# LEAF RUST OF WHEAT IN CANADA IN 1973[1]

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## Disease development and crop losses in Western Canada

Wheat leaf rust caused by *Puccinia recondita* Rob. ex Desm. was first found in Manitoba on June 14. By mid-July, leaf rust was widespread in Manitoba and eastern Saskatchewan. Moderate to severe infections were present on 'Manitou' and 'Neepawa' wheats in early August from the Red River valley to Estevan and Yorkton in eastern Saskatchewan. Farther west the amount of leaf rust diminished, and damage to wheat was restricted to the heavily infected eastern area. It was estimated from field observations that leaf rust caused yield losses of 5 to 10% in this area.

## Leaf rust in the nurseries

Ratings of leaf intensity on 18 wheat (*Triticum aestivum* L.) varieties grown at nurseries across Canada are shown in Table 1. The utility wheat, Glenlea, was highly resistant at all locations. This variety possesses gene **Lr1** and additional genes conditioning adult-plant resistance to leaf rust. R.L. 4255 is a 'Manitou' backcross line containing genes Lr1, Lr2a, Lr12, Lr13 and **Lr18** for resistance to leaf rust. It was highly resistant in the rust nurseries but has not been licensed for commercial production because of inferior quality.

## Physiologic specialization

In 1973, as in previous years, field collections of leaf rust were established on 'Little Club' wheat in the greenhouse and one single-pustule isolate was taken from each collection. Most of the collections in Manitoba and Saskatchewan were obtained from commercial fields of 'Manitou' or 'Neepawa'. These varieties do not possess any seedling genes for leaf rust resistance. However, in 1973, 'Selkirk' comprised 12.6% of the bread wheat acreage in Manitoba and 3.8% of the bread wheat acreage in Saskatchewan. This

Table 1. Percentage infection by *Puccinia recondita* on 17 wheat varieties in uniform rust nurseries at 21 locations in Canada in 1973

| Location | Lee | Pitic 62 | Napayo | Red Bobs | C.I. 8154 × Frocor[2] | Neepawa | Kenya Farmer | Marquis[6] × (Stewart[3] × R.L. 5244) | Hercules | Mindum | D.T. 332 | Wascana | Exchange | Frontana | Thatcher[6] × Transfer | R.L. 4255 | Glenlea |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Creston, B.C. | 0 | 10 | 5 | 35 | tr* | 5 | 0 | 15 | 5 | tr | 30 | 5 | 0 | 0 | 0 | 0 | 0 |
| Edmonton, Alta. | tr | 10 | 5 | 45 | tr | 10 | 10 | 30 | 5 | tr | tr | 10 | 0 | 0 | 0 | 0 | tr |
| Lacombe, Alta. | 15 | 15 | 20 | 40 | 15 | 40 | 25 | 30 | 20 | 0 | 25 | 15 | 0 | tr | 0 | 0 | 0 |
| Indian Head, Sask. | 45 | 50 | 25 | 80 | 5 | 30 | 50 | 50 | 20 | 5 | 35 | 30 | 0 | 10 | 0 | 0 | tr |
| Scott, Sask. | 0 | tr | tr | tr | 0 | 0 | tr | tr | 0 | 0 | tr | 0 | 0 | 0 | 0 | 0 | 0 |
| Melfort, Sask. | 3 | 10 | 5 | 30 | 15 | 5 | 1 | 20 | 3 | 0 | 3 | 3 | 0 | 0 | 0 | 0 | 0 |
| Brandon, Man. | 70 | 60 | 70 | 80 | 60 | 70 | 50 | 70 | 20 | 0 | 15 | 30 | tr | tr | 0 | 0 | 0 |
| Durban, Man. | 15 | 25 | 20 | 60 | 5 | 15 | 25 | 50 | 20 | 0 | 25 | 20 | 0 | 0 | 0 | 0 | 0 |
| Morden, Man. | 50 | 30 | 60 | 80 | 10 | 50 | 50 | 70 | 1 | tr | 1 | tr | tr | tr | 0 | tr | tr |
| Glenlea, Man. | 15 | 10 | 30 | 70 | tr | 30 | 5 | 70 | 5 | tr | 5 | 3 | tr | tr | 0 | 0 | 0 |
| Kemptville, Ont. | 0 | 0 | 0 | 35 | 0 | 0 | 0 | 35 | 0 | tr | tr | tr | 0 | 0 | 0 | 0 | 0 |
| Thunder Bay, Ont. | 10 | 5 | 15 | 35 | tr | tr | 5 | 35 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Guelph, Ont. | 35 | 20 | tr | 60 | 15 | 15 | 15 | 30 | 25 | 20 | 40 | 40 | tr | 0 | 0 | 0 | tr |
| Ottawa, Ont. | 20 | 10 | 10 | 75 | 10 | 5 | 5 | 60 | 30 | tr | 40 | 45 | 0 | 0 | 0 | 0 | 0 |
| Appleton, Ont. | 10 | 5 | 5 | 35 | 5 | 0 | tr | 30 | 20 | tr | 25 | 10 | 0 | 0 | 0 | 0 | 0 |
| Vineland, Ont. | 10 | 5 | 20 | 60 | tr | 5 | 20 | 60 | 10 | 0 | 10 | 15 | 0 | 0 | 0 | 0 | 0 |
| La Pocatière, Qué. | 0 | tr | 0 | tr | 0 | 0 | 0 | tr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Macdonald College, Qué. | 0 | 15 | 0 | 60 | 10 | 0 | tr | 40 | 40 | 20 | 35 | 30 | 0 | 0 | 0 | 0 | 0 |
| Normandin, Qué. | tr | 0 | 1 | 10 | 0 | 0 | tr | 10 | 5 | 0 | tr | tr | 0 | 0 | 0 | 0 | 0 |
| Fredericton, N.B. | 10 | 10 | 3 | 20 | 20 | 2 | 5 | 10 | 3 | 0 | 3 | 3 | 0 | 0 | 0 | 0 | 0 |
| Charlottetown, P.E.I. | 0 | 0 | 0 | 5 | 0 | 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 1973

