# LEAF RUST OF WHEAT IN CANADA IN 1963

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## Disease development in western Canada

Leaf rust of wheat (Puccinia recondita Rob. ex. Desm.) was first found at Winnipeg, Manitoba, on June ?I, and,on June 12, a trace of leaf rust was found in early fields of Selkirk wheat in the Red River Valley. This was an earlier than usual occurrence of leaf rust. However, the moderate resistance of Selkirk and Pembina delayed rust development, and severe infections did not develop until after heading. This is usually too late to cause large losses but this year hot dry weather in Manitoba during July and the leaf rust attack caused defoliation before the kernels were fully formed. Continued hot dry weather matured the crop rapidly leaving little time for the grain to fill. These conditions caused a greater reduction in yields and grades than could have been anticfpated from leaf rust alone.

By early August, leaf rust infections were severe in much of Saskatchewan. However, leaf rust developed later than in Manitoba and early-seeded wheat probably did not suffer any appreciable damage. Late fields undoubtedly were damaged to some extent but favourable temperature and moisture conditions prevented any serious yield loss even in late fields.

## Leaf rust in the rust Nurseries

Severe infections of leaf rust occurred at nurseries throughout the prairie provinces (Table 1). Selkirk, Lee and Kenya Farmer were severely attacked, but on these varieties rust development is delayed, usually until after heading. Thatcher6 x Transfer, which contains the gene from Aegilops umbellulata for leaf rust resistance, was highly resistant at all locations in Canada,.

Exchange and Frontana were resistant to leaf rust at all nurseries. These varieties have adult plant resistance to leaf rust and are being used in current breeding programs, both in Canada and the United States.

## Distribution of physiologic races

Nine races of wheat leaf rust were isolated in the 1963 race survey (Table 2). Race 15 was the most prevalent race in Canada. and was markedly predominant in the prairie provinces. This situation has existed for a number of years. However, in recent years, evolutionary changes leading to increased virulence on commercial varieties have occurred within the race 15 population. The latest shift in virulence is occurring with respect to the commercial wheat varieties Selkirk and Pembina.

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Table 1. Per cent infection of wheat leaf rust (Puccinia recondita) in 1963 on 12 wheat varieties in uniform rust nurseries at 34 1/ locations in Canada

| Locality | McMurachy | Lee | Kenya Farmer | Red Bobs | Marquis | Mindum | Thatcher | Selkirk | That 6 x Trans. | Exchange | Frontana | Ramsey |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Saanichton, B.C. | 70 | 15 | 25 | 70 | 60 | 0 | 70 | 0 | 0 | t | 0 | t |
| Agassiz, B.C. | t | 0 | 0 | t | t | 0 | t | 0 | 0 | 0 | 0 | 0 |
| Creston, B.C. | 100 | 20 | 20 | 100 | 100 | 20 | 100 | 50 | 0 | 0 | 0 | 0 |
| Lethbridge, Alta. | 85 | 65 | 60 | 90 | 90 | t | 90 | 65 | t | 0 | t | 5 |
| Lacombe, Alta. | 65 | 50 | 50 | 70 | 70 | 2 | 70 | 30 | 0 | 1 | t | 2 |
| Scott, Sask. | 80 | 40 | 40 | 90 | 80 | t | 90 | 30 | 0 | t | 0 | 3 |
| Melfort, Sask. | 100 | 80 | 50 | 100 | 100 | t | 100 | 80 | 0 | 3 | t | t |
| Indian Head, Sask. | 100 | 70 | 70 | 100 | 100 | 0 | 100 | 70 | 0 | t | 0 | 0 |
| The Pas, Man. | 90 | 75 | 75 | 95 | 90 | 15 | 95 | 70 | 0 | t | 5 | 5 |
| Brandon, Man. | -- | 80 | 80 | 90 | 80 | t | 90 | 70 | 0 | 2 | t | 5 |
| Morden, Man. | 80 | 80 | 70 | 80 | 70 | 5 | 80 | 70 | 0 | t | t | t |
| Glenlea, Man. | 80 | 60 | 70 | 90 | 80 | t | 100 | 50 | 0 | 2 | 0 | t |
| Winnipeg, Man. | 90 | 80 | 60 | 100 | 90 | t | 100 | 70 | 0 | 0 | 0 | 0 |
| Fort William, Ont. | 90 | 60 | 50 | 80 | 80 | 3 | 90 | 60 | 0 | 1 | 0 | 0 |
| Kapuskasing, Ont. | 15 | 1 | 2 | 20 | 15 | t | 15 | 5 | 0 | 0 | 0 | t |
| St. Catherines, Ont. | t | t | 0 | 0 | 0 | 0 | t | 0 | 0 | 0 | 0 | 0 |
| Guelph, Ont. | 85 | 20 | 20 | 85 | 70 | 15 | 85 | 45 | 0 | 0 | 0 | 0 |
| Kemptville, Ont. | 85 | 60 | 40 | 80 | 75 | t | 80 | 15 | 0 | 5 | t | t |
| Ottawa, Ont. | 70 | 3 | 3 | 70 | 60 | 1 | 70 | 3 | 0 | 0 | 0 | 0 |
| Verner, Ont. | 60 | 10 | 10 | 60 | 60 | -- | 60 | 5 | 0 | 0 | -- | 0 |
| Appleton, Ont. | 20 | 3 | 2 | 20 | 20 | 1 | 20 | 2 | 0 | 0 | 0 | 0 |
| Alfred, Ont. | 60 | 1 | 1 | 60 | 60 | t | 60 | 1 | 0 | 0 | 0 | 0 |
| Williamstown, Ont. | 80 | 40 | 30 | 90 | 80 | 10 | 80 | 30 | 0 | 20 | 2 | t |
| Macdonald College, Que. | 20 | 1 | 1 | 20 | 20 | 0 | 20 | t | 0 | 0 | 0 | 0 |
| Lennoxville, Que. | 15 | 5 | 8 | 20 | 20 | 2 | 25 | t | 0 | 0 | 0 | 2 |
| La Pocatiere, Que. | 15 | 1 | 10 | 15 | 10 | -- | -- | -- | -- | -- | -- | -- |
| Normandin, Que. | 90 | 35 | 15 | 90 | 90 | 10 | 90 | 30 | 0 | 0 | 0 | 0 |
| L'Assomption, Que. | 20 | 1 | 1 | 20 | 35 | 0 | 25 | t | 0 | t | 0 | 0 |
| Quebec, Que. | 60 | 5 | 10 | 75 | 75 | 5 | 70 | 10 | 0 | 0 | 0 | 1 |
| Fredericton, N.B. | t | 0 | 0 | t | t | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Kentville, N.S. | 15 | t | 2 | 15 | 15 | t | 15 | 0 | 0 | 0 | 0 | 0 |
| Nappan, N.S. | t | t | t | t | t | 0 | t | 0 | 0 | 0 | 0 | 0 |
| Brule, N.S. | t | 0 | 0 | t | t | 0 | t | 0 | 0 | 0 | 0 | 0 |
| St. John's West, Nfld. | 10 | t | t | 10 | 10 | 0 | 10 | 0 | 0 | 0 | 0 | 0 |

