STEM RUST, OF OATS IN CANADA IN 1970'

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Prevalence and crop losses in Western Canada

In 1970 stem rust of oats caused by Puccinia graminis Pers. f. sp. avenae Eriks. & E. Henn. was first found in Manitoba on July 20 and it developed rapidly to produce the most severe epidemic since 1955. Abundant inoculum combined with a considerable acreage of late-seeded oats resulted in heavy losses. Stem rust infections of over 30% were common in Manitoba and eastern Saskatchewan before the crop had reached the dough stage: infections of up to 80% occurred in some late fields in Manitoba. Light infections of rust occurred as far west as Assiniboia, Sask., and northward beyond Nipawin, Sask. Preliminary estimates of combined crown and stem rust damage in Manitoba indicate losses in excess of 10 million bushels, and more than half of the loss is attributable to stem rust.

Uniform rust nurseries

Oat stem rust infections were relatively light in rust nurseries grown at 35 locations across Canada (Table 1). Rust was observed in only 9 of the nurseries, and infections of 20% or more occurred only at Kentville, N.S., and Brandon and Morden, Man. The infections in Manitoba and Saskatchewan nurseries are not indicative of the considerably heavier infections observed in fields during extensive disease surveys in these areas late in the growing season.

Identification and distribution of physiologic races

Physiologic races were identified by the methods used in previous years (1). In addition to varieties with the genes listed in Table 2, a supplementary set consisting Of 'Kyto' (pg 12), 'Saia', and 'R. L. 2926' (pg 13) (2) was used. All 256 isolates were avirulent on Kyto and Saia; two cultures of race C1 from Manitoba and one culture of race C16 from Nova Scotia were virulent on R.L. 2926. Physiologic race C10 continued to predominate (67%of all isolates) in Western Canada (Table 2); race C20, previously found only in trace amounts in 1966, and race C23, first found in 1969, comprised 17% and 11%, respectively, of all isolates from this region. Races C3 and C5, once dominant, have almost disappeared. In Eastern Canada, race C10 appears to have increased but the number of isolates is too small to attach any signigicance to this indication. The discovery of two races, C1 from Manitoba and

Table 1. Percentage infection by Puccinia graminis f. sp. avenae on 12 oat varieties at 9 uniform rust nurseries* in Canada in 1970

Locality	Bond	Trispernia	Landhafer	CI 4023	Saia	Rodney ABDH	CI 3034	Rodney	Harmon	R.L. 2924	R.L. 2925	R.L. 2926
Indian Head, Sask.	0	tr**	0	0	0	0	0	tr	0	0	0	0
Brandon, Man.	20	tr	0	0	0	0	0	tr	tr	5	5	tr
Morden, Man.	20	tr	tr	5	tr	10	3	30	40	10	5	tr
The Pas, Man.	tr	0	0	0	0	0	0	10	10	5	tr	0
Guelph, Ont.	tr	0	0	0	0	tr	0	0	0	0	0	0
Thunder Bay, Ont.	tr	0	0	tr	0	0	0	0	0	0	20	0
Appleton, Ont.	tr	0	0	0	0	5	0	5	tr	tr	0	tr
New Liskeard, Ont.	10	0	0	0	0	0	0	tr	0	tr	0	tr
Kentville, N.S.	0	0	0	tr	0	0	0	5	0	20	tr	0

* No rust was observed in 23 other nurseries located at Agassiz and Creston, B.C.; Edmonton, Beaverlodge, Lacombe, and Lethbridge, Alta.; Scott and Melfort, Sask.; Apple Hill, Kemptville, New Liskeard, Ottawa, and Vineland, Ont.; L'Assomption, Lennoxville, Macdonald College, Normandin, Québec, and La Pocatière, Qué.; Truro, N.S.; Fredericton, N.B.; Charlottetown, P.E.I.; and St. John's, Nfld.

** tr = trace infection

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Table 2. Distribution of physiologic races of oat stem rust in Canada in 1970

Race formula no.	Virulence formula (effective/ineffective Pg host genes)	No. of isolates from N.S.	Ont.	Man.	Sask.	Total isolates	Percentage of total isolates
	A) Combined isolates from all hosts (B + C)						
C1	1, 2, 3, 4, 8/9			2		2	0.8
c3	2, 8/1, 3, 4, 9			5		5	2.0
c5	4, 9/1, 2, 3, 8			2	2	4	1.6
C8	3, 8/1, 2, 4, 9		2			2	0.8
C9	8/1, 2, 3, 4, 9	1	8			9	3.5
C10	9/1, 2, 3, 4, 8		8	121	36	165	64.4
C16	1, 4, 8/2, 3, 9	1				1	0.4
C20	/1, 2, 3, 4, 8, 9		2	28	11	41	16.0
C23	2, 4, 9/1, 3, 8			14	13	27	10.5
Total		2	20	172	62	256	
	B) Isolates from cultivated oats with stem rust resistance						
C1				2		2	1.3
c3				2		2	1.3
C8			1				0.6
C9			7			7	4.4
C10			8	79	23	110	69.6
C16		1				1	0.6
c20				24	9	33	20.7
C23				2	1	3	1.9
Total		1	16	109	33	159	
	C) Isolates from wild oats and varieties with no stem rust resistance						
c3				3		3	3.1
c5				2	2	4	4.1
C8			1			1	1.0
C9		1	1			2	2.1
C10				42	13	55	56.7
C20			2	4	2	8	8.2
C23				12	12	24	24.7
Total		1	4	63	29	97	

Table 3. Frequency of virulence in the stem rust population on various types of resistance in Canada in 1970

Geographic area	Percentage of isolates virulent on varieties with the following genes for resistance: Pg-1	Pg-2	Pg-3	Pg-4	pg-8	pg-9	pg-13	Total no. isolates	Mean* virulence capability
Eastern Canada	86.3	90.9	100.0	86.3	54.5	54.5	4.5	22	4.77
Western Canada	99.1	85.5	99.1	85.9	97.0	19.7	0.8	234	4.87

* Mean virulence capability = no. of isolates virulent on Pg-1 + . . . + pg-13/total no. of isolates.

C16 from Nova Scotia, with virulence on resistance conferred by pg 13 is significant. These are the first field isolates with virulence on this resistance; they were obtained from R. L. 2926 in the uniform rust nurseries. Evidently virulence on pg 13 resistance exists in the pathogen population even though there has been no selection pressure for it in North America. However, the presence of this virulence in races such as C1 and C16 presents no immediate problem to the production of resistant varieties because this resistance is being used in conjunction with other types that have effective resistance to these races.

The virulence range of the rust population has been maintained at a very high level (Table 3). Only pg 8 in Eastern Canada and pg 9 and pg 13 in both Eastern and Western Canada can be considered as significantly effective. Since Pg 2 and Pg

4 are the only types of resistance present in commercial oat varieties, conditions favoring rust development could again result in serious crop losses in 1971.

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