LEAF RUST OF WHEAT IN CANADA IN 1970[1]

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Disease development and crop losses in Western Canada

Leaf rust was first found in Manitoba on June 22, which is a little later than usual. However, the initial infection was much heavier than usual. By the end of July, leaf rust was prevalent in most of Western Canada, with moderately severe infections on common wheat (Triticum aestivum L.) varieties, including 'Manitou' and 'Neepawa'. Infections of 60% or more were common in fields in the dough stage.

Rust losses were difficult to estimate in 1970. Crops in much of Manitoba and eastern Saskatchewan were late, and maturity varied widely from field to field. Preliminary estimates based on field observations indicate the average loss from wheat leaf rust was about 5% of the potential yield.

Leaf rust in the rust nurseries

Ratings of leaf rust intensity on 16 wheat varieties grown at nurseries across Canada are shown in Table 1. Leaf rust was widely distributed in Canada and severe infections occurred on the susceptible variety 'Red Bobs' at a number of locations. In Manitoba and Saskatchewan, leaf rust was more severe on 'Manitou' than in previous years.

Physiologic specialization

In 1970, field collections of leaf rust were established on 'Little Club' wheat in the greenhouse and one single-pustule isolate was taken from each collection. Extensive surveys in Manitoba and Saskatchewan resulted in collections of leaf rust from most areas

Table 1. Percentage infection by Puccinia recondita on 16 wheat varieties in uniform rust nurseries at 23 locations in Canada in 1970

Location	Lee	Pitic 62	Selkirk	Red Bobs	Manitou	Neepawa	Kenya Farmer	R.L. 5404	Hercules	Mindum	Stewart 63	DT 316	Exchange	Frontana	Tc^6 x Transfer	R.L. 4255
Agassiz, B.C.	0	tr	tr	10	2	tr	0	tr	0	0	0	0	0	0	0	0
Creston, B.C.	tr	30	20	80	tr	tr	tr	5	5	0	1	10	0	0	0	tr
Edmonton, Alta.	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Lacombe, Alta.	tr	tr	0	2	tr	tr	tr	0	0	0	0	0	0	0	0	0
Indian Head, Sask.	40	25	30	60	25	20	35	5	10	0	0	10	0	0	0	0
Scott, Sask.	5	5	10	20	5	5	5	15	0	0	0	0	0	0	0	0
Melfort, Sask.	40	25	25	50	20	20	20	20	5	0	0	5	0	0	0	0
Brandon, Man.	60	50	30	70	30	20	30	25	15	0	tr	5	0	0	0	0
The Pas, Man.	50	25	25	80	30	20	25	10	0	0	0	0	0	0	0	0
Morden, Man.	70	70	50	80	50	40	60	20	10	tr	tr	20	3	1	0	tr
Williamstown, Ont.	5	tr	5	60	0	0	tr	10	10	0	0	10	0	0	0	0
Kemptville, Ont.	tr	tr	tr	40	tr	tr	tr	0	0	0	0	5	0	0	0	0
Fort William, Ont.	60	35	35	80	35	30	35	25	10	0	0	5	0	0	0	0
Apple Hill, Ont.	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0
Ottawa, Ont.	10	3	tr	40	2	tr	10	5	10	0	0	tr	0	0	0	0
Appleton, Ont.	10	tr	10	50	1	tr	25	5	10	0	0	0	0	0	0	0
Vineland, Ont.	20	20	tr	60	tr	tr	25	10	15	0	0	15	0	0	0	0
La Pocatière, Qué.	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0
Quebec, Qué.	5	tr	tr	60	tr	tr	5	tr	5	0	0	5	0	0	0	0
Macdonald College, Qué	tr	0	0	30	0	0	tr	tr	5	0	0	3	0	0	0	0
Lennoxville, Qué.	tr	0	0	40	0	0	0	0	3	0	0	3	0	0	0	0
Normandin, Qué.	15	tr	0	50	tr	tr	20	tr	5	0	0	tr	0	0	0	0
Kentville, N.S.	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0

* tr = trace

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Table 2. Virulence of isolates of Puccinia recondita on backcross lines containing single genes for resistance to leaf rust in Canada in 1970

Resistance genes	No. of isolates from:							Total no. of virulent isolates	% total isolates
	Maritimes	Qué.	Ont.	Man.	Sask.	Alta.	B.C.		
~~Lr 1~~	0	0	5	1	1	0	0	7	3.4
	0	0	4	1	0	0	0	5	2.4
Lr 2D	5	7	1	4	2	0	3	7	38	18.2
~~Lr 3~~	6	6	19	80	78	6	7	202	97.1
Lr 10	5	7	14	35	37	6	7	111	53.4
Lr 16	0	0	0	7	4	2	0	13	6.3
Lr 17	0	0	0	4	1	3	5	13	6.3
Lr 18	5	7	14	16	6	0	0	48	23.1

Table 3. Virulence combinations of Puccinia recondita isolates on backcross lines containing single genes for resistance to leaf rust in Canada in 1970

