Adult plant reactions of commercial varieties of common wheat to new races of stem rust identified in 1974[1]

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Four of eleven new races of wheat stem rust *[Puccinia graminis* f. sp. *tritici]* identified in Canada in 1974 were moderately virulent on seedlings of important commercial varieties *Triticum aestivum.* Infection studies with adult plants in the greenhouse showed that Selkirk, Sinton, Glenlea, and Norquay were resistant to all four races, and Manitou and Neepawa were resistant to three races. One race had intermediate virulence on Manitou and Neepawa, but this race does not appear to threaten these varieties under field conditions in western Canada. The resistance of Thatcher and its derivatives to several of the races cannot be explained genetically.

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Quatre des onze nouvelles races de la rouille de la tige du blé *[Puccinia graminis* f. sp. *tritici]* identifiees au Canada en 1974 se sont révélées moderement virulentes sur des plantules de varietes commerciales importantes. Des études par inoculation sur des plants adultes en serre ont montre que Selkirk, Manitou, Neepawa, Sinton, Glenlea, et Norquay étaient résistantes aux quatre races, sauf une qui montrait une virulence intermediaire sur Manitou et Neepawa. Cette race ne semble pas menacer ces variétés dans les conditions de culture au champ de l'ouest du Canada. Il est impossible d'expliquer génétiquement la resistance de Thatcher et de ses derives à plusieurs des races de rouille.

Wheat stem rust *[Puccinia graminis* Pers. f. sp. *tritici* Eriks. and E. Henn.] was widespread in western Canada in 1974 although commercial varieties were not affected. Rust samples from susceptible varieties in experimental plots and from susceptible *Hordeum jubatum* L. were identified as 32 races, including 11 new virulence combinations (1).

The new races occurred rarely but three of them (C57[32], C59[31] and C63[32]) were moderately virulent on seedlings of the important commercial varieties Selkirk, Manitou and Neepawa. The three strains belong to "standard" race group 11-31-32-113 (5) that has increased in virulence on commercial varieties in recent years. One other new race (C58[29]) was virulent on the variety Selkirk, which has been important commercially in the rust area of western Canada.

Materials and methods

Pure cultures of races C33(15B-1L), C57(32), C58(29), C59(31) and C63(32) were used to inoculate plants at the heading stage in the greenhouse. The methods of inoculation, incubation and disease assessment have been described (2). Race C33(15B-1L) was included because it has predominated in western Canada since 1971.

Table 1. Varieties studied, their parentage, and genotypes for rust resistance as indicated by genetic studies, rust reactions, and parentage

Variety	Genotype	Parentage (3, 4)
Bread wheat		
Thatcher	*Sr5, Sr12, Sr16*	Mq/Im/ /Mq/Kr
Selkirk	*Sr6, Sr7b, Sr9d, Sr17, Sr23*	MM/Ech/ /3*Rm
Manitou	*Sr5, Sr6, Sr7a, Sr12, Sr16*	Tc*7/Ftn/ /6*Tc/KF /3/6*Tc/PI170929
Rleepawa	*Sr5, Sr7a, Sr12, Sr16*	Tc*7/Ftn/ /6*Tc/KF /3/2*Tc/ /Ftn/Tc
Sinton	*Sr5, Sr12, Sr16*	Tc*6/KF/ /6*Lee/ KF/3/Mit
Rlon—bread wheat		
Glenlea		Pb*2/Bage/ /Sn64/ TZPP/3/Nar 60
Norquay		LR/Sn64/ /Jt

The varieties studied, their parentage and genotype for rust resistance, as far as it is known, are presented in Table 1.

Results and discussion

The results of the infection studies (Table 2) indicate that none of the new races seriously threatens the common wheat varieties grown in the rust area of western Canada, although the reaction of Manitou and Neepawa to race C57(32) was intermediate. Manitou and Neepawa have been severely infected in other parts of the world (unpublished data) but it is unlikely that races

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Table 2. Adult plant reactions of eight wheat varieties to five stem rust races

Variety	Physiologic race				
	C33(15B–1L)	C57(32)	C58(29)	C59(31)	C63(32)
Thatcher	S*	Int	VR	MR	MR
Selkirk	VR	MR	R	R	VR
Manitou	VR	Int	VR	R	MR
Neepawa	R	Int	VR	R	R
Sinton	VR	VR	VR	VR	VR
Glenlea	VR	R	VR	VR	VR
Norquay	VR	R	VR	R	VR

* VR = very resistant, R = resistant, MR = moderately resistant, Int = intermediate, S = susceptible

Table 3. Reaction of wheat lines with single resistance genes to five races of stem rust

Resistance gene	Physiologic race				
	C33(15B–1L)	C57(32)	C58(29)	C59(31)	C63(32)
Sr5	S*	S	R	S	S
Sr6	R	S	S	S	S
Sr7a	S	S	S	S	R
Sr7b	S	S	S	S	S
Sr9d	S	R	R	R	R
Sr17	R	S	S	S	R

* S = susceptible, R = resistant

such as C57(32) would seriously damage them in western Canada.

The resistance of Thatcher and its derivatives, Manitou, Neepawa, and Sinton, to the five races (Table 2) cannot be accounted for by the resistance genes they are known to carry (Table 1). Gene *Sr5* is effective>against race C58(29) (Table 3) but "single-gene" wheat lines with ***Sr12*** and ***Sr16*** have not shown good resistance to any field race found recently in Canada. The resistance of Manitou to race C33(15B-1L) is conferred by gene ***Sr6*** (Table 1) and its resistance to the other races is controlled by its Thatcher background. Neepawa is a Thatcher derivative similar to Manitou. It is usually more resistant than Manitou although it does not carry gene ***Sr6***. It is possible that Neepawa inherited *Sr8* or ***Sr9b*** from its parent Frontana but the genes it carries, in addition to those from Thatcher, are unknown. Sinton is also a Thatcher derivative (Table 1) of unknown genotype for stem rust reaction. Selkirk's resistance to race C33(15B-1L) is conferred by gene ***Sr6*** inherited from McMurachy and to the other races by gene ***Sr9d*** inherited from H-44-24. Gene ***Sr23*** does not confer adult plant resistance. The genotypes of Glenlea and Norquay for stem rust resistance are unknown.

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