolates from susceptible hosts are considered (Table 3) but it is evident that race 56 was more predominant than is indicated by the data in Table 2.

The reaction types produced by the races and subraces identified in 1963 on 3 supplementary differential host varieties and backcross lines of Marquis carrying genes Sr6 to Sr11 appear in Table 4. Most of the Marquis lines again served as good differential hosts except for races producing a mesothetic reaction on Marquis, No races avirulent on Marquis were identified in 1963. The Marquis^{10} -Sr11 line produced clearer reactions than Lee in the susceptible class. For example, Lee produces a 2t or intermediate reaction with race 15B-4 (Can.) but Marquis** -Sr11 produced reaction type 3+. Lee seems to have other genes, lacking in Marquis^{10} -Sr11, that influence reaction to some Canadian races, A virulence formula for each race is given in Table 4.

A high proportion of the stem rust collections from barley and wild barley (Hordeum jubatum L.) included rye stem rust (Table 5). Evidently rye stem rust was common in Ontario, Manitoba. and Saskatchewan in 1963.

Table 2. Distribution by provinces of physiologic races of Puccinia graminis f. sp. tritici collected on wheat, barley and grasses in 1963.

Race 1/	Province						Total No. of Isolates	Per cent of Total Isolates
	Que.	Ont.	Man.	Sask,	Alta,	B.C.		
11-32 Group	-	4	9	7	-	-	20	5.5
15B-1 (Can.)	-	-	1	-	-	-	1	.3
15B-1L(Can.) 2/	2	7	59	80	4	-	152	41.9
15B-4 (Can.)	-	-	2	3	-	-	5	1.3
27A	-	1	9	6	1	-	17	4.7
18	-	-	-	-	-	1	1	.3
29-1 (Can.)	-	-	-	1	-	-	2	.3
56	8	36	43	66	13	-	166	45.7
Total No. of Isolates	10	48	123	163	18	1	363	

1/ Races 15B-1L (Can,) and 15-4 (Can.) appear to be equivalent to races 15B-2 and 15B-3, respectively, of the Cooperative Rust Laboratory, St. Paul, Minnesota,

2/ From Que,, Ont,, Man,, Sask,, and Alta., 2, 4, 38, 37 and 3 cultures, respectively, attacked Marquis^{6} -Sr 7 and Marquis^{4} -Sr 10. The other cultures of race 15B-1L (Can.) were avirulent on these varieties.

Table 3. Distribution by provinces of physiologic races of Puccinia graminis f. sp. tritici collected on barley, wild barley and susceptible varieties of wheat in 1963,

Race	Province						Total No. of Isolates	Per cent of Total Isolates
	Que.	Ont.	Man.	Sask,	Alta.	B.C.		
11-32	-	4	3	4	-	-	11	4.6
15B-1L (Can,)	2	3	28	39	1		73	30.7
17A	-	-	3	3	-	-	6	2.5
28	-	-	-	-	-	1	1	.4
56	7	36	39	56	9	-	147	61. 8
Total No. of Isolates	9	43	73	102	10	1	238	

Table 4. Infection types produced on supplemental host varieties of wheat and backcross lines of Marquis wheat with substituted genes for resistance by races and subraces of stern rust in 1963

Race	Host Variety										Virulence Formula (Effective/ Ineffective Host Genes)
	Lee	Golden Ball	Yuma	Marquis^{6}-Sr6	Marquis^{6}-Sr7	Marquis^{6}-Sr8	Marquis^{6}-Sr9a	Marquis^{6}-Sr9b	Marquis^{4}-Sr10	Marquis^{10}-Sr11	
15B-1 (Can.)	3	2	;	;	23^{CN}	2	4-	3+	3+	3+	6, 7, 8/9a, 9b, 10, 11
15B-1L (Can.)	3+	2	3^{C}	;	23^{CN}	2	1+	2	X	3+	6, 7, 8, 9a, 9b, 10/11
15B-1L (Can.)	3+	2	3^{C}	;	34	2	2	2	34	4-	6, 8, 9a, 9b/7, 10, 11
15B-4 (Can.)	2+	4	;	;	23^{CN}	2	3+	3+	3+	3+	6, 7, 8/9a, 9b, 10, 11
17A	3	4	;1	;	23^{CN}	4	2	2	X-	3+	6, 7, 9a, 9b, 10/8, 11
18	1	2	;	;	3+	2	4-	2+	3+	1	6, 8, 9b, 11/7, 9a, 10
29-1 (Can.)	1	4	;	3+	4	3+	2	2	3+	1	9a, 9b, 11/6, 7, 8, 10
56	1	2	;	;	4	2	2	2	4[1]	1	6, 8, 9a, 9b, 11/7, 10
11(5)[2]	1	2	;	3+	23^{CN}	1+	3+	3+	3+	1	7, 8, 11/6, 9a, 9b, 10
11(1)	1	2	;1	;	23^{CN}	3+	3+	3+	;1	1	6, 7, 10, 11/8, 9a, 9b
11(1)	1	3	;	;	23^{CN}	2	3	3	3	1	6, 7, 8, 11/9a, 9b, 10
11(1)	1	3+	;1	3+	3±	2	3+	3+	3+	1	8, 11/6, 7, 9a, 9b, 10
11-32(5)[3]	3	2	;1	I	X	X	X	X	;1	X	
11F-32B(3)[5]	3+	3+	;	31	3+	31	3+?[4]	3+	4	3+	/6, 7, 8, 9a?, 9b, 10, 11
11-32(4)[3]	12	2	;1	;	23^{CN}	23^{CN}	23^{CN}	X	X-	12	

1.

2/ Number of isolutec In brackets.

3/ Produced a mesothetic reaction on Marquis. The effect of *the* resistance genes In the Marquis backcross lines was difficult to assess.

4/ Reaction unstable; sometimes typo 2.

5/ Seems equivalent to race 11F or 32B of the Cooperative Rust Laboratory, St. Paul, Minnesota.

Table 5. Number of collections of stem rust on barley and wild barley, and the number of isolates of Puccinia graminis f. sp. secalis obtained from them in 1963.

Province	Number of Collections	Isolates of P. gr. secalis
Ontario	11	8
Manitoba	36	6
Saskatchewan	50	10

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