Virulence formula (effective/ineffective host genes)	No. of isolates from:							Total no. of isolates
	Maritimes	Qué.	Ont.	Man.	Sask.	Alta.	B.C.	
1, 2A, 2D, 10, 16, 17, 18, /3	1	1	3	34	40	0	0	79
1, 2A, 2D, 16, 17, 18/3, 10	0	1	2	20	27	2	0	52
1, 2A, 2D, 10, 16, 17/3, 18	0	0	1	9	2	0	0	12
1, 2A, 2D, 10, 16, 18/3, 17	0	0	0	1	1	0	0	2
1, 2A, 3, 16, 17, 18/2D, 10	0	0	1	0	0	0	0	1
1, 2A, 3, 10, 16, 17/2D, 18	0	1	0	0	0	0	0	1
2A, 2D, 16, 17, 18/1, 3, 10	0	0	1	0	1	0	0	2
1, 2A, 2D, 17, 18/3, 10, 16	0	0	0	6	3	1	0	10
1, 2A, 2D, 16, 18/3, 10, 17	0	0	0	1	0	0	0	1
1, 2A, 2D, 16, 17/3, 10, 18	0	0	1	5	3	0	0	9
1, 2A, 16, 17, 18/2D, 3, 10	0	0	0	0	0	0	2	2
1, 2A, 3, 16, 17/2D, 10, 18	0	2	2	0	0	0	0	4
1, 2A, 2D, 17/3, 10, 16, 18	0	0	0	1	1	0	0	2
1, 2A, 2D, 16/3, 10, 17, 18	0	0	0	1	0	0	0	1
2A, 10, 16, 18/1, 2D, 3, 17	0	0	0	1	0	0	0	1
1, 16, 17, 18/2, 2D, 3, 10	0	0	0	1	0	0	0	1
1, 2A, 16, 18/2D, 3, 10, 17	0	0	0	0	0	2	5	7
1, 2A, 16, 17/2D, 3, 10, 18	5	4	7	0	0	0	0	16
10, 16, 17/1, 2A, 2D, 3, 18	0	0	4	0	0	0	0	4
1, 2A, 18/2D, 3, 10, 16, 17	0	0	0	0	0	1	0	1

of these provinces. Most of the collections in Manitoba and Saskatchewan were obtained from 'Manitou', which does not possess any of the seedling genes for leaf rust resistance that are present in the single-gene lines currently being used as differential hosts. This removes any influence of host selection on the distribution of virulence on these single-gene lines. It does introduce a serious bias in studies on the prevalence of virulence on 'Manitou'.

In 1970, eight single-gene backcross lines were used to study physiologic specialization in leaf rust. The distribution of virulence on the individual single-gene lines is shown in Table 2. These results are very similar to those obtained in 1969 (1). The leaf rust populations in eastern Canada, Alberta, and British Columbia are characterized by virulence on gene Lr2D. However, isolates from eastern Canada were avirulent on gene Lr17 and virulent on gene

Lr18, while those from Alberta and British Columbia were virulent on gene Lr17 and avirulent on gene Lr18.

Twenty virulence combinations were obtained in 1970 (Table 3). The majority of isolates from Manitoba and Saskatchewan were virulent on only gene Lr3 or on genes Lr3 and Lr10.

The commercial variety 'Manitou' possesses gene Lr13 that conditions an adult plant type of resistance with considerable necrosis and small, sporulating pustules. 'Manitou' was resistant to leaf rust in the field when first released but considerable levels of infection have developed on 'Manitou' in the last 2 years. In 1970, adult plants of 'Manitou' were inoculated in the greenhouse with 85 isolates of leaf rust from Manitoba and Saskatchewan. 'Manitou' was resistant to 26 isolates, moderately susceptible to 21 isolates, and susceptible to 38 isolates. These isolates were largely obtained from collections made on 'Manitou', and virulent strains of leaf rust would be expected to predominate. However, similar collections made in 1968 yielded a much lower percentage of virulent cultures (1).

Composite collections of leaf rust were used to inoculate the varieties 'Agatha', 'Transfer', 'Klein Lucero', 'Aniversario', 'Wanken', 'Rio Negro', 'El Gaucho', 'Terenzio', 'Preska', 'Timpaw', 'Timgalen', 'Agent', 'Einkorn', 'Tobari 66', 'Bonanza', 'Huelquen', 'Klein Rendidor', 'Hopps', 'Rafaela', 'Castilla', and 'Trintecinco'. Susceptible-type pustules were obtained on a number of these varieties and single pustule isolates were established. These isolates were studied on the single gene lines and the resistant varieties. The patterns of rust reactions obtained indicate that 'Timgalen' possesses only gene Lr10, 'Trintecinco' has gene Lr1, 'Tobari 66' and 'Bonanza' have gene Lr1 plus an additional gene or genes conditioning a moderate level of resistance. 'Huelquen' has one unknown gene conditioning an X reaction. 'Hopps' and 'Klein Rendidor' gave a type 2+ to 3 reaction to most isolates. 'El Gaucho' and 'Rafaela' each appear to have one gene for seedling resistance to leaf rust. Two isolates virulent on 'El Gaucho' were obtained and both isolates were virulent on 'Aniversario' which was resistant to all other isolates.

Susceptible-type pustules were not observed on 'Einkorn', 'Agent', 'Timpaw', 'Preska', 'Transfer', and 'Agatha'. Several isolates conditioning a type 1+ reaction on 'Transfer' were obtained from Nova Scotia. These isolates are probably heterozygous for virulence on gene Lr9 (2).

A number of these varieties probably possess genes for adult plant resistance and studies are in progress on those varieties where cultures virulent on seedling plants are available.

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