STEM RUST OF OATS IN CANADA IN 1964

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Prevalence and importance in western Canada

Oat stem rust appeared later than usual. in western Canada in 1964. It was first observed in southern Manitoba on July 23, and developed too slowly to harm most of the oat; crop. Mere traces of stem rust were present throughout Manitoba and southeastern Saskat-. chewan when most oat fields were maturing. Stem rust was not reported on oats in Alberta.

Very late fields in the Red River Valley of Manitoba had infections up to 50 per cent; early in September. This late attack seemed to be caused largely by the dangerous new race 6AF because some of the affected fields were sown to the variety Garry which is resistant to all other races found in the area.

Incidence in the rust nurseries

Uniform rust nurseries, that included the varieties shown in Table 1, were grown at 36 locations across Canada in 1964. The nurseries were planted and cared for by staff of the Canada Department of Agriculture or by University personnel. When the plants approached maturity a small sheaf was cut from each row in each nursery and sent to Winnipeg where diseaee ratings were made.

Oat stem rust infections were light or absent in most rust nurseries (Table 1). In the prairie provinces only the nursery located at Glenlea in southeastern Manitoba was severely infected. No rust was observed in nurseries west of Indian Head in southeastern Saskatchewan. The trace of rust observed in the nursery located at Creston, B.C., probably developed from inoculum originating west of the mountains. The nurseries in eastern Canada with severe infections were located in eastern Ontario where much of the primary inoculum originates on barberry.

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The infection on the formerly highly resistant varieties Garry and C.I. 4023 at Glenlea, Man., was probably caused by the dangerous new race 6AF and indicates that this race was more prevalent in 1964 than in 1963. Most of the infection on the same varieties at Appleton and Merrickville, Ont., was probably initiated by rust from nearby barberry. Races virulent on Garry have predominated in eastern Ontario since 1958.

Distribution of physiologic races

Races 6F, 6AF and the 7A-12A race group were found throughout eastern and western Canada in 1964 (Table 2). Races 4A, 6A and 13A occurred mainly in eastern Canada. Presumably races 6F, 6AF and 7A-12A spread northwards from the overwintering areas in the southern United States, but races 4A, 6A, and 13A originated on barberry in eastern Canada. Races 1, 2, 8, 8AF, 10A and 11A occurred rarely in various parts of the country.

The potentially important race 6AF increased in prevalence from 3.5 per cent of the isolates in 1963 to 25.9 per cent in 1964. It can attack all commercial oat varieties grown in Canada and if it continues to increase in prevalence it will threaten oats in the rust areas of Canada. The prevalence of race 6AF is probably exaggerated by the data in Table 2. Many of the isolates in that table were from varieties resistant to nearly all races excepting 6AF. The data obtained with isolates from suscepti'ble varieties of oats (Table 3) indicate that race 6F, which has predominated for the past 2 years, occurred twice as frequently as 6AF in western Canada. The varieties Rosen's Mutant and Ark. 674 were resistant to the cultures of race 6AF/obtained in 1964 but they are susceptible to other common races.

Races 6A and 13A have predominated in eastern Canada since 1958. They are dangerous races that can attack all oat varieties grown commercially in Canada.

Table 1. Per cent infection of stem rust of oats (Puccinia graminis avenae) on 7 varieties of oats in 19 a/ uniform rust nurseries in Caneda in 1964.

Locality	Bond	Exeter	Clinton	Rodney	Garry	C.I. 4023	Saia
Creston, B.C.	0	t	0	0	0	0	0
Indian Head, Sask.	1	0	t	t	0	0	0
Brandon, Man.	5	1	1	0	t	0	t
Glenlea, Man.	60	60	70	40	10	10	0
The Pas, Man.	3	0	t	0	0	0	0
Fort William, Ont.	5	80	50	t	0	t	t
Kapuskasing, Ont.	5	t	t	0	0	0	0
St. Catharines, Ont.	0	0	t	0	0	0	0
Guelph, Ont.	t	t	t	t	t	0	0
Kemptville, Ont	70	25	25	25	t	0	0
Verner, Ont.	40	0	0	t	0	0	0
Appleton, Ont.	60	60	50	70	70	5	0
Merrickville, Ont.	70	60	70	50	20	40	1
Williamstown, Ont.	t	0	0	0	0	0	0
Macdonald College, Que	2	30	30	1	0	0	0
Lennoxville, Que.	t	t	t	t	t	0	0
La Pocatière, Que.	t	0	0	0	0	0	0
Québec, Que.	10	t	1	0	0	-	-
Kentville, N.S.	t	t	0	0	0	0	0

a/ No rust was observed in 17 other nurseries located at Saanichton and Agassiz, B.C., Beaverlodge, Edmonton, Lethbridge and Lacombe, Alta., Scott and Melfort, Sask., Douglas, Ont., Normandin and L'Assomption, Que., Fredericton, N.B., Nappan, Brule and Boulardarie, N.S., Charlottetown, P.E.I., and St. John's West, Nfld.