wheat

Table 2. Distribution by provinces of physiologic races of Puccinia recondita isolated in Canada in 1963.

| Race | | Province | | | | | | Total Isolates | Per Cent of Total Isolates |
|---|---|---|---|---|---|---|---|---|---|
| UN | | Que. | Ont. | Man. | Sask. | Alta. | B.C. | | |
| 1 | 1 | -- | -- | -- | 2 | -- | -- | 2 | 0.8 |
| 2 | 15 | 6 | 20 | 82 | 50 | 13 | -- | 171 | 66.8 |
| 3 | 58 | 5 | 34 | -- | -- | -- | -- | 39 | 15.2 |
| 3 | 161 | -- | -- | -- | 1 | -- | 10 | 11 | 43 |
| 5 | 5 | -- | 2 | 5 | 9 | 2 | -- | 18 | 7.0 |
| 6 | 105 | -- | 1 | -- | -- | -- | -- | 1 | 0.4 |
| 9 | 9 | -- | -- | 1 | 1 | -- | -- | 2 | 0.8 |
| 10 | 11 | -- | 7 | -- | 1 | -- | -- | 8 | 3.1 |
| 13 | 35 | -- | 4 | -- | -- | -- | -- | 4 | 1.6 |
| Total No. Isolates | | 11 | 68 | 88 | 64 | 15 | 10 | 256 | 100.0 |

| Province | ;1⁻ | 1-2 | 2⁺ | 2⁺⁺ | 3 | 3±4 | Total |
|---|---|---|---|---|---|---|---|
| Man. | 2 | 46 | 12 | 10 | 6 | 12 | 88 |
| Sask. | 0 | 39 | 11 | 6 | 5 | 3 | 64 |
| Alta. | 0 | 13 | 0 | 0 | 2 | 0 | 15 |
| Total | 2 | 98 | 23 | 16 | 13 | 15 | |

Selkirk and Pembina have the same seedling genes for leaf rust resistance; of these, the L gene conditioning a fleck and type 1 reaction, and the E gene which conditions a type 1 to 2 reaction, are the most important. It can be seen from Table 3 that nearly all isolates from the Prairies can attack the L gene. The interesting feature shown in Table 3 is the lack of a clear distinction between virulence and avirulence on the E gene. The reaction type 1 to 2 is typical for cultures with avirulence to this gene and type 3 to 4 would be expected from virulent cultures. It is possible that reaction types 2t, 2++ and 3 are conditioned by cultures which are heterozygous for virulence, with virulence being incompletely dominant, The influence of modifying genes can lead to a range of reaction types with different heterozygous cultures.

The NA 61 races isolated In Canada in 1963 are shown in Table 4, Mast of the isolates were identified as NA 61-14 which attacks three of the four supplementary differentials. It is obvious that this group of supplementary differentials is no longer adequate and should be changed in the near future.

Table 4, Distribution by geographic areas of NA 61 races of Puccinia recondita isolated in Canada in 1963.

| Geographic Area | Number of isolates of indicated NA 61 races | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 | 3 | 4 | 5 | 7 | 12 | 14 |
| B.C. | | 8 | | | | | 2 |
| Alta. | | | | | | | 15 |
| Sask. | | 2 | | 1 | | 6 | 55 |
| Man. | | 2 | | | | 2 | 04 |
| Ont. | 7 | 5 | 4 | | 11 | | 41 |
| Que. | | | | | 1 | | 10 |
| Total Isolates | 7 | 17 | 4 | 1 | 12 | 8 | 207 |

Bulked collections of leaf rust uredospores from each area were used to inoculate a group of highly resistant wheat varieties which included Exchange, Agrus, Transfer, Klein Lucero, Aniversario, Africa 43, Klein Titan and Maria Escobar. A small sporulating pustule was observed on Transfer after inoculation with a bulked collection from Saskatchewan. Spores were transferred to Little Club wheat and the culture was tested again on Transfer, producing a 1+ reaction. There is only one other recorded instance of a culture being isolated capable of even limited sporulation on Transfer. This culture was isolated at Winnipeg in 1960

(reaction type 1+ on Transfer) and was found to be heteroxygous for virulence on the Transfer gene for resistance. It is reasonably certain that the culture obtained in 1963 is also heteroxygous for virulence at this locus.

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