| Resistance genes | No. of virulent isolates from: Qué. | Ont. | Man. | Sask. | Alta. & B.C. | Total no. of virulent isolates | % total isolates |
|---|---|---|---|---|---|---|---|
| *Lr 1* | 1 | 1 | 0 | 0 | 0 | 2 | 1.2 |
| Lr 2a | 1 | 0 | 0 | 1 | 0 | 2 | 1.2 |
| *Lr 2d* | 7 | 11 | 0 | 1 | 7 | 26 | 15.8 |
| *Lr 3* | 11 | 8 | 56 | 66 | 12 | 153 | 93.3 |
| *Lr 3ka* | 1 | 3 | 0 | 0 | 0 | 4 | 2.4 |
| *Lr 10* | 7 | 9 | 33 | 33 | 10 | 92 | 56.1 |
| *Lr 16* | 2 | 0 | 8 | 2 | 2 | 14 | 8.5 |
| *Lr 17* | 0 | 0 | 0 | 0 | 7 | 7 | 4.3 |
| *Lr 18* | 9 | 12 | 15 | 18 | 2 | 56 | 34.2 |

Table 3. Virulence combinations of *Puccinia recondita* isolates on backcross lines containing single genes for resistance to leaf rust in Canada in 1973

| Avirulence/virulence formula | No. of isolates from: Qué. | Ont. | Man. | Sask. | Alta. & B.C. | Total no. of isolates |
|---|---|---|---|---|---|---|
| 1,2a,2d,3ka,10,16,17,18/3 | 2 | 0 | 15 | 23 | 1 | 41 |
| 1,2a,2d,3ka,16,17,18/3,10 | 2 | 1 | 19 | 23 | 2 | 47 |
| 1,2a,2d,3ka,10,16,17/3,18 | 0 | 0 | 8 | 10 | 1 | 19 |
| 1,2a,3,3ka,10,16,17/2d,18 | 4 | 5 | 0 | 0 | 0 | 9 |
| 1,2a,2d,10,16,17,18/3,3ka | 1 | 0 | 0 | 0 | 0 | 1 |
| 1,2a,2d,3ka,17,18/3,10,16 | 2 | 0 | 7 | 1 | 0 | 10 |
| 1,2a,2d,3ka,16,17/3,10,18 | 2 | 1 | 6 | 8 | 0 | 17 |
| 1,2a,3ka,10,16,17/2d,3,18 | 1 | 1 | 0 | 0 | 0 | 2 |
| 1,2a,3,3ka,16,17/2d,10,18 | 1 | 2 | 0 | 0 | 0 | 3 |
| 2a,2d,3ka,16,17,18/1,3,10 | 0 | 1 | 0 | 0 | 0 | 1 |
| 1,2a,3ka,16,18/2d,3,10,17 | 0 | 0 | 0 | 0 | 6 | 6 |
| 1,2a,2d,3ka,17/3,10,16,18 | 0 | 0 | 1 | 0 | 1 | 2 |
| 1,3ka,17,18/2a,2d,3,10,16 | 0 | 0 | 0 | 1 | 0 | 1 |
| 1,2a,3ka,18/2d,3,10,16,17 | 0 | 0 | 0 | 0 | 1 | 1 |
| 1,2a,16,17/2d,3,3ka,10,18 | 0 | 3 | 0 | 0 | 0 | 3 |
| 3ka,10,16,17/1,2a,2d,3,18 | 1 | 0 | 0 | 0 | 0 | 1 |

variety possesses genes Lr10 and Lr16. Some collections of leaf rust must have been taken from Selkirk but the exact number is not known,

Nine single-gene backcross lines were used to study physiologic specialization in leaf rust (1,2,3,4,5). The distribution of virulence on the individual single-gene lines (Table 2) is essentially similar to the distribution obtained in 1972 (6). Few isolates are virulent on Lr1 and Lr2a, and most isolates are virulent on Lr3. Virulence to genes Lrl and Lr2 is present in the leaf rust population and virulent cultures can readily be obtained by inoculating varieties possessinq gene Lr1 with bulked collections of urediospores. However, for a number of years. approximately 1% of the isolates from Manitoba and Saskatchewan have been virulent on genes Lr1 and Lr2a. Gene Lr3ka was obtained from 'Klein Aniversario' and is allelic to Lr3 fxom 'Democrat'. Only a few isolates from Eastern Canada were virulent on this gene. Virulence to Lr17 was observed only in collections from Lethbridge, Alberta, and Creston, B.C. Collections of leaf rust from these two areas show very similar patterns of virulence while collections of leaf rust from central and northern Alberta have virulence patterns identical to those shown by collections from Manitoba and Saskatchewan. It is obvious that Alberta receives inoculum from two different ecological areas.

Sixteen virulence combinations were obtained in 1973 (Table 3). Four combinations showing virulence on Lr3, Lr10 and Lr18 comprised the majority of the isolates.

Composite collections of leaf rust were used to inoculate a number of highly resistant varieties of wheat. This study showed that there was in the rust population a low frequency of virulence on Lr1 and Lr2a and an even lower frequency of virulence on 'Agent'. No susceptible-type pustules were observed on 'Agatha', 'Transfer', 'Aniversario', 'El Gaucho', 'Terenzio', 'Tobari 66', and 'Waldron'.

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