Table 2. Distribution by provinces of physiologic races of Puccinia graminis f. sp. avenae identified in Canada in 1964.

Race	Virulence Formula No.	P.E.I.	Que.	Prov Ont.	Man.	Sask.	B.C.	Isolates	Total Isolates
1	C1	0	0	0	1	0	0	1	.4
2	c2	0	0	0	1	0	0	1	.4
4A	C8	0	0	2	0	0	0	2	%
6A	C9	0	19	37	1	0	0	57	23.1
6F	C5	0	6	9	28	14	0	57	23.1
6AF	C10	0	0	10	39	15	0	64	25.9
7A (12A)	C3	0	3	(1)	13 (11)	6 (2)	0	36	14.6
8	c4	1	0	0	0	0	2	3	1.2
8AF	C7	1	0	0	0	0	0	1	.4
10A	C6	0	1	1	0	0	0	2	.8
11A	C6	0	0	1	0	0	0	1	.4
13A	C9	0	7	15	0	0	0	22	8.9
Total		2	36	76	94	37			

Table 3. Distribution by provinces of physiologic races of Puccinia graminis f. sp. avenae collected on susceptible varieties of cultivated oats and wild oats in Canada in 1964.

Race	Virulence Formula No.	P.E.I.	Que.	Prov Ont.	Man.	Sask.	B.C.	Number of Isolates	Per cent of Total Isolates
2	c2	0	0	0	1	0	0	1	1.2
6A	C9	0	2	6	0	0	0	8	9.4
6F	C5	0	3	4	25	6	0	38	44.7
6AF	C10	0	0	4	11	3	0	18	21.2
7A (12A)	C3	0	2	0	5 (1)	1 (1)	0	10	11.8
8	C4	1	0	0	0	0	2	3	3.5
8AF	C7	1	0	0	0	0	0	1	1.2
13A	C9	0	3	3	0	0	0	6	7.0
Total		2	10	17	43	11	2	85	100.0

The varieties that have been used as differential hosts are: Richland (gene A), Rodney (gene B), Minrus (gene D), Jostrain (gene E) and Eagle^2 x C.I. 4023 (gene F). Race numbers are assigned according to the reaction to the varieties Minrus, Richland and Jostrain. Rodney and Eagle2 x C.I. 4023 have differentiated subraces. Cultures attacking Rodney have been indicated by the letter "A" and those attacking Eagle2 X C.I. 4023 by the letter "F". In 1964 the varieties Rosen's Mutant and a selection from C.I. 5844 (C.I. 5844-1) were added because of their resistance to race 6AF. The last 2 varieties have the same pattern of reaction to the races identified in 1964 but Rosen's Mutant is more resistant (infection type 1) than C.I. 5844-1 (infection type 2). A recent study (McKenzie and Green, submitted to Can. J. Genet. Cytol.) has shown that C.I. 5844-1 carries a single recessive gene, called "H", for resistance to race 6AF. It does not carry *any* other indentified gene as it is susceptible to race 1.

The race numbers in Tables 2 and 3 do not indicate the reaction of C.I. 5844-1 or Rosen's Mutant to the races identified in 1964 because it is impractical to add a third symbol to race numbers such as 6AF. The reactions of the standard supplementary differential host varieties to the various groups of cultures identified in 1963 and 1964 have been shown in virulence formulae (Table 4) as was done in 1963[1/]. To make the virulence formulae more useful they have been numbered and the numbers appear in Tables 2 and 3. A prefix "C" is used to indicate "Canadian" and avoid confusion with other series of race numbers. Race 8A was found in Canada in 1963 but not in 1964 and the reaction of C.I. 5844-1 to it is unknown.

Table 4. Virulence formulae and numbers for races of oat stem rust identified i Canada 1963 and 1964.

Race	Formula (Effective/ Ineffective Host Genes)	ormula No.
1	ABDEF/H	C1
2	ABDF/EH	C2
7A, 12A	AF/BDEH	C3
8		C4
6F	BH/ADEF	C5
10A-11A	DF/ABEH	C6
8AF	D/ABEFH	C7
4A	EF/ABDH	C8
6A-13A	F/ABDEH	C9
6AF	H/ABDEF	C10
8A	DF/ABE	C11
8AF	DH/ABEF	C12

1/ Green, G.J. Stem rust of oats in Canada in 1963. Can. Plant Dis. Survey 43: 173-178. 1963.